THESIS ON NATURAL AND EXACT SCIENCES B81

THE COMPARABILITY, REPRODUCIBILITY AND VALIDITY OF ESTONIAN FOOD CONSUMPTION SURVEYS

SIRJE VAASK

Department of Food Processing
Faculty of Chemical and Material Technology
TALLINN UNIVERSITY OF TECHNOLOGY

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Supervisor:
Prof. Raivo Vokk, Department of Food Processing, Tallinn University of Technology, Tallinn, Estonia. Current position: Head of the Department of Food Processing, Tallinn University of Technology, Tallinn, Estonia

Opponents:
Prof. Daina Karklina, Dr.sc.ing., Dean of the Faculty of Food Technology, University of Agriculture, Latvia
Mai Maser PhD, Estonian Society of Nutritional Science, Estonia

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Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for any degree.

Sirje Vaask

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EESTI TOIDU TARBIMISE UURIGUTE VALIIDSUS, REPRODUTSEERITAVUS JA RAHVUSVAHELINE VÕRRELDAVUS

SIRJE VAASK

ABSTRACT

Vaask S. **The comparability, reproducibility and validity of Estonian food consumption surveys.** Tallinn University of Technology (2008).

The main objective of this study was to evaluate the international comparability, reproducibility and validity of Estonian food consumption surveys. In order to conduct food safety risk assessment for Estonia, there should be enough reliable food consumption data available. Therefore the study focuses on the methodologies of food consumption surveys and their suitability for risk assessment to recommend the methodology for future food consumption surveys in Estonia.

Baltic Nutrition Survey was conducted among representative national samples of adults in Estonia, Latvia and Lithuania in summer 1997. Interviews included a 24-hour recall of dietary intake, a standardized questionnaire, height and weight measurements. The results (macronutrient intakes) have shown systematic differences between Latvia/Lithuania and Estonia. When food intakes were converted into daily nutrient intakes, two different food composition databases were used. Therefore, the comparability study was carried out to compare the databases and validity of the results of the previous survey.

The purpose of the NORBAGREEN project (Consumption of vegetables and fruit and other dietary health indicator foods in the Nordic and the Baltic countries) was to examine the consumption frequency of these foods with a comparable method in the Nordic and the Baltic countries, and to produce and validate a food frequency questionnaire (FFQ) for this purpose. The representative number of completed interviews of adults in spring 2002 was 8397 in eight countries. Validation studies were carried out in Finland and Lithuania. A repetitive survey of NORBAGREEN was carried out in spring 2004 using similar methodology and shortened questionnaire only in Estonia.

Baltic Nutrition Survey is still the only representative dietary survey carried out in Estonia that covers the whole diet. Regarding the different sampling principles and data collection practices, the reproducibility of Baltic Nutrition Survey is not sufficient. Comparability between the countries is rather good due to the similar questionnaire and basic principles, but the validity of the frequencies is unproven. The harmonized food composition databases are important for conducting internationally comparative dietary surveys. Controlling factors affecting the comparability in an international study require careful attention throughout the study process. Several limitations in Baltic Nutrition Survey do not encourage using the existing data for risk assessment.

In the future, the NORBAGREEN FFQ can be used to follow the trend in vegetable, potato, fruit, bread and fish consumption; results are comparable between the NORBAGREEN countries. Reproducibility of the NORBAGREEN FFQ is fairly sufficient, and FFQ was validated. Experience of this survey indicates that the same method may be expanded to other countries as well. To understand why people select unhealthy diets within further food consumption studies is the first step in improving the diet.

The recommendations for further representative food consumption survey, covering individual whole diet needed for risk assessment, were worked out as a result of this work.

Key words: Estonia, food intake, survey methodology, 24-h recall, FFQ, risk assessment

Sirje Vaask, Department of Food Processing, Tallinn University of Technology, Ehitajate tee 5, 19086, Tallinn, Estonia

LIST OF PUBLICATIONS

The present dissertation is based on the following papers, which are referred to in the text by their Roman numerals I-VI:

I Pomerleau J, Pudule I, Grinberga D, Kadziauskiene K, Abaravicius A, Bartkeviciute R, **Vaask S,** Robertson A, McKee M. Patterns of body weight in the Baltic Republics. Public Health Nutrition 2000; vol. 3(1): p 3-10.

II McKee M, Pomerleau J, Robertson A, Pudule I, Grinberga D, Kadziauskiene K, Abaravicius A, Vaask S. Alcohol consumption in the Baltic Republics. J Epidemiol Community Health 2000; vol. 54(5): p 361-6.

III Pomerleau J, McKee M, Robertson A, Kadziauskiene K, Abaravicius, A, Bartkeviciute R, **Vaask S,** Pudule I, Grinberga D. Dietary beliefs in the Baltic republics. Public Health Nutrition 2001; vol. 4(2): p 217-25.

IV Pomerleau J, McKee M, Robertson A, Kadziauskiene K, Abaravicius A, **Vaask S,** Pudule I, Grinberga D. Macronutrient and food intake in the Baltic republics. European Journal of Clinical Nutrition 2001; vol. 55(3): p 200-7.

V **Vaask S,** Pomerleau J, Pudule I, Grinberga D, Abaravicius A, Robertson A, McKee M. Comparison of the Micro-Nutrica Nutritional Analysis Program and the Russian Food Composition Database using data from the Baltic Nutrition Surveys. European Journal of Clinical Nutrition 2004; vol 58(4): p 573-9.

VI **Vaask S.** NORBAGREEN survey: consumption of food groups as dietary indicators for healthy nutrition in Estonia. Eesti Arst 2004; vol 12: p 811-816. (in Estonian)

In the appendix of this thesis, copies of papers I-VI have been included. Papers I-VI are reproduced with the permission from the publishers.

THE AUTHOR'S CONTRIBUTION TO PUBLICATIONS

Paper I:
The author was the main investigator of comparable Baltic Nutrition Survey in Estonia, including planning and implementation of survey, data entry and data analysis, and provided further statistical analysis with the obtained data; is the co-author of the paper.

Paper II:
The author was the main investigator of comparable Baltic Nutrition Survey in Estonia, including planning and implementation of survey, data entry and data analysis and provided further statistical analysis with the obtained data; is the co-author of the paper.

Paper III:
The author was the main investigator of comparable Baltic Nutrition Survey in Estonia, including planning and implementation of survey, data entry and data analysis and provided further statistical analysis with the obtained data; is the co-author of the paper.

Paper IV:
The author was the main investigator of comparable Baltic Nutrition Survey in Estonia, including planning and implementation of survey, data entry and data analysis (including the analysis of the food consumption data into nutrients with the Micro-Nutrica Nutritional Analysis Program) and provided further statistical analysis with the obtained data; is the co-author of the paper.

Paper V:
The author was the main investigator of comparable Baltic Nutrition Survey in Estonia, including planning and implementation of survey, data entry and data analysis (including the analysis of the food consumption data into nutrients with the Micro-Nutrica Nutritional Analysis Program); the author was the main investigator of the validation survey in Estonia and Latvia, including planning and implementation of the survey, data entry, and provided further statistical analysis with the obtained data; is the main author of the paper.

Paper VI:
The author was the main investigator of the comparable NORBAGREEN survey in Estonia in 2002, including planning of survey, and provided further statistical analysis with the obtained data; the author was a main investigator of the repetitive Estonian survey in 2004, including planning of survey and data analysis; is the main author of the paper.

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ABBREVIATIONS

BMI	Body Mass Index
CATI	Computer Assisted Telephone Interviews
CVD	Cardiovascular Diseases
DAFNE	Data Food Networking
EFCOSUM	European Food Consumption Survey Method
EFCOVAL	European Food Consumption Validation
EFSA	European Food Safety Authority
EPIC	European Prospective Investigation into Cancer and Nutrition.
EPIC-SOFT	A Computerized 24-hour Dietary Recall Interview Program
EU	European Union
EUROFIR	European Food Information Resources Network of Excellence
FAO	Food and Agriculture Organization of the United Nations
FINBALT	Survey for monitoring health related behaviours among adults of Finland and Baltic countries
FBS	Food Balance Sheets
FBDG	Food-Based Dietary Guidelines
FFQ	Food frequency questionnaire
HBSC	Health Behaviour in School-aged Children Study
HELENA	Healthy Lifestyle in Europe by Nutrition in Adolescence
HIA	Health impact assessment
IDEFICS	Identification and Prevention of Dietary- and Lifestyle induced Health Effects in Children and Infants
G	Grams
Kcal	Kilocalorie
MJ	Megajoule
Ml	Millilitre
NORBAGREEN	Survey of consumption of vegetables, potatoes, fruit, bread, and fish in the Nordic and Baltic countries
PAPI	Paper Assisted Personal Interviews
RDA	Recommended Dietary Allowance
SAFEFOODNET	Chemical Food Safety Network
WHO	World Health Organization

1. INTRODUCTION

In several countries of Eastern Europe, including the Baltic region, the process of transition towards market economy has been accompanied by radical social changes and severe worsening of the population health by increasing prevalence of chronic diseases[1,2]. There is a growing body of evidence to support a central role of nutrition in aetiology of chronic diseases [Paper I, 3,4,5,6,7.] Both favourable and adverse effects on health related to food consumption depend on how much we eat different food ingredients and what these ingredients contain. Dietary habits in Central and Eastern Europe have been generally less favourable than those observed in western countries [PaperII, Paper III,].

Information on food availability and dietary patterns in populations are essential for the formulation, implementation and monitoring of effective nutrition policies and health promotion programmes to improve overall nutritional wellbeing and to reduce mortality [1].

In the 1990s, such information was unfortunately limited in the Baltic countries. In 1996, the WHO facilitated a Baltic Project to help each country carry out their first surveys of national food intake, nutritional status and knowledge of healthy lifestyle, using a common methodology [1].

Based on the result of the nutrition survey, carried out in the Baltic states in 1997, the first food–based dietary guidelines were worked out for Estonia in 1998 [8,9]. Increased consumption of fruit, vegetables and fish and decreased consumption of fat, sweets and alcohol were the goals in public health work.

Fruit, vegetables, bread and fish are proposed to be monitored as dietary indicators for health (foods) by the EFCOSUM project. Therefore, comparable and new data collection at the individual level has been suggested [9]. The NORBAGREEN study was carried out in eight Northern European countries in 2002. The aim of this study was to get comparable data of consumption of vegetables, potatoes, fruit, bread, and fish, and to produce and formally test a FFQ for this purpose [Paper VI].

Estonia became a member of the European Union in 2004. The European Food Safety Authority was established to assess risks associated with the food chain. For European exposure assessment, it is important to use the existing national food consumption data that is somewhat comparable at the European level. However, at present, there is a lack of internationally comparable data on food consumption. Therefore, one of the EFSA's tasks is to harmonize approaches to food consumption data collection and to develop a comprehensive database on food consumption at the European and international level [11].

There is consequently a need for comprehensive surveys of food consumption and regular monitoring of dietary habits and nutritional status in Estonia. Therefore, there is a need to evaluate the comparability, reproducibility and validity of previous Estonian food consumption surveys, their suitability for risk assessment, which creates the basis for recommending the methodology for future food consumption surveys in Estonia.

1. LITERATURE REVIEW

1.1 Food consumption surveys and application of their results

Information on food availability and dietary patterns in population is essential for the formulation, implementation and monitoring of effective policies and programmes to ensure sufficient food supply at the national and household levels, as well as to improve overall nutritional wellbeing and to reduce mortality [1].
The basic goals of nutrition surveys are monitoring the food consumption, nutrient intake and nutritional status of a population.
It is possible to collect both quantitative (how much food and what is being consumed; what are the morbidity rates caused by contaminated and low-quality food) and qualitative information by questioning residents (their opinions, wishes, evaluations) [13]. Qualitative information is needed for understanding why people select unhealthy diets. Several factors influence individual food choices, including cost, knowledge and beliefs and attitudes towards foods [Paper III].
In addition to food consumption data, the anthropometrical data are needed for above-mentioned purposes, especially for risk assessment [11, 12,13,14].

Food consumption data are needed for a variety of purposes:

- to estimate the adequacy of dietary intake of the whole population and in different population groups;
- to investigate the relationships between diet and health and nutritional status;
- for exposure assessment, risk assessment and risk-benefit analysis concerning food;
- to work out national nutrition recommendations and food-based dietary guidelines;
- to compare consumption with dietary guidelines;
- to plan and evaluate nutrition education and nutrition related intervention programmes and policies, including prevention of obesity;
- to plan and evaluate food fortification programmes [8,11,12].

Comparisons between countries including data on the nutrition and health status of the population will give an overview of disparities and inequalities between the countries and between different population groups. Food consumption habits could be compared to other health indicators like mortality, obesity and physical activity. Monitoring food supply and availability, in comparison with population's energy and nutrient intake, allow identifying risk-groups and factors that influence availability of foods and food preferences.
The comparable data between countries create the solid basis for the planning of future projects in nutrition and health by professionals in the field of nutrition, preventive medicine and for policy makers [3, 5,13].

The figure 1 shows the complexity of the process from defining nutrient adequacy or nutrient deficiencies to planning interventions for modifying diet-related factors and therefore improving health of the population. Food consumption data are needed throughout the process of working out food-based dietary guidelines (FBDG), but also for further evaluation of the interventions (campaign, fortification, dietary supplement for risk group etc) [3,8].

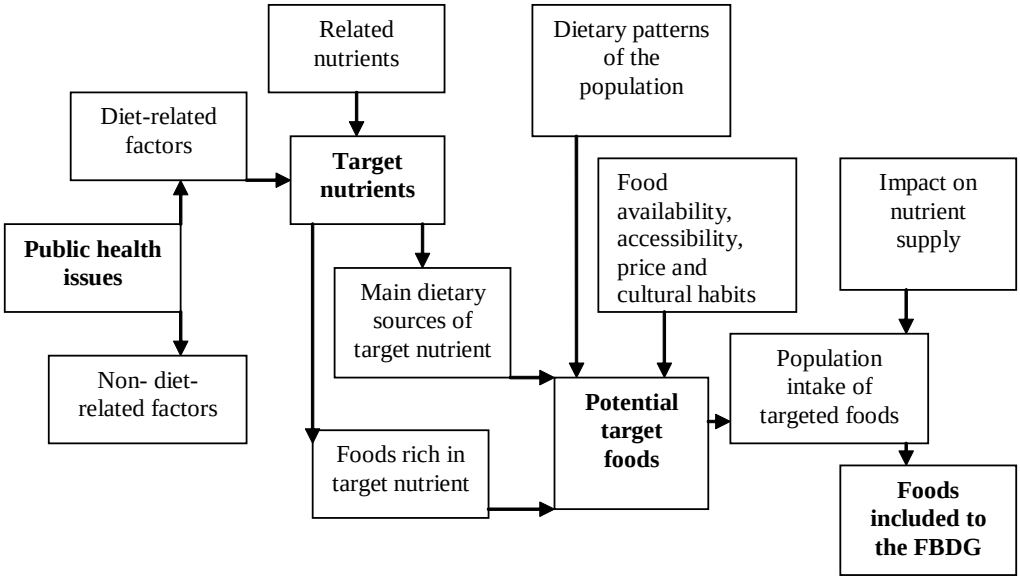

Figure 1. Process of planning intervention and deriving data from nutrients to foods [5]

Consideration of health impacts of non-health sector policies has been encouraged in many countries, with health impact assessment increasingly used worldwide for this purpose. HIA aims to assess the potential impacts of a proposal and make recommendations to improve the potential health outcomes and minimize inequalities, also in food consumption and nutritional status. HIA can assist in ensuring that development and policies are “health promoting'”: the evidence for potential health impacts can be used to influence the decision making process. HIA methodology has been used to assess the complex national policies relating to a specific food-policy process [15,16,17,18].

Dietary surveys are important for understanding food consumption patterns in national studies, clinical research, and patient counselling. Food consumption, food composition and dietary intake calculations are a part of the clinical trials studying links between nutrition and health status: those surveys are the basis for evidence-based policies and for clinical practice guidelines [3, 5,13, 19, 20].

Food consumption data are also needed in private sector for developing new food products, including new product development for people with special

dietary needs, to analyse market opportunities for new products and to evaluate future trends in food consumption [5,13].

1.2 Methods of assessing food consumption

Food consumption data may be collected at the national, household or the individual level. The consumption of foods may be described with four different types of data: Food Balance Sheets, household consumption surveys, national dietary surveys, and surveys measuring selected aspects of the diet as health behaviour surveys and market surveys. Additionally, official statistics on alcohol consumption are often derived from official sales data [Paper II].

There are several internationally approved methods used in individual dietary studies, the most common being described in the textbooks [4,21,22]. Individual data could be divided into retrospective and prospective dietary assessment methods.

Food supply data at the national level provide gross estimates of the national availability of food commodities. A major limitation of national supply data is that they reflect food availability rather than food consumption. Food supply data are not useful for evaluating individual adherence to dietary reference values or for identifying subgroups of the population at a risk of inadequate nutrient intakes. Information regarding food availability at the household level is useful for comparing food availability among different communities, geographic areas and socioeconomic groups, and for tracking dietary changes in the total population and within population subgroups. However, these data do not provide information on the distribution of foods among individual members of the household.

Overview of different methods for assessing food consumption and their main areas of use are described in Table 1.

Table 1. Methods of assessing food consumption[21,22,23,24].

Method	**Type of study**	**Main areas of use**
Diet History	Retrospective	Widely used in large epidemiological studies for investigation of relationships between diet, health, presence of disease and nutritional status.
Food record	Prospective	Mainly self administered method, sometimes with interview, widely used for estimation of adequacy of the dietary intake of population groups.
Food frequency questionnaires	Retrospective	Interview or self- administered questionnaires are widely use for representative national and international food consumption surveys. Used for comparison, to build up hypothesis for further surveys, for planning and evaluating promotion actions
Dietary recall	Retrospective	Interview method is widely used for various purposes, estimation of adequacy of the dietary intake of population groups, assessment of food consumption pattern.

Household Budget Surveys	Prospective	Used for analysis of the household budget, but also food security as expenses for food in different socio-economic groups and household sizes. Used for planning of national subsidies, but also food aid for developing countries.
Food Balance Sheet	Derived from national statistics	Suitable for evaluation of food availability in a country and for performing between countries' comparisons, but also world-wide comparisons. Used to estimate food security in the country and to plan food aid for developing countries.
Telephone surveys	Retrospective or prospective	Low-cost survey can be used for rapid assessment (both recall and estimation of frequencies). Suitable also for evaluation of food preferences, previous or ongoing actions, knowledge and beliefs.
Observational studies	Prospective	Used for assessment of food consumption in those groups where self-reported surveys are not suitable; disabled, children, in case of eating disorders etc. Observational studies could be used also to evaluate food consumption in settings or in markets.
Market databases	Derived from market statistics	Gives a detailed information about the type of food mainly consumed, do not give an overview about the home-grown food or leftovers. Used to evaluate marketing campaigns and actions mainly within private sector. Marked databases are often not accessible and therefore seldom used.
Dietary surveys with clinical research	Retrospective or prospective	Used separately to evaluate nutrient intake and nutritional status of population or population groups in detail. Biomarkers are used to estimate deficiencies or nutritional status. Dietary survey might be a part of the clinical trials (cohort studies or case-control studies).

A growing field within dietary assessment methods has been the use of biochemical markers for validating dietary questionnaires and proxy measures of dietary intake for specific nutrients (for example, urinary markers for sodium and nitrogen intake).

Diet history, food record, food frequency questionnaires and dietary recalls are mainly used to assess dietary intake and those methods are described further in this chapter. In Estonia, food frequency questionnaires and 24-hour recalls administered by interviewer have most frequently been used for assessing dietary intake of adults over the past several years. These two methods are included in the thesis and will be reviewed in the Materials and Methods chapter.

2.1 Diet History

Diet history is a method of dietary assessment in which subjects are asked open-ended questions about their usual dietary intakes. The interviewer inquires carefully about food consumption meal by meal, seeking information about variations in intake and trying to establish the usual pattern of consumption. Interviews of this type are time-consuming, often lasting for more than 1 hour, but they can provide considerable details about an individual's eating habits, including subtle aspects such as food preparation practices and seasonal variation in food choices. However, dietary histories, unlike records or recalls require subjects to make judgments about their usual food habits. Thus, the answers may reflect what the subjects think they eat (or what they would like the interviewer to assume they eat), rather than what is actually eaten. Diet history does not alter intake behaviour; is open-ended; method yields a more representative pattern of individual intakes in the past than other methods. In the same time diet history relies on memory; actual intake may influence reporting of intake in the past; it is difficult to visualize recall period accurately; method may require considerable time and respondent and interviewer burden may be heavy. There is possible to aid memory of consumers by using structured questionnaire. Most frequently this kind of assessment is administered by trained dieticians or experienced personnel [21,22,23,24].

1.2.2 Food records

Food record is a method of dietary assessment in which subjects record the foods that they consume. For a food record, subjects record their intake as they eat. They might be asked to estimate portion sizes, to weigh food before they consume it. If records are obtained for a sufficient number of days and if subjects cooperate well, food records would provide a good picture of usual current dietary intake. In fact, scientists often consider the weighed food record to be the "gold standard" for measuring food intake. However, this method imposes considerable burdens on the subject and can be used only with relatively educated people. The method could also be done by parents to collect information on the diet of their children and the survey can be repeated for several consecutive or non-consecutive days. Also, subjects may not comply with the researcher instructions to maintain their customary eating habits during the study period and some subjects may underreport their intakes. The validity of the results depends on the conscientiousness of the respondent and his/her ability to estimate quantities. Food record does not rely on memory; time period is defined; portions can be measured to increase accuracy; omission of food is minimal; record is open-ended. In the same time food record method have high participation burden; habitual eating patterns may be influenced or changed by recording process; increased respondent burden may adversely affect response rates. The method allows to develop specific aids, but also to use food

photographs to estimate portion sizes. Weighing of food consumed is sometimes integrated to the food record, but as this method has high burden for respondent and suitable equipment is needed, this is only used in small studies and in case of specific clinical trials. Collection of duplicate portions within food record allows to analyse samples directly without using food composition tables. Availability of duplicate portions may influence the results. Combining food record with duplicate portions is quite expensive and therefore seldom used [21,22,23,24].

1.2.3 Food frequency questionnaires

Food frequency questionnaire is a method of dietary assessment in which subjects are asked to recall how frequently certain foods were consumed during a specified period of time. Like diet histories, food frequency questionnaire focuses on usual intake. This method is far more structured, however. Subjects complete an interviewer-administered or self-administered questionnaire that asks how frequently they consume different food items. Some types of food frequency questionnaires pose their questions in open-ended form, whereas others use closed-ended questions with predetermined response categories. FFQs may be un-quantified, semi-quantified or completely quantified. The pre-coding of questionnaire is used to increase validity and to decrease bias in data-entry.
Portion sizes are sometimes estimated, for example, by providing pictures of different dishes. Food frequency questionnaires provide a reasonable measure of usual present or past intake. They are commonly used in epidemiological research because it is easy for the researcher to transform the answers into usable data. The quality of the results, however, depends greatly on the quality of the questionnaire. To design a good questionnaire, epidemiologists need considerable advanced knowledge of their study subjects, because there is always a limited number of a food in the questionnaire. Researchers also need an accurate knowledge of the food sources of the nutrients that they wish to study so that they can include the appropriate foods in the questionnaire. For example, FFQs include questions regarding usual food preparation methods, trimming of meats, use of dietary supplements, and identification of the most common brand of certain types of foods, such as margarines or ready-to-eat cereals. FFQs method may be more accurate for estimating an average intake of those nutrients having large day-to-day variability and for which there are relatively few significant food sources (e.g., alcohol, vitamin A and vitamin C).
FFQ is relatively inexpensive; customary eating patterns are not affected; most FFQ are pre-coded which facilitates simple data handling; rapid method with low respondent burden and relatively high response rate. But FFQ relies on memories; recall period may be imprecise; actual intake may influence reporting of intake in the past; requires complex calculations to estimate frequencies and quantification of food intake may be imprecise [21,22,23,24].

1.2.4 Dietary recalls

Dietary recall is a retrospective method of dietary assessment in which subjects are asked to recall their food consumption over a specific period of time. For a dietary recall, interviews administered person to person or by telephone, where subjects are asked to recall their dietary intake during the 24 hours prior to the interview, or the day is recalled from waking up until the same hour on the following day. This method is relatively quick and simple and does not require the researcher to have prior knowledge of the subjects' food habits24-hour dietary recall can be repeated for several consecutive or non-consecutive days. Underreporting of food intake may be a problem, however. Increasing evidence indicates that many people systematically underreport their total food intakes and that this tendency is stronger in some segments of the population (especially overweight people) than in others. Dietary recalls are best suited to obtain information on present diet rather than diet in the distant past, when lapses of the memory could be a problem. A single 24-hour recall from each individual can be used, however, to estimate the mean nutrient intakes of groups of people rather than of specific individuals. In 24-h recall method respondent burden is small; time period is defined; administration time is short; procedure does not alter intake pattern. But in 24-h recall method respondent recall depends on memory; portion size is difficult to estimate accurately and trained interviewers are required [21,22,23,24].

Differences between food consumption methods described above are characterized in figure 2.

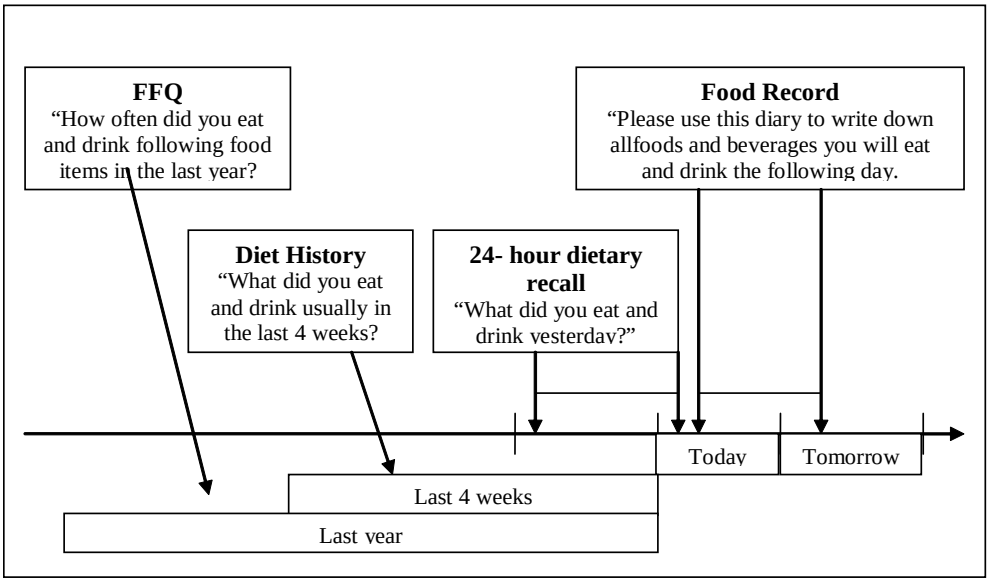

Figure 2. Main food consumption survey methods

In general, FFQs overestimate the total energy intake and are better at ranking, rather than quantifying the usual intake. In contrast, food records and recalls can be used to both rank and quantify nutrient intakes. Because of day-to-day variability in intake, however, food records and recalls require multiple days of collection to measure usual intakes of individual persons. Mean nutrient intakes of a population can be calculated from a single dietary recall or record. Compared with FFQs, food recalls and food records (in particular) require more effort on the part of the researcher/clinician and the respondent. On the other hand, methods for collecting food record or recall information require little adaptation for different population or age groups. In contrast, the FFQ requires the food list and portion sizes to be appropriate to the population under investigation.
Combination of different study methods has been used in many countries.
In addition to measuring dietary intake, the nutritional status is assessed also by using biomarkers, such as blood of urine levels of a nutrient. In some instances, they may even be the preferred way to evaluate exposure to a particular dietary factor. For example, sodium is difficult to measure in the diet, and therefore, some studies (Intersalt study) have used urinary sodium excretion as their measure of sodium intake [12].
There exist studies using innovative approaches in food consumption surveys: those include use of web-based questionnaires, which was as valid as postal questionnaire. Shopping behaviour and brand loyalty has been additionally studied. The new approach in dietary surveys is the use of digital photographs of foods consumed: those have been useful especially in studying children's food consumption, but also among teenagers. Digital photographs are met to be useful in studying supplement use (brand of supplement and quantitative information about the supplement) and to fix composition of fortified food consumed, but also packages used [25,26].
After considering the intended purpose of the assessment as well as the constraints of the setting, researchers can use the results of published studies as a guide to evaluate and possibly adopt the chosen dietary method.

1.3 Food consumption surveys in Estonia

The history of modern food surveys in Estonia dates back to the beginning of the previous century. The surveys of population food habits and assessment of their influence on people's health started in 1922 [27]. In 1962, dietary surveys of rural people began and wider Estonian dietary surveys have been conducted since then [28].
Nowadays, from the most substantial surveys, one could mention the monthly surveys of household expenditures; the annual surveys of consumers' food preferences; the annual reviews of food markets' conjuncture; the Health Behaviour Surveys among the Estonian Adult Population; Health Behaviour in

School-aged Children study and on-time nutrition surveys carried out by scientists working for institutions of higher education, including international projects and surveys.

The household budget surveys of the Statistics Estonia are conducted once a month on a regular basis, in the course of which, approximately 600 households are being questioned. Based on this information, it is possible to get a good review of Estonians' food expenditure, the amounts of purchased food and cost. In addition, the Statistics Estonia presents the natural consumption percentage of different food groups in total consumption. The results are disclosed in Statistical Publications[29].

Estonian Institute of Economic Research is conducting surveys on the economy of the Estonian family; the share of domestic and import goods in the turnover of Estonian shops; the residents' purchasing preferences of food articles depending on the country of origin and the dynamics of prices of agricultural products and foods in Estonia. A set of questions addresses people's eating habits and attitudes towards healthy nutrition [13].

The FINBALT Health Monitoring Survey monitoring health related behaviour, practices and lifestyles started as collaboration between Finland and Estonia in 1990, the the survey expanded to include Lithuania in 1994 and all the Baltic countries when Latvia was included in the study in 1998. This study has been carried out using a postal questionnaire as the data collection method (using a stratified random sample aged between 16 to 64 years of up to 5000 people). Conducting the study each time on the basis of a common methodology and employing a questionnaire that in a large part contains identical questions enables the monitoring and analysis of alterations of specific indicators of health behaviour over a long period [30]. Among other questions regarding health behaviour, the questionnaire also includes questions on nutritional behaviour like food preferences and frequency of consumption of certain foods.

Since 1993, the Health Behaviour in School-aged Children study has been carried out. The studies are conducted every third year by using self-reported questionnaires (a stratified random sample of 5000 children). Besides the questions on health behaviour, the questionnaire also includes questions about nutritional behaviour like food preferences and frequency of consumption of certain foods [31].

The studies conducted by universities and scientific research establishments address the correlation between nutrition and health, and the factors hazardous to health. Quite many smaller only-time surveys have been carried out, but most of them have been not representative for the whole country (regional surveys or surveys concerning certain target-group). Representative surveys have been carried out mainly within international projects and those studies are the Adult's Nutrition Survey in 1997, the European Youth Heart Survey in 1998/1999 and the NORBAGREEN project in 2002 [32,33].

1.4 Food composition tables used in Estonia

Food composition databases provide detailed information on the concentrations of nutrients and nutritionally important components in foods. Knowledge of the chemical composition of foods is the first essential criterion in the dietary treatment of disease or in any quantitative study of human nutrition. Food composition data are needed for formulation of appropriate institutional and therapeutic diets, including schools and hospitals, but also for providing the foundations for nutrition education guidance, which includes nutrition labelling information. Food retailers and manufacturers need to know the composition of foods or ingredients imported, for example, to meet food labelling requirements or national standards and regulations. At an international level, standards such as Codex Alimentarius utilise food composition data[34].

In general, data obtained on food intake by individuals or groups of individuals is converted to consumption of nutrients. This conversion process can be achieved either by analysing the foods consumed directly or by using food composition tables. Methods based on the use of food composition tables are more often used, because direct analysis is too cumbersome, costly, and time consuming [21].

Estonia does not have a national food composition table. The Estonian food composition database contains nutrient data mostly from Finnish and Swedish databases, but it also contains Russian and USDA data, as well as labelling information and data calculated from recipes [34]. The database used in Estonia today is Micro-Nutrica Nutritional Analysis Program, based mainly on the Finnish database. The program has been improved and adopted for Estonia in the Department of Food Processing, Tallinn University of Technology and contains currently about 1150 food items and dishes and 66 nutrients. Now the database is available also through Internet in Estonian and Russian language, it contains local foods and recipes and has been adjusted to be able to carry out Estonian dietary surveys [33].

The quality of food composition data varies from nutrient to nutrient. Even for nutrients for which extensive data are available, the values in databases may need to be refined as new scientific information is developed. In the previous food consumption surveys, different food composition tables have been used for calculations. PC software program ANKE 1.1.1.1 was used, which contains mainly nutrient databases of Russian, Finnish and German tables. Nutrient assessment program DanKost2, which is a computer database of foods from the National Food Agency of Denmark, was used in dietary analyses by the Estonian Institute of Cardiology [35].

Micro-Nutrica Nutritional Analysis Program allows calculations of nutrient intakes from different foodstuffs and recipes, analyses of daily nutrient intake, by meal or by consumed foodstuffs. Database allows calculating the percentage of energy derived from macronutrients (protein, fat, carbohydrates and alcohol) and fatty acids; to make a relative calculation of nutrients to 1000 kcal or 10 MJ

and to compare the nutrient intake with Estonian and Nordic Recommendations and RDA [36]. The program has also notes to the literature used for nutrient composition, recipes and recommendations [33]. Free Internet-based food composition calculation program was developed in Estonia at the beginning of 2006 (www. terviseinfo.ee) [33].

1.5 International recommendations for food consumption surveys to get comparable data

Household budget surveys of 13 European countries (DAFNE project) provided comparable data at food availability in household level in the European countries, but the project defined many discrepancies in this methodology, also a need to collect data at the individual level. Therefore, comparable and new data collection at the individual level has been suggested [3,4].

The first try to collect comparable food consumption frequency data as a part of a collaborative system for monitoring health related behaviour, practices and lifestyles in Finland and the Baltic countries has been the FINBALT Health Monitoring Survey. The survey uses postal questionnaire as a data collection method. The FINBALT survey has data on frequency of consumption of vegetables, fruits and fish during the last week [1]. Some remarks have been stressed out concerning mail surveys. They require motivation, enthusiasm and literacy and therefore are declared to be inappropriate for use with respondents from very low socioeconomic status backgrounds. Those who are more health conscious are more willing to take part in dietary surveys [4,37].

There have been many regional European projects to compare food consumption habits between the countries. The project "Compatibility of the Household and Individual Nutrition Surveys in Europe and Disparities in Food Habits" provided a comprehensive overview on socioeconomic differences in food habits. The results of this survey indicated that there is limited information on meal pattern and studies should focus also on socioeconomic differences [37].

The European Nutrition and Health Report is the first comprehensive assessment of the present status of nutrition and health in Europe. The report gives an overview of food supply and availability, energy and nutrient intake in different age groups, health indicators and status, obesity, physical activity etc. It also identified problems concerning the methods and compatibility of data collection[3].

The Nordgrönt working group evaluated the possibilities of achieving comparable and regular data at the individual level about the intake of potatoes, vegetables, fruit and berries among the populations of the Nordic countries. The working group considered that the existing per capita statistics, household consumption surveys and dietary surveys were not good enough for this purpose. The working group recommended the development and testing of a new simple method that can provide comparable data on consumption frequencies for

potatoes, vegetables, fruit and berries in the Nordic countries, and to compare it with the goals expressed in national health policies [38].

The need for harmonization of food consumption and food composition data across Europe is clearly identified and evidenced from above-mentioned European collaborations, but also by EFCOSUM project. Available data of dietary intake in different countries were noticed not to be directly comparable, but the diversity of approaches in assessing dietary intake on the individual level is huge. The improvement of comparability of dietary intake assessment using currently available individual food consumption surveys is another choice for the acute dietary and health monitoring in Europe, but would also need resources for the modification of the data [3,4,11,12].

EPIC study - the European Prospective Investigation into Cancer and Nutrition (EPIC) covers a large cohort of half a million men and women from 23 European centres in 10 Western European countries. The study was designed to investigate the relationship between diet and risk of chronic diseases, particularly cancer. Information on usual individual dietary intake was assessed using different validated dietary assessment methods across participating countries. Software program (EPIC-SOFT) was specifically designed to carry out the computer assisted 24-hour dietary recall and to standardise the dietary measurements across study populations [39].

Validation studies have been carried out within EPIC study to evaluate under- and over-reporting and their determinants in the EPIC 24-hour dietary recall and calibrate and standardise the procedures for 24-hour dietary recall. Energy intake tends to be underestimated in the vast majority of the EPIC centres, although to varying degrees; at the aggregate level, most centres were below the expected reference value of 1.55. Under-reporting seems to be more prevalent among women than men. Between-group calibration of dietary questionnaire measurements to study the diet-disease relationship is recommended. Standardization study has shown that despite encouraging results and the efforts to standardize the 24-hour dietary recall interview method, conscious or unconscious behaviour of respondents and/or interviewer bias cannot be prevented entirely [40,41].

One of the studies within EPIC study compared telephone vs. face-to-face interviews in the assessment of dietary intake by the 24 h recall with EPIC SOFT program. No statistically significant difference in dietary intake was found between interviews conducted by telephone and face-to-face, his survey indicated that both methods (telephone and face-to-face interview) are comparable and usable for conducting dietary surveys [42].

The HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescents) Study is a European, collaborative research project in the area of nutrition-related adolescent health. The basic objective of the HELENA project is to obtain reliable and comparable data from a random sample of European adolescents (boys and girls aged 13–16 years) on a broad battery of relevant nutrition and health-related parameters: dietary intake, food choices and preferences,

anthropometry, serum indicators of lipid metabolism and glucose metabolism, vitamin and mineral status, immunological markers, physical activity, fitness and genetic markers. The HELENA project is carried out in 10 European cities among adolescents aged 13-17 by using self-administered computerized 24-hour dietary recall (YANA-C). Never before has a European project covered such a broad portfolio of examinations in one collaborative effort in this age group. The project has established liaisons with several other ongoing European projects, especially with the IDEFICS (Identification and Prevention of Dietary- and Lifestyle induced Health Effects in Children and Infants) and the EUROFIR projects. The HELENA project is conceived as a scientific construction with four complementary substudies that are elaborated through 14 well-defined work packages. In this study, the survey was clearly connected to the education and interventions: to develop a Lifestyle Education Programme and test its effectiveness for improving adolescents' health was one of the subtasks of the HELENA project. The IDEFICS project studies food intakes of children aged 2-10 by using 24-hour dietary recall adapted from YANA-C in 2 weekdays and in one weekend day in 8 intervention centres [43, 44].

Increased opportunities for cooperation in international nutrition studies within Europe defined a need for increased compatibility of the nutrient databanks. The EUROFIR (European Food Information Resource Network) is the world's leading European Network of Excellence on Food Composition Databank systems, a partnership between 47 universities, research institutes and small-to-medium sized enterprises from 25 European countries. The EUROFIR will provide the first comprehensive pan-European food information resource, using state-of-the-art database linking, to allow effective management, updating, extending and comparability [34].

1.6 Food consumption surveys needed for risk assessment

According to Regulation No 178/2002 of the European Parliament, all food measures must be based on risk analysis. In order to conduct food safety risk analysis, there must be enough reliable nutrition data available. Therefore, it is necessary to conduct a thorough diet and nutrition survey to base the risk analysis [11,12].

Risk assessment is a systematic, logical and transparent method of assembling information on food-related disease to characterize the risk to human health associated with food. Contamination might be caused in all food chains, including environmental contamination through the water used, but also through food processing and packaging: all those aspects should possibly be quantified. Children should comprise one study group as the children's body burdens are often many times above the amount implied by tolerable intakes which are based on adult's body weight. Therefore, precise age-specific average body weight estimates are necessary for deterministic risk assessments, and an accurate body weight distribution is equally important in probabilistic risk assessments [45,46].

Figure 3 gives an overview of risk assessment process. Food consumption data are needed to assess dietary intake. Other parts of risk assessment are not described or analysed within this study.

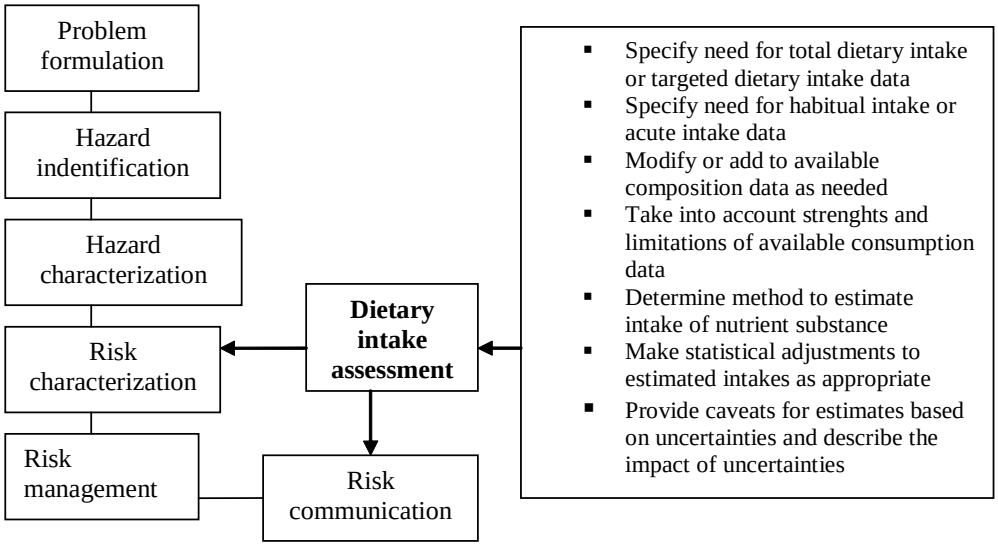

Figure 3. Scheme of implementation of food-related risk assessment [11].

The very specific food items are often in focus of risk assessment besides chronic and widely occurring contaminants. Lead and other heavy metals can enter the food chain through soil or water. People are mainly exposed to mercury because of consumed fish. Acrylamide has been discovered in starchy foods, such as potato chips, French fries and bread that has been heated. Ochratoxin A is known to occur in commodities like cereals, coffee, dried fruit and red wine. Environmental pollutants dioxins enter the general population almost exclusively from ingestion of food, specifically through the consumption of fish, meat, and dairy products since dioxins are fat-soluble and readily climb the food chain. There were differences in approaches used by authorities in assessing the risk of dioxins to human health. Organic contaminants were found in farmed salmon, but the experts disagreed about the approach in assessing the comparative health risks associated with the consumption of farmed and wild salmon, because the results are potentially confusing for consumers [11,12, 45,46].

At the initiative of the EFSA, the representative board of scientists listed the common principles for the dietary and nutrition survey used for risk analysis.

- Food consumption surveys should be up-to date and carried out at the individual level.

- The representative sample of the population should be guaranteed, the sample covers the whole population, but also an adequate dimension of the sample and an adequate representation of risk groups (e.g. infant, pregnant women, etc.).
- Survey should cover the whole diet (foods eaten out of home, supplements, drinking water), but this should be referred to short-term and long-term food consumption.
- Individual body weights, including individual body mass index but also descriptions of physical activity are needed for risk assessment.
- The results of such surveys should be codified at a high level of details within agreed and well-defined food groups to ensure comparability between countries. Information about brand (for additives and flavourings), type of packaging (for analyse residues of packaging material) and cooking method (for estimate toxic substances related to processing) should be integrated into the survey [11].
- Detailed information about the food distributor, the package, the method of preparation should be available.
- Risk assessment should be based on internationally agreed principles and it should consider other factors, such as health benefits, socioeconomic factors, ethical issues and environmental considerations.
- Some recent studies are recommending also validating portion size estimation of frequently consumed food items like bread and main dishes in dietary studies. For acute or microbial exposures, exact instead of estimated portion sizes are needed [11,12, 33, 42].

The diet and nutrition survey has to be applicable, for example, to conduct food safety risk analysis in the case of pesticides, contaminants (including contaminants from materials and substances that may be in contact with food items), additives, but also analyse nutrient intake from enriched foods and from special foods [25]. The results of the national diet and nutrition survey should be internationally comparable [10,11,45,46].

The European Food Consumption Validation (EFCOVAL) project was carried out to develop and validate a trans-European food consumption method to be used for estimation of the intake of foods, nutrients and potentially hazardous chemicals within the European population. The EFCOVAL concluded that harmonization of dietary surveys in Europe is less advanced for children than for adults. Studies have shown that parents have to help children before age 11, but the problem arises when the parents do not have direct assess to the intakes of their children during school meals. As recommended by the EFCOSUM consortium, the computerized repeated 24-hour dietary recall method (2 non-consecutive days) using EPIC-SOFT will be applied as the method for pan-European nutritional surveys to assess intake of adult population at the individual level. Short-term diet intakes could be extrapolated to long-term/chronic exposures by using statistical approaches [47].

The SAFEFOODNET project was established to harmonise and integrate the infrastructures and activities in the field of chemical food safety in EU. The first step was to set up a protocol for collecting information from each country, so that it can all be compared to validity. Another task was to assess whether a standard national diet could be defined for each country, together with patterns of consumption.
Food consumption data available at the EU level for exposure assessment are highly variable. Raw data (data per subject) are needed for exposure assessment. The EFSA's Colloquium concluded that recommendations on how to ensure validation of the food consumption surveys needs to be defined. Uncertainties should be explicitly considered at each step of the survey and risk assessment and documented in a transparent manner. Expression of uncertainty may be qualitative or quantitative, but should be quantified to the extent that is scientifically achievable. A good survey design allows to reduce uncertainties [11,45,46].

GENERAL OBJECTIVES OF THE THESIS

The long-term objectives of presented studies were to gather information about food consumption habits and nutritional status of the population and to plan and evaluate nutrition-related actions and policies according to that.

The main objective of this study was to evaluate the international comparability, reproducibility and validity of Estonian food consumption surveys. The suitability of existing food consumption surveys for risk assessment was additionally studied.
The study focuses on methodologies of food consumption surveys carried out in 1997 and 2002, the comparability, reproducibility and validity of these methods and their use for risk assessment.
On the basis of this study, the recommendations and future plan for food consumption surveys in Estonia will be worked out.

2. MATERIALS AND METHODS

2.1 Methodology of Baltic Nutrition Survey

The aim of the Baltic Nutrition Survey was to provide detailed information on the food consumption patterns and health behaviour of the population of the Baltic states [1].

During the summer of 1997, cross-sectional surveys were conducted among representative national samples of adults aged 16-64 in each country (Estonia: n=2108; Latvia: n=2308; Lithuania: n=2153. Interviews with participants included three parts: a 24-hour recall of dietary intake, a standardised questionnaire (covering demographic characteristics, eating habits and health behaviour) and height and weight measurements.

In Estonia, a simple random sample of 3000 individuals, stratified by age, was drawn from the National Population Register. Interviewers did not return to a house if there was no reply. Substitution was allowed if the response rate in the county in question was less than 60%. Overall, less than 5% of individuals in seven counties were substituted. Interviews were conducted by public health specialists, nutritionists and individuals with previous interviewing experience. Each attended a 1 day initial training session. The response rate was 67.3% and the final sample size was 2108 [Paper I].

In Latvia, two-stage sampling was used to draw a sample of 3000 persons from the National Population Register. The first sampling stage selected a sample for each of the 26 regions in Latvia according to the population size. In the second stage, random samples within strata were selected. The exception was for the city of Riga, where there appeared to be problems with the population register data, with a disproportionate number of people registered with ages over 60. Consequently, in Riga the second stage sample was also stratified by age group.

Interviewers were recruited from the regional environmental health centres. Substitution was not permitted and interviewers would return to an address up to five times. Each interviewer received training. The response rate was 77.7% and the final sample was 2331.

In Lithuania, a sample of 3000 names was drawn at random from those individuals listed on the National Population Register who were living at addresses in Lithuania and who were aged between 20 and 65. Interviewers were mainly assistants working in hygiene stations, who underwent an initial training session. In most cases the interviewers returned to an address on multiple occasions if they were unable to find the subject. There was no substitution. The response rate was 72.7% and the final sample size included 2182 respondents.

The interviewer-administered questionnaire was developed and agreed by all countries. It was translated by professional translators from English into Estonian, Latvian, Lithuanian and Russian. Each country used the same Russian version of the questionnaire. The questionnaire covered demographic and socioeconomic characteristics (sex, age, nationality, educational achievement,

and income), health behaviour (cigarette smoking, physical activity level at work and during leisure time), selected dietary habits (e.g. vegetable intake, type of water used, etc.) and dietary beliefs. Respondents were also asked about their height without shoes and their weight without clothes or shoes. Measurements of height and weight were performed by the interviewers according to standardized procedures, with respondents without shoes in light clothing. In Estonia a large amount of respondents did not have their height measured [Paper I].

The 24-hour dietary recall was used to define and quantify food intake during the previous 24 hours using common sets of household measures and photographs and/or drawings of commonly used foods to help the participants estimate food portion size. Probing questions about snacks, drinks, types of milk, fat and other foods were used to elicit more information [Paper I, Paper IV].

Nationality was classified as that of the native population, Russian, or "other" - which essentially equated to Ukrainian, Belarussian, or Polish. In each country, income was divided into four categories based on national criteria for the poverty level; with the poorest category considered to be living in severe poverty. All individuals with missing information on age were excluded from the analyses (n=7 in Latvia and n=11 in Lithuania), as were pregnant and lactating women respondents in Latvia and Lithuania (n=17 and n=18, respectively) in order to parallel the sampling selection of the Estonian survey. In Lithuania, three respondents were over 65 years of age but were kept in the analyses. After excluding 70 individuals who did not provide information for the 24-hour dietary recall, the samples included 2015 respondents in Estonia, 2300 in Latvia, and 2094 in Lithuania [Paper IV].

Dietary beliefs were correlated with the food consumption habits reported [Paper III].

In Estonia, dietary information from 24-hour dietary recall were converted into daily nutrient intakes using the Micro-Nutrica Nutritional Analysis Program (Estonian Version 2, 1997, Food Processing Institute, Tallinn Technical University, Estonia) [Paper IV, Paper V,]; this program includes over 1150 food items and dishes and 66 nutrients. In Latvia and Lithuania, Russian Food Composition Database was used to convert foods into nutrients. This program includes 1618 food items and 20 nutrients. Nutrient losses due to the food preparation were included into the calculations [Paper IV, Paper V, 48].

2.2 Comparability analysis of the Baltic Nutrition Survey

As two different databases were used to derive nutrient intakes in the Baltic Nutrition Survey, this comparability study set out to investigate whether intrinsic differences between databases could have influenced between-country variations in estimated nutrient intakes. The objective of the comparability study was to compare the nutrient content of foods and of diets based on data from two food composition databases used in the Baltic Nutrition Survey: Micro-Nutrica Nutritional Analysis Program was used in Estonia (an adapted version of the Finnish database) and the Russian Food Composition Database was used in

Latvia and Lithuania [Paper V, 49]. Nutrient data in Micro-Nutrica Nutritional Analysis Program are mostly from Finnish and Swedish databases [48,50].
The comparison of the databases was done at two different levels: first the energy and nutrient composition of 15 foodstuffs commonly consumed by the populations of the region, and second the mean energy and nutrient intake of a sample of 32 survey participants.
This comparison had wider relevance, as most data on the countries of the former Soviet Union are derived from the Russian food composition tables while the Finnish food composition tables closely resemble those used in many parts of Western Europe. [Paper V].
In the first level of analyses, a list of fifteen foodstuffs commonly consumed in the Baltic countries was prepared. Food items were chosen mainly because they are consumed frequently in both countries [51] and in most cases represent staple foods (e.g., potatoes, bread and milk). In addition, simple foods were preferred (e.g., boiled egg) and that would not differ greatly among countries in their mode of preparation (in the industry or at home), thus avoiding composite dishes that would differ because of national variations in recipes. Finally, we attempted to include foods from different food groups were (e.g., milk products, breads, meat and substitutes, fats, sweets). The energy, macronutrient, vitamin C, calcium and iron content of the foods were estimated using both food composition databases, i.e., the adapted version of the Micro-Nutrica Nutritional Analysis Program and the Russian Food Composition Database. Energy content was calculated from macronutrients using the following conversion factors: carbohydrates 4 kcal/g; protein 4 kcal/g; fat 9 kcal/g; alcohol 7 kcal/g). The results obtained using the two methods were compared. In the second set of analyses, a sample of 32 24-hour dietary recalls from Latvian respondents was selected. All were in Russian so that they could be translated to Estonian by one of the authors who spoke both languages and all were easily readable (legibility of hand writing) in order to facilitate translation. Records were translated into Estonian, and analysed using the two food composition databases. The energy and macronutrient content of the foods was examined, as well as the content in calcium and iron, micronutrients considered to be potentially problematic in the reference populations [Paper V].

2.3 Methodology of NORBAGREEN survey

The aims of the NORBAGREEN study can be divided to the following two categories:
1) The main aim, based on the lack of comparable data, was to study the average frequency of consumption of vegetables, potatoes, fruit, bread, and fish with a comparable method in the Nordic and the Baltic countries.
2) The methodological aims were to produce and validate a food frequency questionnaire (FFQ) for the Nordic and Baltic countries for monitoring the

frequency of consumption of foods considered to be dietary health indicators, i.e. vegetables, fruit, bread and fish.

The NORBAGREEN study in 2002 was carried out in eight Northern European countries among 8397 persons: Sweden, Norway, Denmark, Iceland, Estonia, Latvia and Lithuania. The interviewing method used in the Baltic countries was a Paper Assisted Personal Interview (PAPI), in the Nordic countries a Computer Assisted Telephone Interview (CATI) was used. The professional research companies performed the survey in all countries. In Finland, Norway and Iceland, the interviews were carried out ad hoc, in other countries the interview was a part of an omnibus. In Estonia, the study was carried out by ES Turu-Uuringute AS [Paper VI, 4].

The number of completed interviews was approximately 1000 persons in each country aged 15-74 years (aged 16-80 in Sweden and Denmark). The requirement of an area, sex, and age-group representative sample was fulfilled. Tables 2 and 3 describe the methodological differences between the NORBAGREEN countries.

Table 2. Methodological information of the NORBAGREEN study: Nordic countries [4].

	Finland	**Sweden**	**Norway**	**Denmark**	**Iceland**
Collaborating research company	Toy Research	GfK Sverige AB	Opinion AS	Gfk Danmark A/S	Gallup Iceland
Method	CATI	CATI	CATI	CATI	CATI
Omnibus / ad hoc	Ad hoc	Part of telebus	Ad hoc	Part of telebus	Ad hoc
Sampling	Randomly household numbers + mobile phones	Randomly household numbers	Randomly household numbers	Randomly household numbers	Randomly national register + mobile phones
N	1009	1005	1000	999	1002
Weighed N	1008	983	997	997	1002
Proportion of complete inter-views of all contacts (%)	50	74	50	27	70
Age of respon-dents (years)	15-74	16-80	15-74	16-80	15-74
Languages of the questionnaire	Finnish	Swedish	Norwegian	Danish	Icelandic
Missing answers of food questions (%)	< 1	< 3	< 2	< 2	< 4

The CATI samples in the Nordic countries were randomly drawn from the household telephone numbers apart from Iceland where the sample was randomly drawn from the National Register. Mobile phone numbers were included in Finland and in Iceland. The respondents in the households were selected by using the last birthday or next birthday method: the person in the household, who was last/next in line to have his/her birthday, was selected. If this person was not at home, a time for an interview was scheduled. All phone numbers were called at least three times [4].

Table 3. Methodological information of the NORBAGREEN study: Baltic countries [4].

	Estonia	**Latvia**	**Lithuania**
Collaborating research company	ES Turu-uuringute AS	Latvian Facts	Vilmorus Ltd
Method	PAPI	PAPI	PAPI
Omnibus / ad hoc	Part of omnibus	Part of omnibus	Ad hoc
Sampling	Sampling points	Sampling points	Sampling points
N	996	1060	1076
Weighed N	996	1060	1076
Proportion of complete interviews of all contacts (%)	75	82	67
Age of respondents (years)	15-74	15-74	15-74
Languages of the questionnaire	Estonian Russian	Latvian Russian	Lithuanian Russian
Missing answers of food questions (%)	< 9	< 4	< 3

In the Baltic countries, the sampling points were composed according to the national statistical population data: the choice of the sampling points was made taking into consideration the number of inhabitants in each area. In Estonia, the starting address' method and the younger man's rule were used to select the respondents in cities and towns. In villages and country areas, the respondents were chosen randomly from the list of residents. In Latvia, the starting address' method was used to select the households. The selection of respondents in each apartment was carried out by using Kish table. In Lithuania, the selection of households was carried out in towns using the random route procedure and the starting address' method. In the households, respondents were selected using the birthday rule or Kish table.

The questionnaire used in the survey is based on a food frequency questionnaire (FFQ) of NORDGRÖNT project, for measuring consumption of different food

groups; the questionnaire was adopted and pre-tested in all participating countries. The questionnaire was validated in Finland and Lithuania, partly also in Sweden.
The respondents were asked how often they had usually eaten certain foods on the average during the past year. The portion was used in the food groups fruits/berries, vegetables, potatoes and fish. Respondents were asked to omit highly sugared fruit or berry jam and marmalade from fruit and berries group. In addition the preference of different preparation forms of vegetables, fruit, berries and potatoes were asked. The frequency of consumption of bread was asked as slices. The following categories were used for the breads to ensure comparability between countries: bread containing fibre > 6 g/100 g or 3 g/slice (later 'whole grain bread'), bread containing fibre 3-6 g/100 g or 1.5-3 g/slice (later 'semi whole grain bread') and bread containing fibre < 3 g/100 g or < 1.5 g/slice (later 'white bread'). The fibre content in Estonia was categorised according to food composition tables and food labelling information in Estonia.
Demographic background questions asked in all countries were: age, gender, geographical area, residence, marital status, last terminated education, years of full-time education after the compulsory school, total annual household gross income, working situation, trade / profession, family situation, number of children under 18 years at home, ethnicity (excluding Iceland). In addition, the native language was asked in Finland, Estonia, Latvia and Lithuania. In Sweden, Norway and in Iceland, it was marked if the interview was carried out before or after the day when the research results of acrylamide were published. Type of usually eaten food (mixed food/vegetarian food) was asked in every country [4].
Information about the survey details were collected from the participating countries by using quality questionnaire at the end of 2002. To ensure comparability, information about translation, how well the sample matched with the real population, what was a basis to specify fibre content in bread in different categories, etc, was collected and analysed.

To compare the results of survey with the actual food consumption, the validation studies were carried out in Finland (within the National FINDIET 2002 Study) and in Lithuania (within the CINDI Health Monitor Study). The validation studies were carried out 2 times between 6-8 months to analyse seasonal variations (in Finland, January-May and October-December; in Lithuania, May-June and August-September) and differences in different food groups. Reference methods were 2 x 3 day food records in Finland and 4 x 24-hour dietary recall in Lithuania.
In Finland, of the 222 subjects who got the FFQ1, 73 filled in the FFQ1 in the spring and the three day food records in the spring and in the autumn (external validity of the FFQ) and 71 filled in the FFQ2 (reproducibility of the FFQ).
The sample of 100 citizens of Kaunas was selected from the list of the participants (aged 20- 64) and the patients of Family Medicine Clinic of Kaunas Medical University Clinic (aged 15-19 and 65-75). In Lithuania, only those who

agreed to participate in the study were included in the sample within CINDI Health Monitor Study. Data of 99 persons were analysed. The sample was divided into four equal groups (one group for one interviewer). The data were collected by means of face-to-face interviews. The respondents were interviewed in the households.
In April 2002, the first FFQ1 was filled in by the subjects and the first 24-hour dietary recall interviews were carried out. The second 24-hour dietary recall interviews were carried out in May-June, and the third in August-September. In October, the second FFQ2 was filled in and the fourth 24-hour dietary recall was accomplished [4]. The results were divided by using factor 5 and 7.5 and were presented as food consumption frequency for one month.

A repetitive survey was carried out in April 2004 in Estonia by using similar methodology and short questionnaire, excluding questions on potato consumption. The survey was not as detailed as main surveys of the NORBAGREEN and frequencies of different fruits, berries and vegetables were not asked. The repetitive survey was also carried out by the ES Turu- Uuringute AS. The repetitive survey used also questions about the reasons for choosing foods and factors influencing the food choice [Paper VI, 4, 52, 53].

3. RESULTS AND DISCUSSION

3.1 Methodological issues of conducted surveys

General characteristics of the sample and data collection

The planning of the Baltic Nutrition Survey started at the end of 1996. The survey was carried out in summer 1997. Although the overall sample of the Baltic Nutrition Survey was relatively large (the final samples included 2018 respondents in Estonia, 2308 in Latvia, and 2153 in Lithuania), the small size of certain groups reduced the power to detect significant differences. Data were only collected for those between the ages of 19 (20 in Lithuania) and 64, so we do not have data for the elderly or for teenagers [54].
In the Baltic Nutrition Survey, the sampling principles and also data collection practices differ between countries [Paper I, Paper II, Paper III]. This was due to the organizational aspects and limited time between planning and implementation, which did not allow harmonize all procedures. The questionnaire, the sample size, the methods of 24-hour dietary recall and procedures to measure height and weight were agreed, but the detailed study protocol was not agreed between countries. For example, sampling details, principles to recruit interviewers, training – program for interviewers, public communication about the survey, return to an address or substitution and other organizational aspects were not negotiated and agreed between countries. The organizational structure therefore

depended on the resources, possibilities and limitations of the responsible body for carrying out the survey. For example, interviewers could have substituted the selected people even without reporting of substitution.
Cultural differences were observed within the Baltic Nutrition Survey. For example, less than one in ten persons lived on their own in Lithuania, compared to one in five in Estonia: the household size is known as one of the predictor of food choices [36]. In the Baltic Nutrition Survey, the proportion of respondents who went only to primary school tended to be slightly higher in Latvia (19%) and Lithuania (20%) than in Estonia (13%). However, the proportion of respondents with more than secondary education was lowest in Estonia (42%) and highest in Lithuania (54%)[1]. As the education is the important factor, which could influence also self-reported data within the survey, the disparities between educational levels should be taken into consideration. For example, under-reporting has often been associated with lower social classes and lower level of education [36]. The consumption of foods containing fat is related to educational level of respondent. The diet of better-educated people is closer to recommendations for the consumption of saturated and unsaturated fats than the diet of people with lower level of education [55].

The above-mentioned problems were not so wide in the NORBAGREEN survey. The planning process of the NORBAGREEN study started at the beginning of 2001 and the survey was finally conducted in April 2002. During planning the international survey, also the validation studies were planned both in the Nordic and Baltic countries.
The NORBAGREEN food frequency questionnaire was prepared by modifying and expanding the validated FFQ of the preceding NORDGRÖNT project. After the translation of FFQ from Swedish to English and then to 9 languages (three Russian versions of the questionnaire were used in the Baltic countries) a retranslation procedure from local languages back to English was used to assure the uniformity of the FFQ's between countries. The questionnaire was pretested in the participating countries. Some minor country-specific modifications were allowed to the questionnaire [4].
The sampling design, fieldwork and data registration was commissioned to a commercial market research company. This turned out to be the only possibility, since no governmental or research organisation could take the full responsibility for the survey fieldwork. Therefore, the organization of study was similar to all participating countries and the instructions to different companies were the same. Due to the cultural differences between countries and common practices used for surveys, different interviewing methods were used in the countries: Computer Assisted Telephone Interview; Paper Assisted Personal Interview (PAPI). The weighing of the data was performed on the basis of area, sex and age in every country.

Body weight and height

Most of the variables analysed in the surveys are self explanatory [Paper II]. One of the strengths of the survey was representative sample of the population, whose height and weight was measured according to the standardized procedures. Asking the weight and height followed by weighing. Weight was measured with scales with 0.1 kg error without shoes and in light clothes. Each participating county purchased scales, but use of electronic scales was agreed and therefore, differences between the countries were not observed. Weight was measured usually two times after the interview; mean of the two measurements was recorded. In Estonia, height was recorded simultaneously only in some counties due to unsuitable equipment. For measurement of height, Microtoise measures from Sweden had been ordered to all participating countries. This height equipment wasn't understandable for house-to-house interviewing (this was designated for mount to the wall) and stiff measures were simultaneously used [1]. This was the reason why in Estonia a large proportion of respondents did not have their height measured. In those cases, the self-reported height was taken for further calculations. Anthropometric surveys in the past have shown that people tend to under-report their weight and over-report their height [56,57]. If compared with the self reported weight, slight under-reporting (~1 kg) of weight in females in all age groups and slight over-reporting (~1 kg) in age group 19-34 in men was detected in Estonia.

Food frequency and health behaviour questions

Food frequency questions were part of the Baltic Nutrition Survey as well as in the NORBAGREEN survey. In both surveys, the questionnaires were similar for all participating countries and they were translated from the basis questionnaire into English. In the Baltic countries, the questionnaires were both in Estonian and in Russian language.

The questionnaire the Baltic Nutrition Survey covered demographic and socioeconomic characteristics (sex, age, nationality, educational achievement and income), health status and health behaviour (presence of chronic diseases, cigarette smoking, physical activity level at work and during leisure time), selected dietary habits (e.g. vegetable intake, dependence on home-grown foods, reasons for choosing foods, type of water used, type of salt used, supplements use, etc.) and dietary beliefs [Paper I]. Some questions allow comparing the answers in the questionnaire with data obtained by 24-hour dietary recall and this was used in the data analysis process.

Some frequency questions were semi-quantitative in the Baltic Nutrition Survey. Respondents were also asked how much of specified measures alcohol they had consumed in the preceding week. These were: spirits (50 ml measures), wine (100 ml glasses) and beer (500 ml bottles). These were converted to grams of alcohol, summed, and divided by seven to give the mean daily consumption.

Turning to the amount drunk, the mean daily consumption in grams was taken as the percentage of heavy drinkers (respondents drinking greater than 80 g/day). The study shows that the mean daily alcohol consumption was lower in Latvia than in other countries, with Lithuania being in an intermediate position below Estonia. The commonest beverage, among both men and women and in all three countries, is beer, followed by spirits among men and wine among women.
The percentage of heavy drinkers is much higher in Estonia than in other countries, at almost one in 10 men [Paper II]. The distribution of crude alcohol intake during the day before the 24-hour dietary recall interview varied among countries, but the median intake was zero in each country [Paper IV]. In Estonia, for example, sedentary men tend to consume more alcohol than others, while among women alcohol intake is the highest in the group who are doing sports. The problems with alcohol abuse in Estonia are recent [58,59] and policies are implemented to reduce availability of alcohol, but the results were alarming already in 1997.
The question about the supplement use was followed with free space to write down what kind of supplement a respondent was usually consuming. In Estonia, for example, the majority of urban people who took a supplement received a multivitamin. Multivitamins were less commonly used by rural people, who took vitamin C alone. Supplement use increased in correlation with education and income. Around 70% of people who choose their food by price did not used supplements at all.

The NORBAGREEN questionnaire included only questions about the frequency of the fruit and vegetables, but in details. Also, the questions about the overall diet (vegetarian or not) were included, since the vegetarian diet is a strong predictor to fruit and vegetable use. Potatoes were included to the FFQ for the following reasons: monitoring potato consumption separately, but in connection with the monitoring of vegetable consumption to better understand the total consumption pattern of plant foods. Demographic background questions (sex, age, residence, marital status and family situation, education, working situation and nationality) were included [4].
For example, the proportion of subjects who responded that they were eating a vegetarian diet was in the Nordic and the Baltic countries 2-3% except in Sweden where the proportion of subjects eating vegetarian food was 7 %. When those “vegetarians” eating also fish were excluded from the groups, the amount of respondents being vegetarians, lacto-vegetarians or lacto-ovo-vegetarians was less than 2 % in all countries.

Mean energy, nutrient and food intakes

Measurements of dietary intake based on a single 24-hour recall may provide reasonable estimates of mean intakes for a group or population sub-group. This technique is flexible and it facilitates the inclusion of all types of foods and

recipes. Estimates of dietary intake based on a single recall may provide reasonable estimates of mean intakes for a group or population sub-group. However, the standard deviations obtained with this technique are greatly overestimated because of normal day-to-day variation in dietary intakes.
Data collection using the 24-hour dietary recall method is relatively fast and inexpensive, but data entry is not. The validity of the method may be affected by the memory, co-operation, and communication ability of the subjects, as well as by the skills of the interviewer. To help increase the accuracy of the data, 24-hour food recalls were administered by trained interviewers and common sets of household measures, photographs and/or drawings of foods were used to facilitate the estimation of portion sizes [Paper IV].

Dietary intake estimates were also a subject to the general limitations associated with the use of different nutrient databases to derive the nutrient composition of an individual's diet. The Estonian version of the Finnish Micro-Nutrica Nutritional Analysis Program and the Russian Food Composition Database were the most complete ones adapted for a diet in the Baltic countries. Micro-Nutrica Nutritional Analysis Program allows using existing recipes where details of the type of fat, milk, etc. could be taken into consideration. If national foods are missing in the database, the food or recipe on basis of similarity with the foods and meals could be used. Food intake could be calculated as nutrients, main food groups or subgroups (foodstuffs alone).
The comparability study was planned after the results between countries showed differences between Estonia, Latvia and Lithuania. Lower energy and fat intake observed in Estonia could be partly related to the use of the Finnish database [PaperIV].

The results of the comparability survey showed that two databases yielded different values for energy, macronutrient, calcium, vitamin C and iron content in the selected foods [Paper V]. The calculated energy and content of the foods was generally lower in the Estonian Micro-Nutrica Nutritional Analysis Program than in the Russian Food Composition Database, particularly in the case of transformed foods: fried potatoes (-87%), grilled chicken (-34%), pelmens (dumplings) with pork (-33%) and frozen fish fingers (-20%). Differences worth noting with regard to carbohydrates include strawberry jam (-31%) and yoghurt with fruits (+71%). Compared with the Russian Food Composition Database, the Micro-Nutrica Nutritional Analysis Program reported less vitamin C in boiled potatoes (-44%), but more in fried potatoes (+50%).With regard to bread, black bread had a lower iron content in the Micro-Nutrica Nutritional Analysis Program than in the Russian Food Composition Database (-13%), but the reverse was true for white bread (+80%). The differences were present even for common foodstuffs that were expected to have a similar nutrient content and to have been prepared using similar methods (e.g. milk, boiled egg, boiled potatoes).
The results of analysed 32 of 24-hour dietary recall data indicated that the Micro-Nutrica Nutritional Analysis Program tended to give lower mean energy

and nutrient intakes than the Russian Food Composition Database except for alcohol intake. Alcohol intake is in a slightly different position as the same estimates (0 g/day) were obtained with both databases in 27 of the 32 respondents. For energy and the other nutrients, lower intakes were observed in a majority of individuals, that is, 28 for fat, 27 for energy and calcium, 20 for protein, and 19 for carbohydrates and iron. However, differences reached significance level only for energy, fat (both $P<0.0001$ based on paired t-tests), carbohydrate ($P<0.01$) and calcium ($P<0.001$). The difference between the databases was particularly striking for fat with a mean difference of 23.5% and with an important level of disagreement in some individuals. Disagreement was also considerable for energy and similarly for carbohydrate and calcium intakes. In spite of the differences observed, results from the two databases were highly correlated. The lowest Pearson correlation coefficient was observed for iron (0.67), but all the other coefficients were greater or equal to 0.82 (ranging from 0.82 for fat to 0.99 for alcohol) [Paper V].

3.2 Comparability, validity and reproducibility of conducted surveys

General characteristics of the sample and data collection

All countries in the Baltic Nutrition Survey had representative sample where different subgroups are present. In each country, there was a higher proportion of female than male respondents (55% in Estonia and 54% in Latvia and Lithuania). Significant between-country differences were observed among countries for the distribution by age, nationality, education level, number of persons in the household, work activity, and income (all $p<0.001$). Overall, respondents from Estonia were younger (mean age=39 years) and those from Latvia older (mean=44 years) than respondents from Lithuania (mean=42). No significant between-country difference was observed for the area of residence; almost two-thirds of the respondents lived in urban areas.

In the Baltic Nutrition Survey, one-third of the respondents was considered to be living in severe poverty (lowest income group), with variations from 28% in Estonia up to 38% in Lithuania. In contrast, the proportion of respondents in the highest income range was highest in Lithuania (21% compared with 9% in Estonia and 6% in Latvia), suggesting higher income discrepancies in the population of this country [1]. In each country, the income was divided into four categories based on national criteria for the poverty level, with the poorest category considered to be living in severe poverty. In Estonia, the cut-off point used for this lowest category was equivalent to the ‘minimum basket for living’ in 1997 (US$75 person-1 month-1). In Latvia and Lithuania, as salaries are lower than in Estonia, a cut-off point of US$50 person-1 month-1 was selected [Paper I]. This might be the cause of discrepancies between countries.

When planning the first national dietary surveys 1996, validation studies were not a part of the study plan.

In the NORBAGREEN survey, the data collection method differed among the Nordic (CATI) and Baltic (PAPI) countries due to national considerations. In Sweden, Denmark, Estonia and Latvia, the questionnaire was included in ordinary omnibus surveys, while in other countries it was carried out as an ad hoc survey. Previous studies have shown that there is no statistically significant difference in dietary intake between interviews conducted by telephone and face-to-face and data obtained by using different methods are comparable [41]. Also, the sampling technique used to obtain a representative sample differed. The sampling design included a demand of representativeness of sample in all countries by age, sex, and geographical area of residence. The influence of these different approaches to comparability of the data is unknown.
The socioeconomic questions were in the format that professional research companies and national surveillance usually ask. Therefore, the different socioeconomic groups will be comparable with other surveys.

Regarding the different sampling principles and also data collection practices between countries described previously, the reproducibility of the Baltic Nutrition Survey is not sufficient. Comparability between countries is good due to the same basic principles of surveys, but the above-mentioned limitations should be taken into consideration.

The comparability between the NORBAGREEN countries is good, even if there were differences in sampling methods and data collection methods. As weighed samples were used for analysis, the between-country varieties decreased.
By using unified FFQ and interviewing practices (interviews were carried out by professional interviewers in all countries), the between-country variations were eliminated. Reproducibility of the NORBAGREEN survey is good, there is a possibility to carry out the survey by using the same methodology and also sampling and data collection practices.

Body weight and height

Self-reported height and weight was validated by measured height and weight. For example, in Estonia, the average height of men was 174 cm, and of women 164 cm in 1997. Average body mass index was 25 in case of men and 23 in case of women, and tended to be higher in older groups. Under-reporting increased in connection with body weight, it was common in case of women, and slight over-reporting was perceivable in case of men in the age group 19-34. Table 4 shows the proportion of respondents who were aware of their height and weight in the Baltic Nutrition Survey.

Table 4. Reported *versus* measured BMI categories in Estonia

	Measured weight and height				
	BMI category*	Under-weight	Normal	Overweight	Obese
Reported weight and height	**Men**				
	Underweight	n=6(0.7%)	0	0	0
	Normal	n=2(0.2%)	n=539(60.5%)	n=35(3.9%)	0
	Overweight	0	n=11(1.2%)	n=224(25.1%)	n=9(1%)
	Obese	0	0	n=3(0.3%)	n=62(7%)
	Women				
	Underweight	n=28(2.5%)	n=20(1.8%)	0	0
	Normal	n=6(0.5%)	n=672(61.0%)	n=44(4.0%)	n=1(0.1%)
	Overweight	0	n=5(0.5%)	n=233(21.2%)	n=15(1.4%)
	Obese	0	0	n=4(0.4%)	n=73(6.6%)

*Based on WHO classification

The survey indicated that people are well aware about their body size and weight.

The results for body weight between countries show more diversity especially in women. In all age groups, mean BMI was significantly higher in Latvia and Lithuania than in Estonia. Prevalence of overweight and obesity (BMI>25 kg/m2) in women was 30% in Estonia, but 50% in Latvia and 60% in Lithuania. Among women, the proportion of obese people in Latvia and Lithuania was almost three times that in Estonia. But, as the similar systematic difference was not found in men, this cannot be speculated as a systematic bias in measuring weight of women.

Previous studies have found that weight was understated by 1.6% of men and 0.6% of women, whereas height was overstated by 1.3% of men and 0.6% of women [57]. The results from the Baltic Nutrition Survey support the similar pattern also in the Baltic States. The results showed that on average, Latvian men and women were slightly more likely to under-report their BMI (by 0.6 kg/m2) compared with their Estonian and Lithuanian counterparts (by 0.2 kg/m2)[1].

Recent studies are confirming that self-reported height and weight data are valid for identifying relationships in epidemiological studies. But in analyses where anthropometric factors are the primary variables of interest, measurements in a representative sample of the study population can be used to improve the accuracy of estimates of height, weight and BMI[60,61,62,63].

Therefore, anthropometrical data from the Baltic Nutrition Survey could be considered to be comparable and with high validity. The reproducibility of the survey is not good due to the organizational limitations in this survey. If it is planned to reproduce the anthropometrical measurements in further surveys, the equipment should be fully suitable for the survey and performing height and weight should be standardized and supervised.

Food frequency and health behaviour questions

FFQ in the Baltic Nutrition Survey was with high comparability, the questionnaire was translated by professional translators from English into national languages. Each country used the same Russian version of the questionnaire [Paper II].

Alcohol is a compulsory component if analysing the whole diet. Studying alcohol use is much more complicated than completing a dietary survey only. In the Baltic Nutrition Survey, the alcohol use was measured both by semi-quantitative frequency questions as well as a part of the 24-hour dietary recall. When frequencies compared, the results have shown differences between countries in men, but drinking was much lower among women than men in all of the countries. For both men and women, consumption declined with age. This was especially marked among women, where the proportion of those aged 50–64 drinking weekly was between a third and a fifth of that among those aged 19–34 [Paper II]. In the Baltic Nutrition Survey, women reported moderate drinking in all categories, but men tend to drink more beer and spirits and it concentrates during the weekends. Figure 4 shows the correlation between alcohol intake (total consumption from different alcoholic beverages) and self-reported frequencies.

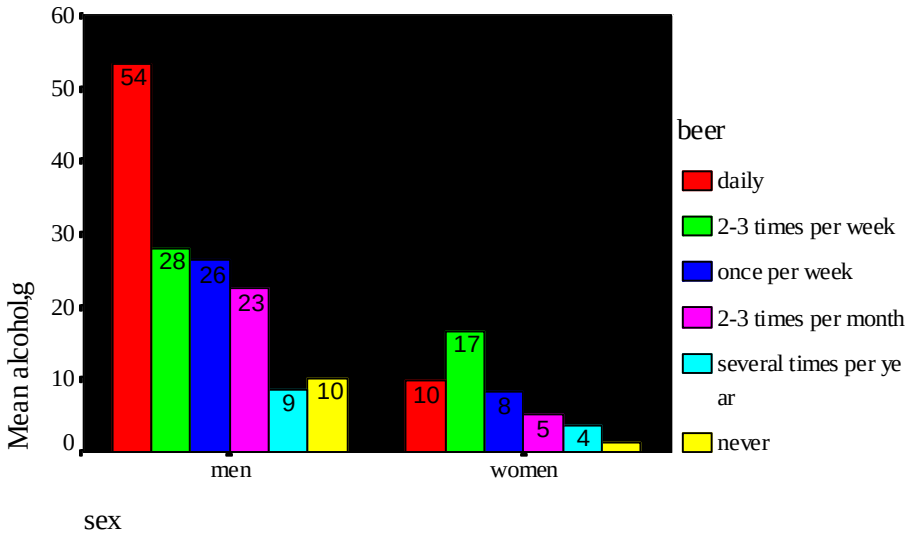

Figure 4. Alcohol intake from 24-hour dietary recall by reported frequency of drinking beer in men and women

As drinking beer was most common in Estonia, the frequencies show the good correlation between self-reported frequencies and actual intake, similarly also with wine consumption and in case of spirits. Quite interesting that in all categories, those women who reported daily consumption of alcohol had lower

actual intake of alcohol than those women who reported consumption of alcoholic beverages 2-3 times per week.
Drinking alcohol is connected to the cultural values and attitudes. Therefore, the validation surveys have been carried out elsewhere to work out instruments to study alcohol abuse. Those studies have shown that men presented an increased frequency of problematic alcohol use 1.6 times that of women [61]. Possible under-reporting of alcohol use by women in different age groups, but also by men in this study was not clearly estimated in the Baltic Nutrition Survey.
Although these three countries are superficially similar, there are important differences in patterns of alcohol consumption. Levels of consumption among the Russian populations in each country vary considerably, and both in Estonia and Lithuania differ significantly from that of the majority population [Paper II].
Alcohol consumption, but also physical activity could be higher in summer than in other seasons. Time of the survey might influence the results and this was not analysed or validated within the study.
The time of the survey enforced people to use more homemade foods and meals and eating out at that time was not common. Dietary beliefs were studied as a part of the survey and they were analysed in the connection with actual health behaviour and food consumption. Variations by nationality were observed in each country. Education level was the most consistent predictor. In Estonia, and Lithuania, individuals of Russian nationalities were less likely to know about the nutrition and possible health effects [Paper III]. Several studies have reported that beliefs and knowledge were positively related to dietary behaviour [65]. In the Baltic Nutrition Survey, the beliefs of the possible effects of dietary salt and types of fat were not consistently associated with healthier behaviour. In Estonia, men and women who believed that excess dietary salt is of no consequence for health were about two to three times as likely as other respondents to add salt at the table, even after differences in education level and other demographic characteristics were taken into account. Those who answered that meat is essential for everyday healthy diet consumed more meat products (both men and women). In Estonia, 57% of the population either believed that potatoes are fattening or did not know whether they are or not, and only 35% believed that potatoes are a good source of vitamin C. Those who answered that potatoes are good sources of vitamin C consumed slightly more potatoes as well.
In addition, the study may have been affected by recall or reporting bias as the information is based on self-report; however, as the questions were generally non-stigmatizing, reporting bias should be small [Paper III].

In the NORBAGREEN survey, additional actions were utilized to secure comparability of questionnaire: retranslating questionnaires from national languages into English and comparing names of the basic fruits and vegetables by using textbooks and also Latin names of different foods [4, 66].
When working out the NORBAGREEN questionnaire, the use of the FINBALT questionnaire was analysed. The FINBALT survey has data on frequency of the

consumption of vegetables, fruits and fish during the last week being therefore not representative for whole-year consumption. In addition, it has to be noted that the Baltic countries have also very high consumption of fruits, vegetables and potatoes of home-grown origin, which makes seasonal variations high. The comparison of the results of the FINBALT survey and the Household Budget Survey in Estonia has shown different trends in food consumption since 1996. There has not been carried out the validation study within the FINBALT survey in any of participating countries[67]. Therefore, the validated NORDGRÖNT questionnaire was taken as a basis for the NORBAGREEN study.
The validity of the extended FFQ was tested in two separate studies carried out in Finland and Lithuania. The results show that the external validity was good for vegetables, fruit and bread. The agreement for vegetables and fruit was good compared to the results of other validation studies. The agreement for potatoes and fish was from weak to moderate in both validation studies, in line with the results for potatoes in the Swedish validation study. Average consumption per day was for potatoes 0.6-0.7 and for fish 0.2. It is probable that the reference periods (6-day food records and 4x24-hour dietary recalls) were not long enough to test the validity of questions of consumption of fish [4].
The global questions on total consumption of studied foods tended to elicit lower estimates than the sums of estimates for differently prepared forms. In case of vegetables and fruit, the sum of differently prepared forms corresponded better with the reference methods than the global question on total consumption. The sum of individual vegetables (19 vegetables were asked) and fruit (14 fruit were asked) clearly overestimated the total consumption.
The reproducibility of the FFQ was good (Spearman correlation coefficient was in the Finnish study 0.49-0.75 depending on food and 0.51-0.83 in the Lithuanian study) when it was repeated in Lithuania and Finland after 6-8 months. Seasonal variation might affect the consumption data of vegetables, fruit and berries. To minimise this, subjects were asked to think about the entire preceding year while answering the questions. In the validation studies, data were collected both in the spring and in the autumn. Good agreement was observed for the questions on the total consumption of all foods, indicating that seasonal variation was of minor importance. For individual vegetables and fruits, one would expect that seasonal availability would have a stronger impact, as found by the earlier Swedish validation study [4].

The comparability in the Baltic Nutrition Survey between countries is good due to the same questionnaire and basic principles of surveys. As the FFQ used in the survey was not validated, the validity of the frequencies is unproven. As for most of the questionnaires used in the surveys, this part could be reproduced in the future, but limitations in study design should be taken into consideration.

The comparability between the NORBAGREEN countries by using validated FFQ is good. As the FFQ was validated both in the Nordic and Baltic countries,

the results of the survey are with high quality. Reproducibility of the FFQ NORBAGREEN survey is good.
In the future, the NORBAGREEN FFQ can be used to follow the trend in vegetable, potato, fruit, bread and fish consumption in the Nordic and Baltic countries. A follow-up study about every 3-5 years would enable to monitor the trends in these countries. It is, however, proposed that the FFQ would be simplified, because of feasibility reasons of carrying out the study. Experience of NORBAGREEN survey indicates that the same method may be expanded to be used also in other countries, but at first would need to be implemented and validated in such countries [Paper VI, 4].

Mean energy, nutrient and food intakes

All survey methods that rely on self-reported behaviour are a subject for problems of reporting error and bias. Misreporting of food intake is a fundamental concern in nutritional research; studies have shown that those foods concerned as "unhealthy" (sweets, fat-rich foods, alcoholic beverages) are under-reported most often. 24-hour recall relies upon respondent's memory, therefore omission of data concerning parts of meals or entire meals might be common. Choosing 24-hour dietary recall as a data collection method, the skills and knowledge of interviewer are crucial in obtaining food consumption data [21,22,68].
In the Baltic Nutrition Survey, the interviewers underwent a one-day training session. Although the interviewers were not nutritionists, some of them had previous training in interview techniques. Again, the scope and principles in training, supervision and quality control were not agreed between countries and those practices varied between participating countries. The varieties between interviewers with different background and training were not observed and analysed even within countries.
Recent studies have shown that the proper use of household measures and food photographs increases the accuracy of portion size estimates. Using food photographs could improve validity of the results and find out systematic errors. For example, under-reporting has been typical for bread, spread and cold cuts and dishes, over-reporting has been typical for cereals in both genders and for vegetables and fruit in women. Using age-appropriate photographs and aids is recommended [69,70,71]. In the Baltic Nutrition Survey, the universal use of household measures and books with photographs and drawing of foods was agreed, but the actual use of them during the interviews was not monitored or well-documented and analysed.
The time of the survey enforced people to use more homemade foods and meals. In case of cooked foods, the cooking procedures and recipes should be reported. Due to a 24-hour dietary recall, it was used quite seldom. If the recipe was absent, the similar food from the database was used for calculations according to reported type of fat or milk. Bias could come from the background of

interviewers, even if the training methodology was the same. In Estonia, due to representative survey and limited funds for transportation, local interviewers were the only possibility to carry out this survey.
The biases could be present also in entering 24-hour dietary recall data. Limitation of used nutrient databases was quite small – in both databases there was almost no data on national foods. Incorrect identification of food due to bad handwriting or recording wrong (improbable) amounts of food might be a confounding factor in the process of data entry. Omission or double entry of data on parts of meals or entire meals might have happened.
Low energy reporting has been described as a major source of bias in dietary surveys [36]. In Western countries, the average daily energy requirements of sedentary adults is approximately 1.55 times the basal metabolic rate; thus, ratios of energy intake to basal metabolic rate less than 1.55 would indicate potentially inaccurate (under) estimates of habitual food intakes [1]. The average energy intakes of the participants in the Baltic Nutrition Survey were generally lower than expected, particularly in women.

Figure 5 shows the correlation between BMI group and mean energy intake in men and women in Estonia.

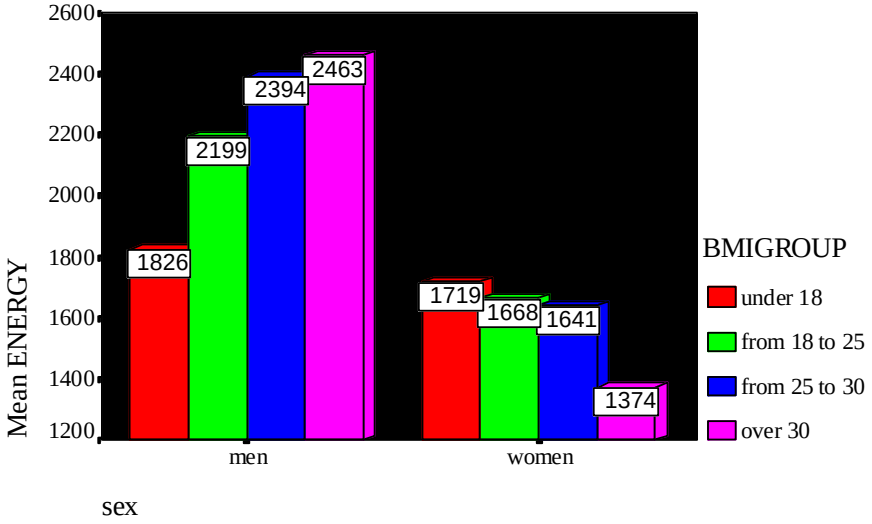

Figure 5. Energy intake by BMI (underweight, normal, overweight and obese) in men and women in Estonia

When slimmer men consume less energy than their bodies need, otherwise obese women consume much less energy than others in Estonia. It might be explained with “weight-watchers” behaviour, but potential under-reporting by obese women could be explained also by dieting as a culturally expectable behaviour in transition countries.

In addition, the median ratio of energy intake to basal metabolic rate suggests potential under-reporting in some population sub-groups, particularly among Estonian respondents. This could explain why Estonians have lower mean crude intakes of nutrients than respondents from Latvia and Lithuania (except for alcohol and niacin intakes). This also suggests that energy adjusted nutrient intakes may need to be calculated and that caution is warranted when comparing crude intakes among countries.

For example, the energy adequacy, as calculated using the Estonian Nutrition Recommendations [6] is 2700 kcal/day for 31-60 years men and 2000 kcal/day for 31-60 year women. The mean energy intake levels were below the average recommendations for all (2278 kcal/day and 1640 kcal/day, respectively). Mean intakes also confirm the greater energy intake of urban people who consume more calories (approximately 20-50 kcal) per day.

The ratio of energy intake to estimated basal metabolic rate was calculated to assess potential under-reporting of energy intake. Estimates of basal metabolic rate were calculated from published equations using information on age and measured body weight [Paper I].

Between-country differences in crude fat, carbohydrate and protein intakes generally followed the pattern observed for energy intake, for Estonians reporting the lowest intakes. For example, mean proportion of energy from fat was high in men and women from all three countries. Fat proportion was particularly high in Lithuania (44%) and Latvia (42%) compared with Estonia (36%). However, it is possible that the lower fat intake observed in Estonia could be partly related to the use of the Finnish database.

Unlike fat intake, mean carbohydrate consumption in the Baltic countries (between 42 and 47% of dietary energy) was considerably lower than the WHO recommendations while mean protein intake appears to be generally sufficient [Paper IV].

As the surveys were conducted during the summer, food consumption may have been affected by seasonal food choices. For example, the usual consumption of fresh vegetables and fruits may have been overestimated. Both results from the questionnaire data (frequency) and from the 24-hour dietary recall suggest that current dietary recommendations for vegetable and fruit intake are not generally met by the adult populations of the Baltic countries. Only 78% of the Lithuanians, 60% of the Latvians and 48% of the Estonians reported daily consumption of vegetables (raw or cooked, excluding potatoes, 6 - 7 days per week). Despite the fact that the surveys were conducted during the summer, a period during which vegetables and fruit should be more easily accessible to the population, the results of the 24-h dietary recall indicate that the median intake of vegetables and fruits of the participants was considerably below the recommended level, particularly in Latvia where it was only 200 g per day before the interview (277 g in Estonia and 241 g in Lithuania). The median consumption of fruits was zero in each country among men and it varied between zero and 35 g per day among women [Paper IV].

This means that the food intake data from the Baltic Nutrition Survey are probably underestimated, not valid enough and crude food intakes should be used with caution. Comparison of macronutrient intakes expressed as percentage of energy may be more appropriate. Considering the study design and organizational structure and limitations within study, this part of the study can not be reproduced.

After the main study was carried out and the first results were analysed, the comparability study was designed. Analysis compared Micro-Nutrica Nutritional Analysis Program with Russian Food Composition Database and pointed out that the Micro-Nutrica Nutritional Analysis Program gave lower estimates of energy and nutrient intakes. The difference reached the significance level for energy, fat, carbohydrate and calcium intake, but it was particularly large for fat intake, reaching almost -24% compared with the Russian Food Composition Database. The study does not explain whether the difference was more likely to be due to the Micro-Nutrica Nutritional Analysis Program 'underestimating' the true fat or other nutrient content of foods found in the Baltic region or to the Russian Food Composition Database 'overestimating' nutrient content, as this would have required direct food analysis [Paper V].
The differences appear even for common foodstuffs that were expected to have a similar nutrient content if prepared using similar methods (e.g. milk, boiled egg, and boiled potatoes). The most striking differences were observed in the fat content of foods, with common foods relatively rich in fat tending to have a lower fat content when the Micro-Nutrica Nutritional Analysis Program was used.
Similar comparison surveys have shown that differences between databases could significantly influence the results. As a result from the comparison of Micro-Nutrica Nutritional Analysis Program with two nutrient assessment PC software programs ANKE (Russian database) and DanKost2 (Danish database), it was found that food-energy by DanKost2 was higher than calculated by the Micro-Nutrica Nutritional Analysis Program ($p<0.01$). This difference appeared mostly due to a higher mean of intake of fats and carbohydrates. Also, food energy calculated by ANKE was higher than calculated by the Micro-Nutrica Nutritional Analysis Program, but not as high as by DanKost2 [34.]
The Micro-Nutrica Nutritional Analysis Program has some confounding factors, which have to be considered in the advanced analysis. Some micronutrients (biotin, molybdenum, chromium, and fluoride) don't have the data by using certain foodstuffs and the value is replaced with zero. That could decrease the summarized values for those micronutrients. Some micronutrients (potassium, iodine, selenium, folic acid, niacine) having higher values in certain foodstuffs, which could increase the summarized values for those micronutrients. The reason for this confounding factor is the fortified food and fertilizers, which are

common in Finland, but not in Estonia. This is the case even if the data could be coded according to brands or common Estonian foodstuffs [72].
When the 24-hour dietary recall from 32 Latvian survey respondents was reanalysed with Micro-Nutrica Nutritional Analysis Program, the results gave lower estimates of energy and nutrient intakes in a large majority of respondents (except for alcohol where it was not possible to assess discrepancy between databases). The difference reached significant level for energy, fat, carbohydrate and calcium intake, but it was particularly large for fat intake, reaching almost -24% compared with the Russian Food Composition Database [Paper V].

The discrepancies between databases observed for fat intakes are particularly important. Although this may not be of importance to monitor changes in fat intake over time within one country, it requires reconsidering the results of the Baltic Nutrition Survey. The results of comparability study indicate that the comparison of nutrient intake estimates from the Baltic Nutrition Survey must be interpreted with caution as there appears to be a discrepancy between the two food composition databases used to convert food intakes into nutrients. However, it is not possible, using currently available data to assess whether the observed level of discrepancy reflects true differences in the food products found in Estonia compared to those found in Latvia and Lithuania. It emphasises the need for further research in the development of comparable national databases in the region [Paper V].

3.3 Accordance with international recommendations for risk assessment

Again, data needed for risk assessment should be up-to-date, representative, covering individual whole diet in short- and long-term consumption including also information about the body weights and physical activity. The results should be codified within defined food groups including brand, type of packaging and cooking method [11,12,45].

The Baltic Nutrition Survey provides data on individual level within different food groups and in detail. It allows to analyse food intake by using individual anthropometrical data (to recalculate food intake per kg/body mass), the survey includes questions needed to analyse whole diet (water used, supplement use, cooking methods, physical activity).
There are many limitations in the Baltic Nutrition Survey for risk assessment as well. Data from the Baltic Nutrition Survey is not recent, but it is still the only representative dietary survey carried out in Estonia. Considering major changes in market economy, alterations in trade and catering, wide changes in society and economy during last 10 years, the data from year 1997 are not valid for assessing recent risks.

The sample of the Baltic Nutrition Survey covered adult population only and therefore, the important risk groups as children, pregnant women and elderly were not present.
Supplement use is necessary data conducting health related assessments. Whether supplementation really counteracts food deficiencies or leads to excessive intake of micronutrients is unknown [73,74]. The Baltic Nutrition Survey included data about the supplement use, but those data were not detailed and quantified as needed for risk assessment.
The Baltic Nutrition Survey does not provide information about the packaging material, brand and amount of fortified foods.
Seasonal variations were not considered and met in the previous survey. Highly educated nutritionists or well-trained interviewers are crucial for quality and validity of dietary information obtained, this was not fulfilled. Validation studies were not planned and implemented.

As the NORBAGREEN survey focused only on the food groups, recommended for monitoring as health indicators, this survey does not cover the whole diet and does not give enough data for conducting consistent risk assessment or risk-benefit analysis. In the same time, as the NORBAGREEN survey gave a very detailed description of the frequencies of fruits and vegetables, which might be calculated to the average amounts of intakes, the NORBAGREEN study could be used to assess chronic exposure correlated with consumption of fruit and vegetables (for pesticides), fish (for dioxines) or bread in adults.

Figure 6 describes some ways to assess chronic or acute risks by using different food consumption survey methods.

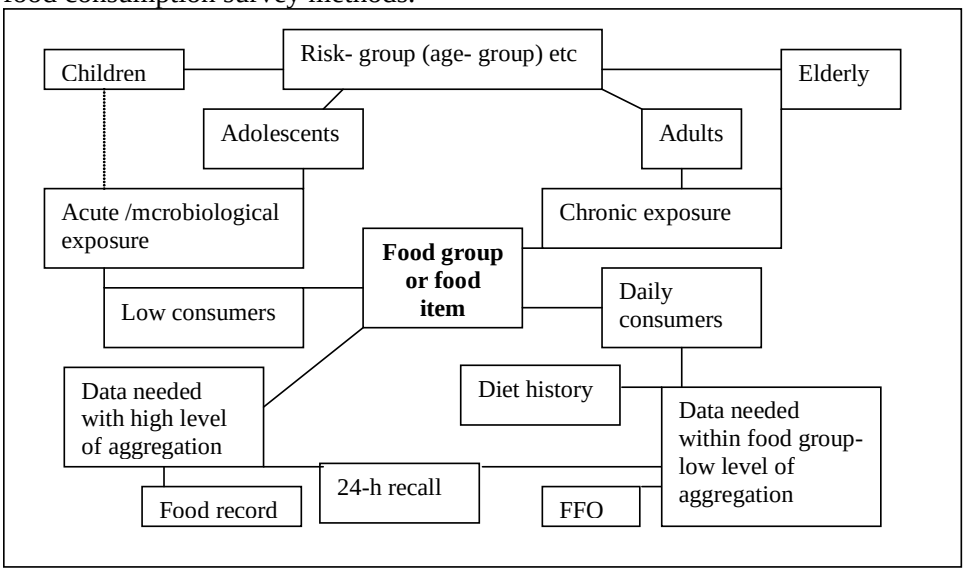

Figure 6. Different types of studies possibly used for risk assessment

While carrying out risk assessment, the various stages described in figure 6 should be taken into consideration. Since the new food consumption survey has not been carried out, there are several ways to assess risk within the known limitations. To assess chronic exposure is more possible than to assess acute risks within existing data.

3.4 Methodological issues for further food consumption surveys

Dietary methods remain the cornerstone for epidemiological and intervention studies on nutrition and health. Food surveys are mostly conducted under the view of assessing the nutritional status of a population. To choose methodology which fulfils needs for risk assessment is much more complicated than requirements to those surveys, needed for monitoring food consumption to plan and evaluate health promotion interventions.

Considering strengths and limitations of surveys, the following recommendations for further dietary surveys were worked out as a result of this work:

- The sample should be representative for the whole population, including children, pregnant women and elderly. Response rate should be > 60%.
- 24-hour dietary recall, as recommended also in the EFCOSUM and EFCOVAL projects, designed to study long- and short-term food consumption, is the best and also cost-effective method to get detailed data needed for risk assessment. The method is suitable for most of the population groups (also children and elderly, for ethnic minorities), and this method has less load for both interviewer and respondent.
- Still, the 24-hour dietary recall might not be fully suitable, if studying children under 11 years [33,45,73]. Therefore, the food record is considered to be more accurate instead of 24-hour recall, if studying children aged 0-11 years.
- Decreasing variations within individual level, but also meeting seasonal variations, 2 repetitive 24-hour dietary recalls in different seasonal periods (or 2 repetitive food records in case of children) is recommended.
- The computer assisted personal interview (CAPI) with specially designed software is recommended, because it allows using food photographs in quantities, but also entry data during the interview and therefore save resources and workforce. The food groups used in software should be classified according to the EFSA's recommendations. Pictures of commonly consumed foods can help respondents to quantify amounts of foods (the pictures use in software should preferably be validated and age-specific).
- Use of fortified foods and use of supplements should be included in the survey. Those data need to be quantified (level of fortification, composition of supplement, but also quantitative amounts of nutrients in supplement).

- Questions about the usual water intake, food packages and also brand usually preferred should be integrated into the questionnaire, but those details should be also included in the 24-hour dietary recall.
- Anthropometrical data should be added to the dietary survey as well as estimation of average physical activity. It allows to calculate total energy expenditure and to compare consumption with energy needs and therefore to analyse possible biases in over-reporting or under-reporting. As a new indicator measuring CVD risk, hip and waist circumference would be included into the survey [32,33,42,75].
- The Baltic Nutrition Survey indicated that people are quite well aware about their body size and weight and estimated systematic differences in results were observed. It means when planning future surveys, self-reported height and weight might be accurate enough. Since previous data are not up to-date, it needs to be tested and validated in the pilot study.
- A pilot study for validation of methodology should be carried out before the representative survey. The pilot study will show organizational limitations, modifications needed in the specially designed software (but also validity of the food photographs), possible biases and development of skills of interviewers.
- Final study protocol should be described (after the pilot study) and the accordance should be monitored in all phases of the study to ensure the quality of food consumption data and to decrease uncertainties.
- Survey budget should be sufficient to organize and carry out the survey within agreed methodology limits. If the changes due to the limited budget will be extensive, the survey team should discuss and decide whether those limitations do not affect the quality of planned survey. If the budget influences the comparability and validity of the survey, the critical decisions should be made to postpone the survey or to carry out the survey in several parts.
- In addition to the representative food consumption survey, the detailed qualitative research is needed to understand why people are choosing unhealthy diet and which policies, actions, environmental changes and health promoting messages would be most effective in persuading them to change their dietary habits [45,65].

Diets have worldwide changed dramatically over the years since the first food composition data were produced. Trade is undertaken on a global level, which has major implications for the foods consumed within each country. Processed foods are widely consumed and their numbers and diversity are continually increasing. New ingredients and new processing methods have been developed and, more recently, there has been increasing interest in functional foods [34]. This brings on a demand for continuous updating of the Estonian Food Composition Database to be in accordance with the present food market.

CONCLUSIONS

The knowledge about the possibilities and limitations to carry out food consumption studies has developed during the years and mechanisms decreasing uncertainties are known.

The Baltic Nutrition Survey is still the only representative dietary survey carried out in Estonia. Regarding the different sampling principles and also data collection practices between countries, the reproducibility of the Baltic Nutrition Survey is not good. Comparability between countries is good due to the same questionnaire and basic principles of surveys. As the FFQ used in the survey was not validated, the validity of the frequencies is unproven. The results of the comparability study suggest that the comparison of nutrient intake estimates from the Baltic Nutrition Survey should be interpreted with caution as there appears to be a discrepancy between the two food composition databases used to convert food intakes into nutrients.
Several limitations in the Baltic Nutrition Survey do not encourage using existing data for risk assessment and risk-benefit analysis.

In the international surveys of food consumption and nutrient intake, it is essential that the dietary data are comparable when different databases and calculation programs are used. It was found that controlling factors affecting comparability in an international study requires careful attention throughout the study process. Validation is needed in pilot study before conducting representative dietary surveys.

National surveillance systems of food consumption and obesity would facilitate the planning of preventive programmes and policies in order to prevent any upward trend in the prevalence of unhealthy diets and obesity in these countries. The harmonized food composition databases are important to conduct internationally comparative dietary surveys, but also risk assessment in different food safety and nutrition aspects.

Food consumption habits still do not fulfil the dietary objectives, therefore there is a great need to promote and monitor consumption of these dietary indicators of health. To facilitate evaluation whether the dietary objectives are met good assessment instruments are needed.
In the future, the NORBAGREEN FFQ can be used to follow the trend in vegetable, potato, fruit, bread and fish consumption in the Nordic and Baltic countries. Reproducibility of the NORBAGREEN FFQ is good, and FFQ was validated. A follow-up study about every 3-5 years would enable to monitor the trends. The comparability between the NORBAGREEN countries is good, even if there were differences in sampling methods and data collection methods. Experience of this survey indicates that the same method, also by using

simplified questionnaire, may be expanded to other countries as well, but it would first need to be validated in those countries.

Appropriate information support and dissemination systems that increase awareness, access, and use of food consumption data and their application for evidence-based policies and guidance's should be developed. Understanding why people select unhealthy diets is the first step to improving diet.

FUTURE PERSPECTIVES

According to the WHO recommendations, the availability of reliable national data on food, nutrition and health is the cornerstone for successful food and nutrition policies. Therefore, the mechanism for monitoring and evaluation should be well developed [42,74,75].

The National Strategy for Prevention of Cardiovascular Diseases till 2020 was approved by the Government on 2005 followed with National Action Plan for Health Development approved in 2008 [74,75]. Nutrition has been considered as a priority area in both strategies to achieve better health of the Estonian population. The strategies are also describing indicators and planning to monitor food consumption habits. In addition to the continuing FINBALT survey for monitoring health behaviour, the detailed national food consumption survey is needed.

The Ministry of Agriculture subscribed the preliminary analysis in 2006 to find out if the current data are sufficient for risk assessment. As the preliminary analysis has shown the need for a new representative dietary survey in Estonia, there is a defined need to conduct the new dietary survey in Estonia [25,33].

The Ministry of Social Affairs and the Ministry of Agriculture and their sub-organizations have performed various food composition and food safety studies, which is planned to systematize and harmonise in the one consistent database. The database will have 4 modules: food composition database: Micro- Nutrica Nutritional Analysis Program; database of surveys and database of food and nutrition related interventions. The process to complete existing Micro- Nutrica Nutritional Analysis Program with food photographs for further surveys, but also the process to redefine food groups according to the EFSA's directions is already underway.

Estonian data from the Baltic Nutrition Survey have been recently assigned to the EFSA's Concise European food consumption database.

Recommendations from current analysis could be taken into consideration while planning and implementing further dietary surveys in Estonia.

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KOKKUVÕTE

Balti riikides nagu ka teistes Ida-Euroopa riikides kaasnes iseseisvumisega üleminek turumajandusele, mis tõi endaga kaasa olulised muutused nii sotsiaalses keskkonnas kui ka halvenemise rahvastiku tervisenäitajates. Üha täpsemalt on teaduslikult tõendatud toitumise ja krooniliste haiguste tekke seosed. Üleminekuühiskondade toitumisharjumused võrreldes arenenud Euroopa riikidega on siiani olnud vähem vastavad üldtunnustatud toitumissoovitustele.
Toitumise ja toidu tarbimise andmed annavad olulise sisendi riikidele rakendamaks vajalikke toitumise programme, parandada seeläbi elanikkonna toitumissituatsiooni ja vähendada haigestumist kroonilistesse haigustesse.
1990-ndatel aastatel iseseisvunud Balti riikidel ei olnud piisavalt toidu tarbimise andmeid. Just seetõttu algatas WHO 1996. aastal Balti projekti ning toetas Balti riike esimese riikidevaheliselt võrreldava ja representatiivse toitumisuuringu läbiviimisel.
Balti Toitumise Uuring teostati 1997. aasta suvel Eesti, Läti ja Leedu täiskasvanud elanikkonna hulgas. Intervjuu sisaldas toidu tarbimisküsitlust 24-tunni meetodil, tervisekäitumise küsimusi ning kaalu ja pikkuse mõõtmist. Balti Toitumise Uuringu tulemusel (makrotoitainete saamine) leiti süstemaatilised erinevused Eesti ja Läti/Leedu vahel. Uuringu käigus kasutati toiduainete toitainetele ümber arvestamiseks kahte erinevat toidu toitainelise koostise arvutusprogrammi. Seetõttu teostati uuringule järgnevalt riikidevahelise võrreldavuse uuring, et võrrelda erinevaid andmebaase ja eelneva uuringu andmete valiidsust.
Eeltoodud uuringu andmetele tuginedes töötati Eesti jaoks 1998. aastal välja esimesed toidusoovitused. Võrreldes elanikkonna tarbimist soovitatavaga, seati olulisteks eesmärkideks suurendada puu- ja köögiviljade ja kala tarbimist ning vähendada rasvade, maiustuste ja alkoholi tarbimist.
Ka projekt EFCOSUM määratles puu- ja köögiviljad, rukkileiva ja kala tarbimise indikaatoriteks, mille abil mõõta toitumise tervislikkust. Projekti raames soovitati ka teostata riikidevaheliselt võrreldav toidu tarbimise uuring saamaks ülevaade eeltoodud toidugruppide tarbimisest.
Seejärel algatati NORBAGREEN projekt, mille eesmärgiks oli hinnata köögiviljade, puuviljade, leiva ja kala tarbimist võrreldava metoodikaga Põhja- ja Baltimaades ning projekti käigus töötada välja ja valideerida toidu tarbimissageduse uurimise küsimustik. Representatiivne uuring teostati 2002. aasta kevadel, kokku intervjueeriti 8397 täiskasvanut kaheksas osalenud riigis. Valideerimisuuringud viidi läbi Soomes ja Leedus. NORBAGREEN kordusuuring viidi läbi 2004. aasta kevadel vaid Eestis, kasutades sama metoodikat lihtsustatud küsimustikuga.
Eesti ühines 2004. aastal Euroopa Liiduga. Euroopa Toiduohutuse Ameti ülesandeks määratleti muuhulgas koordineeriv roll toidust tulenevate riskide hindamiseks. Et hinnata võimalike riskide mõju laiemalt Euroopa Liidus, on vajalikud liikmesriikide toidu tarbimise andmed, samuti et läbiviidud uuringud

oleksid teatud määral omavahel võrreldavad. Ka Eestis on aktuaalne riski analüüsi teostamine toidu ohutuse valdkonnas. Riskide hindamise läbiviimiseks peavad olema ka Eesti kohta kättesaadavad detailsed toidu tarbimise andmed.

Tulenevalt eeltoodust oli käesoleva töö eesmärgiks hinnata toidu tarbimise uuringute valiidsust ja reprodutseeritavust Eestis ning andmete rahvusvahelist võrreldavust. Käesolev töö käsitleb varemteostatud toidu tarbimise uuringute metoodikaid, et hinnata nende reprodutseeritavust ja sobivust riski hindamiseks ning töötada välja edasine kava toidu tarbimise uuringute läbiviimiseks Eestis.

Balti Toitumise Uuring on seni ainus representatiivne Eestis läbi viidud toitumisuuring, mis käsitleb toidu tarbimist terviklikult. Arvestades riikidevahelisi erinevusi valimite moodustamises, aga ka erinevusi andmete kogumise praktilises korralduses, ei ole Balti Toitumise Uuring samal kujul reprodutseeritav. Uuringu riikidevaheline võrreldavus on hea, kuna kasutati sarnast küsimustikku ning uuringul oli ühtne baasmetoodika, samal ajal ei ole toidu sagedusküsimuste valiidsus tõendatud. Tulevaste rahvusvaheliselt võrreldavate toitumisuuringute puhul peab kasutama ühtset harmoniseeritud toidu koostise andmebaasi. Rahvusvahelise uuringu puhul peavad uuringu võrreldavust mõjutavad tegurid olema hoolikalt jälgitud kogu uuringu toimumise kestel. Mitmed kitsaskohad Balti Toitumise Uuringus ei anna piisavalt kindlust, et andmed on sobivad viimaks läbi kaasaegset riskide hindamist.
Tulevikus saab NORBAGREEN sagedusküsimustikku kasutada köögiviljade, kartuli, puuviljade, leiva ja kala tarbimise trendide jälgimiseks, saadud andmed on osalenud riikide vahel võrreldavad. NORBAGREEN uuringu korratavus on hea ning toidu tarbimise sagedusküsimustik on valideeritud. Uuringu kogemus annab kindluse, et sama metoodikat on võimalik laiendada ka teistele riikidele. Toidu tarbimisuuringud peaks edaspidi sisaldama ka küsimusi elanikkonna toidu valiku põhjuste kohta, mis on esmaseks aluseks, et kavandada tegevusi elanike toitumise tervislikumaks muutmiseks.
Käesoleva töö tulemusena on välja töötatud soovitused edasiste representatiivsete toidu tarbimise uuringute läbiviimiseks, mis peaks olema piisava kvaliteediga toidust tulenevate riskide hindamise läbiviimiseks.

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ORIGINAL COMMUNICATION

Comparison of the Micro-Nutrica Nutritional Analysis program and the Russian Food Composition Database using data from the Baltic Nutrition Surveys

S Vaask[1]*, J Pomerleau[2], I Pudule[3], D Grinberga[3], A Abaravicius[4], A Robertson[5] and M McKee[2]

[1]*Food Processing Institute, Tallinn Technical University, Tallinn, Estonia;* [2]*European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, London, UK;* [3]*Health Promotion Centre, Skolas, Riga, Latvia;* [4]*Department of Physiology, Biochemistry and Laboratory Medicine, Faculty of Medicine, Vilnius University, Vilnius, Lithuania; and* [5]*WHO Regional Officer for Europe, Scherfigsvej, Copenhagen Ø, Denmark*

Objective: The objective of this study was to compare the nutrient content of foods and diets based on data from two food composition databases used in the Baltic Nutrition Surveys (conducted in Estonia, Latvia and Lithuania in 1997): an adapted version of the Finnish Micro-Nutrica Nutritional Analysis program (used in Estonia) and the Russian Institute of Nutrition Food Composition Database (used in Latvia and Lithuania).
Design: The adapted Micro-Nutrica and Russian databases were used to estimate the energy and nutrient (protein, fat, carbohydrate, vitamin C, calcium and iron) content of 15 common foodstuffs in the region and the nutrient intakes of 32 Latvian respondents (based on 24-h recalls). Differences between databases were estimated.
Results: There were discrepancies in the energy and nutrient content of the 15 selected foods using the two databases. The adapted Micro-Nutrica database generally gave a lower energy content than the Russian database (median: −6%), and a lower fat content for typically fat-rich foods. Intakes of energy, fat, carbohydrate and calcium by the 32 selected respondents were significantly lower when the Micro-Nutrica database was used. Differences were particularly high for fat (difference = −23.5%, 95% confidence interval = −31.1 to −15.8%, $P<0.0001$).
Conclusions: The results suggest that reported comparisons of nutrient intakes in the Baltic countries should be treated with caution and that more research is needed for the development of comparable national databases in the region. Potential differences between databases should be investigated early when international surveys of dietary intake are being planned.
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Keywords: Baltic States; nutrition surveys; database; factual; comparative study; food; dietary fats

Introduction

In several countries of the former Soviet Union, including the Baltic countries, the process of transition towards the market economy has been accompanied by a severe worsening of the health of the population (Bobadilla *et al,* 1997; Shkolnikov *et al,* 2001). The reasons for the rapid changes observed and the sharp divide in mortality rates between western Europe and former socialist countries of central and eastern Europe have stimulated much debate. While the explanation is clearly multifactorial, there is a growing body of evidence to support a central role for nutrition (Bobak & Marmot, 1996). The precise mechanisms involved are, however, less certain, partly due to the lack of comparable data on dietary intake in countries of the former Soviet Union.

There are several factors that make comparisons of dietary intake difficult in Europe, including the variety of foods consumed, the methods used to collect the information, translation difficulties, the quantification of amounts, the coding of foods into computer-readable form and differences in the completeness, accuracy and appropriateness of food composition tables (Perisse, 1982; Arab, 1987). In 1996, the World Health Organization facilitated the Baltic Nutrition Surveys, funded by the Luxembourg government, to support

***Correspondence: S Vaask, Food Processing Institute, Tallinn Technical University, Ehitajate tee 5, Tallinn 19086, Estonia.**
E-mail: sirje.vaask@haigekassa.ee
***Guarantor*: S Vaask.**
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the Baltic countries Estonia, Latvia and Lithuania to carry out their first national surveys of dietary intake, eating patterns and food beliefs (Pomerleau *et al,* 2000a). A major advantage of the project was the use of a common methodology for data collection (including a 24-h recall of dietary intake) so that comparisons among countries could be facilitated. However, when food intakes were converted into daily nutrient intakes, two different food composition databases were used. As the three participating countries did not have access to national food composition databases, data from Latvia and Lithuania were analysed using the Russian Institute of Nutrition Food Composition Database (Skurikhin & Volgarev, 1994a, b, c). This database remains one of the most commonly utilised ones in countries of the former Soviet Union. In Estonia, the Finnish Micro-Nutrica Nutritional Analysis program (Rastas *et al,* 1997) adapted to include Estonian foods was utilised.

As two different databases were used to derive nutrient intakes in the Baltic Nutrition Surveys, this study set out to investigate whether intrinsic differences between the Russian and adapted-Finnish databases could have influenced between-country variations in estimated nutrient intakes (Pomerleau *et al*, 2001). The objective of the study was to compare the databases at two different levels: first the energy and nutrient composition of 15 foodstuffs commonly consumed by the populations of the region (Kasmel *et al,* 1998), and second the mean energy and nutrient intake of a sample of 32 survey participants. This comparison has wider relevance, as most data on the countries of the former Soviet Union are derived from the Russian tables, while the Finnish tables closely resemble those used in many parts of western Europe.

Material and methods

Details of the survey methods

Details of the survey methods can be found elsewhere (Pudule *et al*, 1999; Pomerleau *et al*, 2000b). In summary, surveys were conducted in the summer of 1997 using a common set of agreed standardised methods. The surveys sought to include representative samples of the national population aged between 19 and 64 y (19–65 y in Lithuania) using National Population Registers as the sampling frames. The response rates were 67.3, 77.7 and 72.7% in Estonia, Latvia and Lithuania, respectively, and the final sample sizes were 2108 in Estonia, 2331 in Latvia and 2182 in Lithuania. The distribution of the study groups by gender, area of residence (rural/urban) and nationality compared favourably with those of the general population. However, Estonian respondents tended to be slightly younger than the general adult population in that country, and Latvian and Lithuanian respondents were slightly older (Pomerleau *et al*, 2000a). Data were collected by trained interviewers through personal interviews conducted in the participants' homes in the national language or in Russian. Interviews included a 24-h recall of dietary intake, a standardised questionnaire (covering demographic characteristics, eating habits and health behaviours) and the measurement of height and weight.

During the 24-h recall, common sets of household measures were used to help the participants assess food portion sizes, as well as a standard book with photographs and drawings of foods commonly consumed (National Food Administration, 1986; Cameron & van Staveren, 1988; Margetts & Nelson, 1997). Probing questions about snacks, drinks, type of milk, fat and other foods were used to elicit more details. Food intakes were converted into nutrient intakes using two food composition databases. In Estonia, the Finnish Micro-Nutrica Nutritional Analysis program adapted to include Estonian foods (Estonian Version 2, 1997, Food Processing Institute, Tallinn Technical University, Estonia) was used (Food Processing Institute, 1998). This program includes over 1150 food items and 66 nutrients. In Latvia and Lithuania, the Russian Institute of Nutrition Food Composition Database (based on Skurikhin & Volgarev (1994a, b, c) tables) was used to convert foods into nutrients. This program included 1618 food items and 20 nutrients.

Comparison of the food composition databases

For this paper, two sets of comparisons were made. In the first set of analyses, a list of 15 foodstuffs commonly consumed in the Baltic countries was prepared. Food items were chosen mainly because they are consumed frequently in both the countries (Kasmel *et al*, 1998; Pudule *et al*, 2000) and in most cases represent staple foods (eg, potatoes, bread, milk). In addition, we preferred foods that were simple (eg, boiled egg) and that would not differ greatly among countries in their mode of preparation (in the industry or at home), thus avoiding composite dishes that would differ because of national variations in recipes. Finally, we attempted to include foods from different food groups (eg, milk products, breads, meat and substitutes, fats, sweets). The energy, macronutrient, vitamin C, calcium and iron content of the foods was estimated using both food composition databases, that is, the adapted version of the Micro-Nutrica Nutritional Analysis Program and the Russian Institute of Nutrition Food Consumption Database. Energy content was calculated from macronutrients using the following conversion factors: carbohydrates 4 kcal/g; protein 4 kcal/g; fat 9 kcal/g; alcohol 7 kcal/g. The results obtained using the two methods were compared.

In the second set of analyses, a sample of 32 24-h recalls from Latvian respondents were selected. All were in Russian so that they could be translated to Estonian by one of the authors who spoke both the languages (SV) and all were easily readable (legibility of handwriting) in order to facilitate translation. Records were translated into Estonian, and analysed using the two food composition databases. The energy and macronutrient content of the foods was examined, along with the content in calcium and iron,

micronutrients considered to be potentially problematic in the reference populations.

Statistical analysis

Data were analysed using the statistical package Stata version 6.0 (College Station, TX, USA). For the first set of comparisons (selected foodstuffs), the per cent differences in the energy and nutrient content of the 15 foodstuffs were calculated using the Russian database as the baseline ({Estonian−Russian} 100/Russian). For the second set of comparisons (data from 24-h recalls), two different statistical methods were used. First, the mean energy and nutrient intakes of the 32 24-h recalls analysed with both databases were compared using paired *t*-tests. The mean per cent difference between the results from the two databases was calculated for each nutrient (with 95% confidence intervals); for fat, the differences were plotted against the means (Bland & Altman, 1986). Second, the Pearson and Spearman correlation analyses were performed to estimate the association between the two databases. As both the methods yielded similar estimates, only the Pearson correlation coefficients are reported. A *P*-value smaller than 0.05 was considered to be statistically significant.

Results

Table 1 compares the energy, macronutrient, vitamin C, calcium and iron content of 15 foods commonly consumed in the Baltic countries, estimated using the adapted Micro-Nutrica and Russian food composition databases. The two databases yielded different values for energy, macronutrient, calcium, vitamin C and iron content in the selected foods. The calculated energy content of the foods was generally lower (11 out of 15 foods) in the Estonian database (overall range: −38.0% to +22.5%, median: −6.0%) than in the Russian database. The calculated fat content of foodstuffs relatively rich in fat was generally lower in the Estonian database, particularly in the case of transformed foods: fried potatoes (−87%), grilled chicken (−34%), pelmens with pork (−33%) and frozen fish fingers (−20%). With regard to foods that are good sources of proteins, the pattern of differences was not as clear; for example, the protein content was higher in the Estonian database in some cases (pelmens with pork: +28%; grilled chicken: +17%) but lower in other cases (e.g., frozen fish fingers: −28%, curd: −28%). Differences worth noting with regard to carbohydrates include strawberry jam (−31%) and yoghurt with fruits (+71%). Differences in the vitamin C content of potatoes varied according to the cooking method used. Compared with the Russian database, the Estonian database reported less vitamin C in boiled potatoes (−44%) but more in fried potatoes (+50%). Differences in the calcium content of milk products and sprats in oil—the highest sources of calcium—were generally low. For the best sources of iron (>1 mg/100 g of foods in both databases), the level of difference between the databases differed among foods. There was no difference in the iron content of sprats in oil and eggs between the databases, but the iron content of grilled chicken was 32% lower in the Estonian database. With regard to bread, black bread had a lower iron content in the Estonian database than in the Russian database (−13%), but the reverse was true for white bread (+80%).

Table 2 describes the mean energy and nutrient intakes of 32 survey respondents from Latvia. Energy and nutrient intakes were derived using the Estonian and Russian food composition databases. The results indicated that the Estonian database tended to give lower mean energy and nutrient intakes than the Russian database except for alcohol intake; alcohol intake is in a slightly different position as the same estimates (0 g/day) were obtained with both databases in 27 or the 32 respondents. For energy and the other nutrients, lower intakes were observed in a majority of individuals, that is, 28 for fat, 27 for energy and calcium, 20 for protein, and 19 for carbohydrates and iron. However, differences reached significance level only for energy, fat (both $P<0.0001$ based on paired *t*-tests), carbohydrate ($P<0.01$) and calcium ($P<0.001$). The difference between the databases was particularly striking for fat with a mean difference of 23.5% and with an important level of disagreement in some individuals (Figure 1). Disagreement was also considerable for energy and similarly for carbohydrate and calcium intakes (Figure 2). In spite of the differences observed, results from the two databases were highly correlated. The lowest Pearson correlation coefficient was observed for iron (0.67), but all the other coefficients were greater or equal to 0.82 (ranging from 0.82 for fat to 0.99 for alcohol).

Discussion

The results of the analyses suggest that differences exist between the two food composition databases used to convert foods into nutrient intakes in the Baltic Nutrition Surveys, that is, the adapted Micro-Nutrica and the Russian databases. This appears to be true even for common foodstuffs that were expected to have a similar nutrient content and to have been prepared using similar methods (eg, milk, boiled egg, boiled potatoes). The most striking differences were observed in the fat content of foods, with common foods relatively rich in fat tending to have a lower fat content when the Micro-Nutrica database was used.

The content of foodstuffs in the Finnish database is mainly derived from recent Finnish and Nordic data (basic components), while the content of foodstuffs in the Russian database is based on the 1994 tables of Skurikhin and Volgarev. When analysing survey data, the adapted Finnish database was chosen to analyse Estonian data as there are numerous Finnish foods available in Estonia (compared with Latvia and Lithuania), and because the Finnish data offered more information (eg, data on vitamin D, vitamin E, folic

Table 1 Energy and nutrient content (per 100 g) of common foodstuffs, based on the Estonian (adapted Micro-Nutrica) and Russian databases

Foodstuff	*Energy (kJ)*	*Protein (g)*	*Fat (g)*	*Carbohydrate (g)*	*Vitamin C (mg)*	*Calcium (mg)*	*Iron (mg)*
Milk, 2.5% fat							
Estonian	232.3	3.4	2.5	4.8	1.2	120	0.04
Russian	220.5	2.8	2.5	4.7	1.3	120	0.06
% difference	5.3	21.4	0.0	2.1	−7.7	0.0	−33.3
Yoghurt with fruits, 2.5% fat							
Estonian	393.5	3.3	2.5	14.5	0.0	104	0.10
Russian	321.3	5.0	2.5	8.5	0.6	119	0.10
% difference	22.5	−34.0	0.0	70.6	−100.0	−12.6	0.0
Sour cream, 20% fat							
Estonian	824.9	1.9	20.0	2.2	0.4	80	0.02
Russian	856.8	2.8	20.0	3.2	0.3	8	0.20
% difference	−3.7	−32.1	0.0	−31.3	33.3	900.0	−90.0
Curd, 1% fat							
Estonian	315.0	13.0	1.0	3.5	0.0	110	0.10
Russian	338.5	18.0	0.6	0.8	0.5	120	0.30
% difference	−6.9	−27.8	66.7	337.5	−100.0	−8.3	−66.7
Butter							
Estonian	3040.8	0.5	80.0	0.5	0.0	24	0.20
Russian	3140.3	0.5	82.5	0.8	0.0	12	0.20
% difference	−3.2	0.0	−3.0	−37.5	0.0	100.0	0.0
Black bread							
Estonian	781.2	7.0	1.6	35.9	0.0	22	3.4
Russian	730.8	6.6	1.2	34.2	0.0	35	3.9
% difference	6.9	6.1	33.3	5.0	0.0	−36.3	−12.8
White bread							
Estonian	985.3	6.9	3.0	45.0	0.0	10	3.60
Russian	1079.4	7.7	3.0	49.8	0.0	22	2.00
% difference	−8.7	−10.4	0.0	−9.6	0.0	−55.9	80.0
Jam made from strawberries							
Estonian	829.9	0.3	0.2	48.7	8.5	11	0.28
Russian	1196.2	0.3	0.0	70.9	8.4	10	0.90
% difference	−30.6	0.0	—	−31.4	1.2	7.0	−68.9
Chicken, grilled							
Estonian	972.7	27.3	13.6	0.0	0.0	15	1.26
Russian	1168.0	23.3	20.5	0.1	0.0	45	1.86
% difference	−16.7	17.2	−33.7	−100.0	0.0	−66.6	−32.3
Sprats in oil							
Estonian	1523.8	17.4	32.4	0.4	1.5	300	4.60
Russian	1523.8	17.4	32.4	0.4	0.0	300	4.60
% difference	0.0	0.0	0.0	0.0	–	0.0	0.0
Fish fingers, frozen							
Estonian	798.8	12.9	9.0	14.4	0.0	23	0.70
Russian	939.5	18.0	11.3	12.5	0.7	41	1.13
% difference	−15.0	−28.3	−20.4	15.2	−100.0	−43.9	−38.1
Pelmens with pork							
Estonian	803.0	12.2	8.4	16.7	1.5	16	2.58
Russian	890.8	9.5	12.5	15.4	0.2	20	0.79
% difference	−9.9	28.4	−32.8	8.4	650.0	−19.8	226.6
Egg, boiled							
Estonian	562.0	12.3	9.4	0.0	0.0	57	2.50
Russian	659.8	12.7	11.5	0.7	0.1	55	2.50
% difference	−14.8	−3.1	−18.3	−100.0	−100.0	3.6	0.0
Potatoes, boiled							
Estonian	294.4	1.6	0.1	15.7	6.0	7	0.70
Russian	314.2	2.0	0.4	15.8	10.8	12	0.80
% difference	−6.3	−20.0	−75.0	−0.6	−44.4	−43.7	−12.5
Potatoes, fried with animal fat							
Estonian	472.1	2.5	1.2	22.9	16.3	9	1.50
Russian	774.5	2.8	9.5	22.0	10.9	15	1.00
% difference	−39.0	−9.1	−87.4	4.1	49.5	−40.5	50.0

Table 2 Mean energy and nutrient intakes of 32 Latvian respondents analysed using the Estonian (adapted Micro-Nutrica) and Russian food composition databases

Energy/nutrient	*Russian database* *Mean ± s.d.*	*Estonian database* *Mean ± s.d.*	*Mean difference*[a] *%*	*95% CI*[a]
Energy (kJ/day)	10263 ± 4638	8483 ± 3671	−15.3	(−20.7; −9.8)
Protein (g/day)	83 ± 2	76 ± 35	−4.6	(−14.6; 5.3)
Fat (g/day)	118 ± 63	85 ± 39	−23.5	(−31.2; −15.8)
Carbohydrate (g/day)	249 ± 110	224 ± 100	−8.3	(−13.9; −2.6)
Alcohol (g/day)	9 ± 25	9 ± 28	0.3	(−1.4; 1.9)
Calcium (mg/day)	865 ± 43	708 ± 383	−17.5	(−26.9; −8.1)
Iron (mg/day)	18 ± 11	16 ± 11	−13.7	(−35.6; 8.3)

[a]Per cent difference between Estonian and Russian database ((Estonian−Russian × 100/Russian) based on paired data; CI=confidence interval.

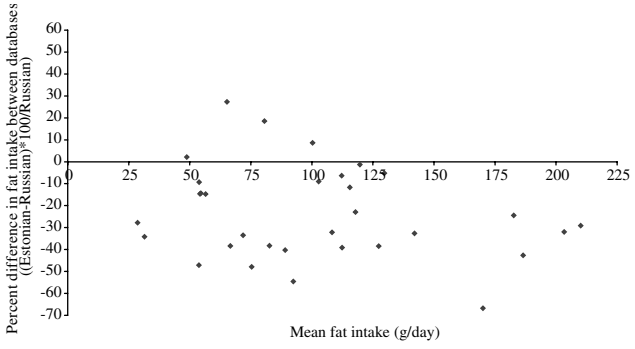

Figure 1 Plot of the per cent difference in fat intake based on data from the Russian and Estonian databases against mean fat intake.

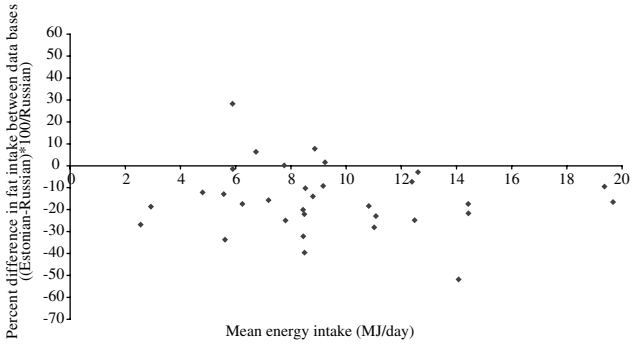

Figure 2 Plot of the per cent difference in energy intake based on data from the Russian and Estonian databases against mean energy intake.

acid, fibre, etc). However, for the first of the two comparisons described in this paper, we selected only foods that would be common in both countries.

Part of the observed differences could be explained by differences in the coding of foodstuffs during data entry, but we estimate that this is unlikely as data entry clerks were nutritionists who were trained for the surveys using a common methodology. Another possibility is the translation of certain terms from Russian to Estonian. However, this is also unlikely to have had a major effect as, for the analyses described in this paper, all queries about atypical foodstuffs were discussed among authors. It is also possible that the Micro-Nutrica (from Finland but adapted to include Estonian foods) might have been limited in terms of the composition of some typically Latvian foods.

An important finding of this study is that when the foods consumed over 1 day were analysed for 32 Latvian survey respondents, the Micro-Nutrica database gave lower estimates of energy and nutrient intakes in a large majority of respondents (except for alcohol where it was not possible to assess discrepancy between databases). The difference reached significance level for energy, fat, carbohydrate and calcium intake, but it was particularly large for fat intake, reaching almost −24% compared with the Russian database. We cannot assess, in this study, whether the difference is more likely to be due to the Finnish database 'underestimating' the true fat or other nutrient content of foods found in the Baltic region or to the Russian database 'overestimating' nutrient content as this would have required direct food analysis. It is possible that it is a combination of these two factors and that the situation will have changed over time due to changes in processing or presentation. We could also hypothesise that the observed difference in nutrient intake is due to variations in the analytical methods used to measure the nutrient content of foods; however, this is difficult to estimate as each database represents a collation of data coming from various sources (eg, direct measurements, published literature by the food industry, calculations, etc) and more than one analytical methods are reported (Skurikhin & Volgarev, 1987; Food Processing Institute, 1998). Finally, the differences could reflect true regional variations in the composition of foods (eg, the fat content of milk depends upon the breed of the cow and the feed; the nutrient content of grains, fruit and vegetables varies depending upon climatic conditions such as rainfall or drought, and agro practices) and recipes (this

can be illustrated by the large difference between databases in the sugar content of strawberry jam).

The discrepancies between databases observed for fat intakes are particularly important. Although this may not be of importance to track changes in fat intake over time within one country, it requires us to reconsider the results of the Baltic Nutrition Surveys (Pomerleau *et al,* 2001), which suggested a lower fat intake in Estonia (37% of dietary energy in male subjects and 36% in female subjects) compared with Latvia (43% in male subjects and 41% in female subjects) and Lithuania (45% in male subjects and 43% in female subjects). Indeed, we can postulate that this difference may be partly due to differences between the food composition databases used to convert survey information into nutrients, and not to true differences in intakes. However, it may also be that leaner foods are more frequently available in Finland than in Russia (eg, leaner cuts of meats, low-fat cheese, etc) due to recent public health and nutrition campaigns (Puska, 2000), and that these foods are more commonly found in Estonia than in Latvia due to geographic proximity and the scale of commercial relations between Estonia and Finland. As mentioned above, it is also possible that the Russian database does not reflect well the 'true' intakes found in Latvia and Lithuania, potentially overestimating intakes. This highlights the potential limitations of using foreign food composition databases when analysing survey data, as these could lead to biased estimates of intakes if they do not reflect well the nutritional content of foods found locally (Deharveng *et al,* 1999). However, it is not possible to estimate the extent of this bias unless direct food analyses are performed. This is a priority for future research on patterns of nutrition in this region.

National food composition databases have many advantages (EFCOSUM Group, 2001). They contain the most popular foods consumed in a given country, their nutrient content is based on the foods locally produced and the names of foods and ingredients of cooked dishes would be easily identified. However, the national comparability of food composition databases has to be considered and many European projects have attempted to improve database comparability during the past few decades (eg, The International Food Data Systems Project, the Eurofoods initiative, the Food-Linked Agro-Industrial Research programme, COST Action 99, TRANSFAIR study, EUROFIR, etc).

In conclusion, the results of this study suggest that the comparison of nutrient intake estimates from the Baltic Nutrition Surveys must be interpreted with caution as there appears to be a discrepancy between the two food composition databases used to convert food intakes into nutrients. However, it is not possible, using data currently available, to assess whether the observed level of discrepancy reflects true differences in the food products found in Estonia compared with those found in Latvia and Lithuania. This emphasises the need for more research on the development of comparable national databases in the region. Potential differences between databases should be investigated early when international surveys of dietary intake are being planned.

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Macronutrient and food intake in the Baltic republics

J Pomerleau[1], M McKee[1]*, A Robertson[2], K Kadziauskiene[3], A Abaravicius[4], S Vaask[5], I Pudule[6] and D Grinberga[6]

[1]*European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, UK;* [2]*WHO Regional Office for Europe, Copenhagen, Denmark;* [3]*National Nutrition Centre, Vilnius, Lithuania;* [4]*Faculty of Medicine, Department of Physiology and Biochemistry, Vilnius University, Vilnius, Lithuania;* [5]*Public Health Department, Ministry of Social Affairs, Tallinn, Estonia; and* [6]*Health Education Division, Health Promotion Centre, Riga, Latvia*

Objective: The objective of this study was to describe mean macronutrient and food intakes in the Baltic republics, with a particular focus on fat, vegetable and fruit consumption.
Design: Cross-sectional study.
Setting: Data from surveys conducted in Estonia, Latvia and Lithuania in the summer of 1997 were used. Information was collected using a 24 h recall of dietary intake and an interviewer-administered questionnaire.
Subjects: Representative national samples of adults were selected. All those with information from the dietary recall were included in the study (Estonia: $n = 2015$; Latvia: $n = 2300$; Lithuania: $n = 2094$).
Results: The mean proportion of energy from fat was high in each country, but particularly in Lithuania (44%) and Latvia (42%) compared with Estonia (36%). In contrast, percentage energy from carbohydrate, protein and alcohol was higher in Estonia. Mean protein intake was generally sufficient if not high in some population sub-groups. Median vegetable intakes were very low (<200 g/day) in each country, particularly in Latvia. While 78% of the Lithuanian respondents consumed vegetables daily, this was the case in only 60% of the Latvian and 48% of the Estonian respondents.
Conclusions: This study suggests that there is a pressing need to replace high-fat energy dense foods by foods rich in complex carbohydrates and dietary fibre, such as vegetables and fruits, in the Baltic republics. This could provide the populations with a reduced risk and increased protection against non-communicable diseases. These issues will need to be tackled through comprehensive food and nutrition policies and health promotion campaigns.
Descriptors: diet surveys; dietary fats; vegetables; Estonia; Latvia; Lithuania
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Introduction

In several countries of the former Soviet Union, including the Baltic republics, the process of transition towards market economy has been accompanied by a severe worsening of the health of the population (WHO, 1998). The wide gap in life expectancy observed between Western European countries and countries of Central and Eastern Europe (CCEE) and Newly Independent States (NIS) is mainly due to differences in premature mortality from cardiovascular diseases. In Western countries, improvements in dietary patterns through the implementation of dietary guidelines and food policies designed to improve health have contributed greatly to the reduction in cardiovascular mortality during the last 20 y (Wietlisbach *et al*, 1997; Jousilahti *et al*, 1996; Roberts, 1991). However, dietary patterns in some CCEE and NIS countries remain less favourable than those found in Western countries, with relatively high intakes of saturated fat from animal products and low intakes of fruits and vegetables (Ginter, 1998; UNDP, 1999). Information on dietary patterns in populations is essential for the formulation, implementation and monitoring of effective policies and programmes designed to improve overall nutritional well-being and reduce mortality. Such information is unfortunately limited in the Baltic republics. This is of particular concern as the rates of many diet-related diseases are extremely high in these countries. For example, in 1996, the male age standardised death rates from ischaemic heart disease per 100 000 men at ages under 65 were 138 in Estonia, 173 in Latvia and 126 in Lithuania but only 45 in the European Union (WHO, 1999). There is consequently a need for comprehensive surveys of food consumption and regular monitoring of dietary habits and nutritional status in these countries.

*Correspondence: M McKee, European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK.
E-mail: Martin.McKee@lshtm.ac.uk
Guarantor: M McKee.
Contributors: JP designed and conducted analysis of the data and prepared the initial draft of the paper. MM participated in the design and analysis of the data and revised the paper. AR designed the surveys, coordinated their implementation and commented on the paper. KK, AA, SV, IP and DG conducted the surveys, contributed contextual information on their own country and commented on earlier drafts.
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In 1996, the World Health Organization (WHO) facilitated the Baltic Project, funded by the Luxembourg Government, to support each country to carry out their first surveys of national food intake and knowledge of healthy lifestyle, using a common methodology. The main objective of the surveys was to provide national representative information on several aspects of food patterns and lifestyle behaviours, including food security, energy, nutrient and food intakes, dietary patterns, food beliefs, obesity, physical activity level, smoking, and pattern of alcohol consumption. This paper describes nutrient and food intakes in the population of the Baltic republics, focussing on macronutrient and vegetable and fruit intakes, as these dietary components have been linked to major health problems in the Baltic republics such as coronary heart disease and cancer.

Methods

Details of the survey methods have been described previously (Pudule *et al*, 1999). The surveys sought to include representative samples of the national population aged between 19 and 64 y (19–65 in Lithuania) using the National Population Registers as the sampling frames. A simple random sample of 3000 people was drawn from the population register in each country. In Estonia, sampling was stratified by age group. In Latvia, it was stratified by region, with further stratification by age group in Riga. In Latvia and Lithuania, substitution was not permitted but the interviewers returned to an address on multiple occasions if they were unable to find the subject. In Estonia, substitution was allowed if the response rate in the county in question was less than 60%; substitutes were selected on the basis of place of residence (usually neighbours, especially in the countryside). Overall, less than 5% of individuals, in seven Estonian counties, were substituted. Response rates were 67.3% in Estonia, 77.7% in Latvia, and 72.7% in Lithuania. Interviewers were mainly assistants working in hygiene stations, who underwent an initial one-day training session.

Survey interviews were conducted during the summer of 1997 in the respondents' homes in the national language or in Russian. Interviews included a 24 h recall of dietary intake, a standardised questionnaire, and the measurement of height and weight. The 24 h recall was used to define and quantify food intake during the previous 24 h (starting exactly 24 h before the time at which the interview started). Common sets of household measures and photographs and/or drawings of commonly used foods were shown to the participants to help them estimate food portion sizes. Probing questions about snacks, drinks, type of milk, fat and other foods were used to elicit more information. In Estonia, dietary information was converted into daily nutrient intakes using the Finnish Micro-Nutrica Nutritional Analysis program adapted to include Estonian foods (Estonian Version 2, 1997, Food Processing Institute, Tallinn Technical University). This program includes over 1150 food items and dishes and 66 nutrients. In Latvia and

Table 1 Mean daily energy and macronutrient intakes by sex, age group and country

	All ages			*19–34 y*			*35–49 y*			*50+ y*		
Nutrient	*Estonia* (n = 900)	*Latvia* (n = 1065)	*Lithuania* (n = 2606)	*Estonia* (n = 396)	*Latvia* (n = 337)	*Lithuania* (n = 339)	*Estonia* (n = 319)	*Latvia* (n = 372)	*Lithuania* (n = 357)	*Estonia* (n = 185)	*Latvia* (n = 356)	*Lithuania* (n = 266)
Men												
Energy, mean (s.d.)	2278 (1144)	2583 (1196)	2606 (1028)	2464 (1255)	2822 (1244)	2663 (1008)	2190 (1103)	2594 (1227)	2649 (1020)	2033 (873)	2345 (1067)	2477 (1056)
Fat (%), mean (s.d.)	36.5 (12.6)	42.7 (11.7)[a]	45.4 (12.2)[a,d]	37.9 (12.2)	44.2 (11.0)[a]	44.7 (11.9)[a]	35.0 (13.2)	42.1 (12.0)[a]	45.8 (12.1)[a,d]	35.8 (12.2)	41.8 (11.9)[a]	45.5 (12.6)[a,c]
Carbohydrate (%), mean (s.d.)	42.7 (14.0)	42.4 (11.8)	39.4 (12.3)[a,d]	41.8 (13.1)	41.3 (11.2)	40.2 (12.1)	43.6 (15.5)	42.6 (11.8)	38.4 (11.9)[a,d]	43.1 (13.0)	43.2 (12.4)	39.5 (12.8)[b,c]
Protein (%), mean (s.d.)	14.7 (4.7)	13.7 (4.2)[a]	13.5 (4.0)[a]	14.3 (4.6)	13.5 (4.1)	13.6 (3.6)	14.7 (4.8)	13.8 (4.5)	13.4 (4.0)[b]	15.4 (4.7)	13.8 (4.0)[a]	13.6 (4.4)[a]
Protein (g/kg), mean (s.d.)	1.0 (0.6)	1.1 (0.6)	1.1 (0.5)	1.1 (0.6)	1.2 (0.6)	1.1 (0.5)	1.0 (0.5)	1.1 (0.6)	1.1 (0.5)	1.0 (0.5)	1.0 (0.5)	1.0 (0.5)
Alcohol (%), mean (s.d.)	6.2 (13.7)	1.2 (4.4)	1.8 (5.8)	6.0 (12.3)	1.0 (2.9)	1.4 (4.4)	6.7 (14.8)	1.5 (5.6)	2.3 (7.4)	5.7 (14.4)	1.1 (4.2)	1.4 (4.9)
Median	0	0[e]	0[e]	0	0[e]	0[f]	0	0[e]	0	0	0	0
Women												
Energy, mean (s.d.)	1640 (766)	1791 (799)	1953 (832)	1760 (801)	1857 (792)	1913 (805)	1605 (765)	1835 (870)	1970 (873)	1491 (676)	1710 (738)	1973 (812)
Fat (%), mean (s.d.)	36.3 (11.3)	41.1 (11.3)[a]	42.6 (11.6)[a,c]	37.4 (11.2)	41.8 (11.4)[a]	43.1 (11.4)[a]	35.6 (11.4)	42.2 (11.1)[a]	42.9 (11.8)[a]	35.3 (11.3)	39.8 (11.4)[a]	41.9 (11.5)[a]
Carbohydrate (%), mean (s.d.)	47.3 (12.6)	44.6 (11.9)[a]	42.7 (12.8)[a,d]	46.4 (13.0)	44.3 (12.1)	42.1 (12.9)[a]	47.4 (12.4)	43.5 (11.7)[a]	42.3 (13.5)[a]	48.5 (12.3)	45.7 (12.0)[b]	43.8 (11.9)[a]
Protein (%), mean (s.d.)	15.0 (4.4)	13.7 (4.8)[a]	14.1 (4.3)[a]	14.6 (4.5)	13.3 (5.0)[a]	14.3 (4.3)	15.2 (4.5)	13.7 (4.4)[a]	14.0 (4.6)[a]	15.3 (4.3)	14.0 (4.9)[b]	13.9 (4.0)[a]
Protein (g/kg), mean (s.d.)	0.9 (0.5)	0.9 (0.5)	1.0 (0.5)	1.0 (0.5)	1.0 (0.5)	1.1 (0.5)	0.9 (0.5)	0.9 (0.5)	1.0 (0.6)	0.8 (0.4)	0.8 (0.4)	0.9 (0.5)
Alcohol (%), mean (s.d.)	1.5 (5.8)	0.5 (3.1)	0.6 (3.7)	1.6 (5.6)	0.6 (2.6)	0.5 (2.5)	1.8 (6.2)	0.5 (3.7)	0.8 (4.8)	1.0 (5.6)	0.4 (2.9)	0.5 (3.4)
Median	0	0	0	0	0	0	0	0	0	0	0	0

[a]Different ($P<0.001$) from Estonia, using analysis of variance and Bonferonni multiple.
[b]Different ($P<0.01$) from Estonia, using analysis of variance and Bonferonni multiple.
[c]Different ($P<0.01$) from Latvia, using analysis of variance and Bonferonni multiple.
[d]Different ($P<0.001$) from Latvia, using analysis of variance and Bonferonni multiple.
[e]Difference in the distribution of intakes ($P<0.001$) compared with Estonia, using Kruskal–Wallis analysis of variance.

Lithuania, the Russian Institute of Nutrition Food Composition Table (based on 1984 Skurihin Tables) was used to convert foods into nutrients.

The interviewer-administered questionnaire covered socio-demographic characteristics, health behaviours, and dietary habits and beliefs. Respondents were also asked to state their height without shoes and weight without clothes or shoes.

Data were analysed using the statistical package STATA version 6.0 (College Station, Texas). All individuals with missing information on age were excluded from the analyses ($n = 18$), as were pregnant and lactating women respondents in Latvia and Lithuania ($n = 35$). In Lithuania, three respondents were over 65 y of age but were kept in the analyses. After excluding 70 individuals who did not provide information for the 24 h recall, the samples included 2015 respondents in Estonia, 2300 in Latvia, and 2094 in Lithuania. The proportions of men and women were similar to those found in the general adult population of each country (Statistical Yearbook of Estonia, Statistical Office of Estonia, 1998; Statistical Yearbook of Latvia, Statistical Office of Latvia, 1998; Department of Statistics, Government of the Republic of Lithuania, 1997, 1998). Estonian respondents tended to be slightly younger than the general adult population of Estonia; in Latvia and Lithuania they were slightly older. The distribution of the study groups by area of residence and nationality closely resembled that in the general population (McKee *et al*, 2000).

Variables with a skewed distribution were transformed using log-normal or square-root transformations before the analyses; transformed values were returned to their original units in the tables of results. Between-country differences in dietary intakes were assessed using analyses of variance (with Bonferroni multiple comparison tests), Kruskal–Wallis one-way analysis of variance by ranks (for variables that could not be normalised using standard transformations: intakes of foods by food groups), and chi-square tests. As sex and age are strong determinants of dietary intake, the results are presented separately for men and women, and they are stratified by age group.

Results

Mean energy, macronutrient and food intakes

Mean intakes of energy, macronutrients and foods are showed in Tables 1 and 2. Overall, mean energy intake was lowest in Estonia, intermediate in Latvia, and highest in Lithuania, in both men and women (Table 1). In men and women from Estonia and Latvia, and in Lithuanian men, energy intake decreased with age. In Lithuanian women, it did not tend to vary by age. The median ratios of energy intake to estimated basal metabolic rate in men were 1.16, 1.32 and 1.36 in Estonia, Latvia and Lithuania, respectively. The corresponding figures for women were 1.09, 1.16 and 1.29.

Between-country differences in crude fat, carbohydrate and protein intakes generally followed the pattern observed for energy intake, with Estonians reporting the lowest intakes (results not shown). The distribution of crude alcohol intake during the day before the interview varied among countries, but the median intake was zero in each country.

The mean proportion of energy from fat was high in men and women from all three countries (Table 1), but it was particularly high in Lithuania (44%) and Latvia (42%) compared with Estonia (36%). Conversely, percentage energy from carbohydrate, protein and alcohol was generally higher in Estonia than in the other countries. Mean protein intake by kilogram of body weight (around 1 g/kg and lowest 0.8 g/kg) tended to decrease with age, and it was higher in men than in women. It was lower in Estonian than in Latvian and Lithuanian men; in women, the intake was slightly higher in Lithuania than in the other two countries.

The mean daily intakes of foods from different food groups are described in Table 2. In men, differences in the distribution of intakes among countries were observed for the intakes of vegetables (excluding potatoes), fruits, cereals, meat and meat products, and fats and oils. In Estonia, 92% of the respondents had consumed vegetables (excluding potatoes) on the day before their interview, compared with 75% of the Latvians and 79% of the Lithuanians. Median vegetable intakes were very low in each country. Latvian men tended to have generally lower intakes of vegetables, fruits, meat and meat products, and fats and oils than their Estonian and Lithuanian counterparts, while the intake of cereals was lower among Lithuanian than Estonian or Latvian male respondents. Fruit intake was particularly low in men, with median intakes equal to zero in all countries. No difference in the distribution of potato intakes was observed in men. In women, we found that Latvian respondents were consuming lower quantities of fruits and milk and milk products than Estonian and Lithuanian women. Intakes of cereals, meat and meat products, and fats and oils were highest in Estonia, intermediate in Lithuania and lowest in Latvia. Estonian women had generally higher intakes of vegetables than Latvian and Lithuanian women, but median intakes were extremely low in each country.

Usual consumption of vegetables or roots (excluding potatoes)

Tables 3 and 4 indicate that there were large differences among countries in the weekly consumption of vegetables and roots (excluding potatoes). While 78% of the Lithuanian respondents reported consuming vegetables daily (6–7 days per week), this was the case in only 60% of the Latvian and 48% of the Estonian respondents (Table 3). In each country, women were more likely than men to consume vegetables daily. Overall, less than 0.2% of the Lithuanians reported eating neither raw nor cooked vegetables; this was the case in 1% of the Latvians and 3% of the Estonians.

Table 2 Mean and median daily intakes (g) of foods by sex, age group and country

	All ages			*19–34 y*			*35–49 y*			*50+ y*		
	Estonia (n = 900)	*Latvia (n = 1065)*	*Lithuania (n = 962)*	*Estonia (n = 396)*	*Latvia (n = 337)*	*Lithuania (n = 339)*	*Estonia (n = 319)*	*Latvia (n = 372)*	*Lithuania (n = 357)*	*Estonia (n = 185)*	*Latvia (n = 356)*	*Lithuania (n = 266)*
Men												
Vegetables (excluding potatoes)												
Mean (s.d.)	220 (195)	201 (235)	211 (211)	225 (207)	227 (263)	210 (199)	218 (186)	199 (224)	220 (230)	213 (182)	179 (214)	199 (198)
Median	187	120[a]	170[b]	185	150	180	187	120[c]	170	198	100[c]	162
Potatoes												
Mean (s.d.)	231 (201)	275 (281)	292 (309)	261 (214)	271 (280)	301 (333)	211 (198)	289 (291)	309 (309)	203 (169)	263 (270)	259 (274)
Median	202	225	225	240	225	225	200	225[a]	250[a]	200	225	200
Fruits												
Mean (s.d.)	135 (255)	67 (196)	139 (301)	151 (291)	87 (222)	118 (254)	145 (242)	56 (183)	142 (310)	87 (176)	58 (182)	160 (340)
Median	0	0[c]	0[c,d]	5	0[c]	0[c]	0	0[c]	0[a,d]	0	0[c]	0[d]
Vegetables and fruits (excluding potatoes)												
Mean (s.d.)	355 (331)	268 (330)	349 (370)	376 (360)	315 (373)	328 (327)	362 (330)	255 (312)	362 (395)	299 (255)	237 (301)	359 (388)
Median	277	200[c]	241[d]	298	225[c]	247	272	168[c]	220[d]	250	128[c]	270[d]
Cereals												
Mean (s.d.)	218 (175)	215 (183)	181 (162)	218 (190)	218 (187)	181 (159)	216 (160)	223 (194)	180 (149)	223 (169)	202 (166)	183 (183)
Median	177	161	148[c,d]	172	166[c]	150	180	161	150[b,c]	176	157[c]	146
Milk and milk products												
Mean (s.d.)	328 (383)	296 (369)	325 (353)	331 (389)	312 (436)	336 (390)	304 (385)	262 (344)	301 (337)	360 (365)	317 (321)	345 (324)
Median	233	200	237	244	200	230	200	135	200	264	250	268
Meat and meat products												
Mean (s.d.)	198 (172)	187 (200)	199 (178)	223 (184)	226 (211)	215 (187)	188 (168)	183 (196)	194 (171)	163 (140)	155 (187)	183 (176)
Median	166	140[a]	170[b]	188	195	180	150	140	175	150	100	150
Fish												
Mean (s.d.)	24 (72)	33 (126)	21 (59)	21 (65)	33 (144)	22 (65)	21 (61)	35 (132)	19 (52)	37 (96)	32 (97)	21 (62)
Median	0	0	0	0	0	0	0	0	0	0	0	0
Fats and oils												
Mean (s.d.)	39 (41)	20 (38)	40 (55)	44 (49)	20 (31)	36 (55)	35 (35)	22 (45)	42 (55)	33 (31)	20 (36)	41 (55)
Median	29	10[c]	20[c,d]	30	10[c]	17[c,d]	28	10[c]	20[d]	28	10[c]	20[d]
	(n = 1115)	*(n = 1235)*	*(n = 1132)*	*(n = 459)*	*(n = 342)*	*(n = 350)*	*(n = 376)*	*(n = 396)*	*(n = 402)*	*(n = 280)*	*(n = 496)*	*(n = 380)*
Women												
Vegetables (excluding potatoes)												
Mean (s.d.)	192 (166)	168 (176)	168 (180)	193 (171)	171 (172)	186 (195)	191 (151)	178 (174)	166 (169)	192 (178)	159 (179)	154 (176)
Median	160	102[c]	120[a]	154	118	140	159	120	121[c]	163	100[c]	100[c]
Potatoes												
Mean (s.d.)	177 (165)	172 (218)	191 (236)	172 (156)	164 (187)	183 (234)	191 (185)	173 (224)	197 (249)	165 (148)	177 (233)	193 (223)
Median	150	125[c]	150[c]	150	150	135	159	150[a]	150	150	80	150
Fruits												
Mean (s.d.)	168 (168)	96 (201)	199 (318)	211 (270)	118 (222)	192 (305)	172 (253)	106 (202)	222 (359)	94 (155)	74 (182)	182 (280)
Median	50	0[c]	35[d]	147	0[c]	60[a,d]	37	0[c]	38[d]	12	0[c]	0[d]
Vegetables and fruit (excluding potatoes)												
Mean (s.d.)	360 (308)	265 (282)	367 (372)	404 (326)	289 (289)	377 (373)	363 (318)	284 (285)	388 (402)	286 (242)	233 (271)	336 (335)
Median	295	200[c]	280[d]	350	200[c]	294[d]	277	200[c]	276[d]	243	150[c]	260[d]
Cereals												
Mean (s.d.)	160 (160)	148 (150)	115 (117)	162 (132)	128 (119)	102 (108)	158 (120)	148 (149)	110 (116)	157 (107)	161 (168)	134 (124)
Median	127	99[c]	86[c,d]	127	94[c]	77[b,c]	121	94[c]	80[b,c]	135	102	100[c]
Milk and milk products												
Mean (s.d.)	296 (296)	276 (311)	310 (306)	301 (269)	252 (259)	256 (265)	284 (258)	278 (352)	274 (286)	306 (263)	291 (307)	397 (340)
Median	250	200[c]	230[b]	250	193[a]	200[a]	243	200	200	250	215	333[a,d]
Meat and meat products												
Mean (s.d.)	123 (123)	94 (127)	117 (125)	134 (119)	112 (140)	122 (124)	126 (115)	103 (124)	117 (132)	102 (98)	74 (118)	112 (120)
Median	100	50[c]	100[a,d]	104	69[c]	100	100	70[c]	91	81	0[c]	80[d]
Fish												
Mean (s.d.)	22 (22)	21 (68)	16 (50)	21 (55)	28 (87)	16 (47)	19 (66)	17 (55)	18 (54)	30 (74)	21 (63)	14 (50)
Median	0	0	0	0	0	0	0	0	0	0	0	0
Fats and oils												
Mean (s.d.)	27 (26)	14 (21)	22 (34)	30 (27)	13 (21)	19 (31)	26 (24)	14 (22)	22 (31)	26 (26)	15 (22)	24 (39)
Median	20	10[c]	10[c,d]	23	10[c]	10[c]	19	10[c]	10[c,d]	20	10[c]	10[c]

[a]Difference in the distribution of intakes ($P<0.01$) compared with Estonia, using Kruskal–Wallis analysis of variance.
[b]Difference in the distribution of intakes ($P<0.01$) compared with Latvia, using Kruskal–Wallis analysis of variance.
[c]Difference in the distribution of intakes ($P<0.001$) compared with Estonia, using Kruskal–Wallis analysis of variance.
[d]Difference in the distribution of intakes ($P<0.001$) compared with Latvia, using Kruskal–Wallis analysis of variance.

Raw and fresh vegetables were consumed 6–7 days per week by 70% of the Lithuanian participants (Table 4). The corresponding figures for Latvia and Estonia were 43% and 34%. In each country, daily consumption of vegetables was lower in men and in respondents age 50 y and over than in women and younger respondents, respectively. Five percent of women and 8% of men from Estonia said they never eat vegetables, compared with only 0.3% of Lithuanian men and women. In each country, boiled and stewed vegetables were consumed less frequently than raw vegetables, possibly because the surveys took place during the summer. Approximately 10% of Latvians and Lithuanians and a quarter of Estonians reported never consuming cooked vegetables. The majority of the respondents consumed them 1–2 days per week and about 16% consumed them daily (14% in Estonia, 19% in Latvia, 16% in Lithuania). As was the case for raw vegetables, women were more likely then men to consume them every day.

Discussion

The role of dietary intake in the prevention of chronic diseases has been studied for many years, and it is now recognised that the consumption of a diet rich in fat (particularly saturated fat) and poor in vegetables and fruits could play a role in the development of a range of chronic diseases including coronary heart disease, some cancers, and obesity (Wiseman, 1997; Lichtenstein *et al*, 1998; World Cancer Research Fund/American Institute for Cancer Research, 1997; La Vecchia & Tavani & 1998; Kuller, 1997). International dietary guidelines suggest that fat intake should be limited to 15–30% of dietary energy and that the daily intake of vegetables and fruits (excluding potatoes) should reach at least 400 g (WHO, 1990; Wood, 1998).

Findings from this study indicate that the average total fat intake of men and women is clearly above these

Table 3 Weekly consumption of raw, fresh, boiled or stewed vegetables by country, sex and age group

	Estonia				*Latvia*				*Lithuania*				
Group	n	*Never*	*<6 days*	*6–7 days*	n	*Never*	*<6 days*	*6–7 days*	n	*Never*	*<6 days*	*6–7 days*	P-*value*[a]
All men	902	4.2	54.2	41.6	1060	0.9	41.9	57.2	981	0.1	25.1	74.8	<0.001
18–34 y	397	5.0	55.4	39.6	334	0.9	40.1	59.0	348	0.3	25.6	74.1	<0.001
35–49 y	320	2.8	55.0	42.2	369	0.3	40.4	59.4	360	0.0	20.3	79.7	<0.001
50 + yrs	185	4.9	50.3	44.9	357	1.7	45.1	53.2	273	0.0	30.8	69.2	<0.001
All women	1116	2.8	43.8	53.4	1233	1.5	35.9	62.5	1161	0.2	19.6	80.2	<0.001
18–34 y	459	3.3	43.1	53.6	342	0.6	29.5	69.9	358	0.0	18.2	81.8	<0.001
35–49 y	376	2.4	45.0	52.7	394	1.5	35.3	63.2	410	0.5	18.3	81.2	<0.001
50 + y	281	2.5	43.4	54.1	497	2.2	40.9	56.9	393	0.0	22.4	77.6	<0.001

[a]*P*-value for variations among countries in the frequency of eating between main meals, using chi-square tests.

Table 4 Weekly consumption of raw and fresh vegetables and of boiled or stewed vegetables by country, sex and age group

	Estonia					*Latvia*					*Lithuania*					
Group	n	*Never*	*1–2 days*	*3–5 days*	*6–7 days*	n	*Never*	*1–2 days*	*3–5 days*	*6–7 days*	n	*Never*	*1–2 days*	*3–5 days*	*6–7 days*	P-*value*[a]
Raw vegetables																
All men	902	8.2	25.4	36.4	30.0	1066	2.1	25.2	31.7	41.0	984	0.3	7.9	25.7	66.1	<0.001
18–34 y	397	8.6	22.7	38.0	30.7	336	1.2	20.2	33.9	44.6	350	0.3	5.7	28.3	65.7	<0.001
35–49 y	320	6.9	26.6	37.2	29.4	372	0.8	25.5	31.7	41.9	359	0.0	6.7	22.0	71.3	<0.001
50 + y	185	9.7	29.2	31.4	29.7	358	4.2	29.6	29.6	36.6	275	0.7	12.4	27.3	59.6	<0.001
All women	1116	5.2	22.1	35.0	37.6	1236	2.9	20.1	33.1	43.9	1163	0.3	6.7	19.1	74.0	<0.001
18–34 y	459	5.0	21.4	36.4	37.3	341	0.9	14.1	33.7	51.3	358	0.0	5.0	18.4	76.5	<0.001
35–49 y	376	5.1	17.0	37.8	40.2	396	2.8	16.9	32.8	47.5	411	0.5	6.1	18.5	74.9	<0.001
50 + y	281	5.7	30.3	29.2	34.9	499	4.4	26.7	32.9	36.1	394	0.3	8.9	20.3	70.6	<0.001
Boiled or stewed vegetables																
All men	902	33.6	33.5	20.5	12.4	1061	10.5	40.2	31.6	17.8	973	8.9	48.3	26.9	15.8	<0.001
18–34 y	397	39.0	32.8	15.9	12.3	335	12.8	43.3	26.0	17.9	345	10.4	46.1	30.4	13.0	<0.001
35–49 y	320	28.4	35.6	22.2	13.8	369	7.1	41.2	31.4	20.3	358	6.7	49.2	25.4	18.7	<0.001
50 + y	185	30.8	31.4	27.6	10.3	357	11.8	36.1	37.0	15.1	270	10.0	50.0	24.4	15.6	<0.001
All women	1116	20.4	39.2	25.9	14.5	1232	8.2	39.8	32.7	19.3	1149	11.4	44.6	27.1	17.0	<0.001
18–34 y	459	23.1	37.5	27.7	11.8	342	6.4	41.8	32.2	19.6	356	9.6	46.1	26.7	17.7	<0.001
35–49 y	376	18.9	43.4	21.5	16.2	394	9.4	40.6	30.0	20.1	407	13.0	44.2	25.3	17.4	0.002
50 + y	281	18.2	36.3	28.8	16.7	496	8.5	37.7	35.3	18.6	386	11.4	43.5	29.3	15.8	0.001

[a]*P*-value for variations among countries in the weekly consumption of vegetables, using chi-square tests.

recommendations, particularly in Latvia and Lithuania. This is a cause of concern since the death rate from ischaemic heart disease among those under 65 is up to three times that in the European Union while the corresponding figures for cancer (other than lung) is 30% higher (WHO, 1998). In addition, some studies have indicated that individuals with a high fat intake are less likely to meet other dietary guidelines than are individuals with a lower fat intake (Subar *et al*, 1994): they tend to have higher intakes of cholesterol, saturated fat, sodium, protein, and energy, and lower intakes of vitamin C, carbohydrate, carotene, folate, and dietary fibre — nutrients considered necessary to maintain good health and prevent illnesses. Data from the Baltic Nutrition Surveys also indicated that awareness of the effect of different types of dietary fat on coronary disease was generally low among the participants: in Latvia, less than a third of the respondents showed awareness of this, compared with 43% or the Estonians and 53% of the Lithuanians (data available upon request). This last observation is surprising considering the fact that Lithuanians were at least three times as likely as other participants to use lard for cooking (29% *vs* 9%) and 23% less likely to use oil for cooking (58% *vs* 75%).

Unlike fat intake, mean carbohydrate consumption in the Baltic countries (between 42 and 47% of dietary energy) was considerably lower than WHO recommendations (55–75% of dietary energy (WHO, 1990). This might have important health effects as a high carbohydrate intake, particularly comprising complex carbohydrates, has been advocated for the prevention of several health problems, including cardiovascular diseases and cancer (World Cancer Research Fund/American Institute for Cancer Research, 1997). One way of increasing the consumption of complex carbohydrates would be to promote whole grain cereals (including rye bread, which is commonly consumed in the region), vegetables and fruits.

Mean protein intake appears to be generally sufficient, if not high in some cases, in the Baltic republics. The high protein intakes in some individuals could be linked with current beliefs observed within the population of the Baltic countries. Indeed, less than half the respondents to the surveys, and particularly men, believed that a healthy diet need not contain meat every day (data available upon request). This general lack of knowledge could lead to an over-consumption of meat that could in turn lead to high intakes of saturated fats and to an increase in the risk of cardiovascular diseases (Lichtenstein *et al*, 1998). This phenomenon has been observed in Russia where a high intake of fat and protein in the form of meat and meat products remains, despite the price of these products (Robertson & Lang, 1997). This could be a legacy from the original Recommended Daily Intake in the Soviet Union which stipulated that high intakes of protein were necessary to maintain good health. This belief is a major source of concern as high animal protein diets are also likely to be high in saturated fat.

Vegetables and fruit play a major role in an everyday healthy diet. They prevent micro-nutrient deficiency and epidemiological findings suggest that they might slow or prevent the onset of various non-communicable diseases (World Cancer Research Fund/American Institute for Cancer Research, 1997; WHO, 1990). The mechanisms of action of vegetables and fruits in preventing chronic diseases is not fully understood. However, it has been suggested that some nutrients (eg folic acid, vitamin E and carotenoids), fibre and other biologically active compounds found in these foods could possibly act by modulating detoxification enzymes, stimulating the immune system, reducing platelet aggregation, modulating cholesterol synthesis and hormone metabolism, reducing blood pressure, and/or by demonstrating antioxidant, antibacterial and antiviral effects (Lampe, 1999). In this study, results from the questionnaire data and from the 24 h recall suggest that current dietary recommendation for vegetable and fruit intake are not generally met by the adult populations of the Baltic countries. Overall, only 78% of the Lithuanians, 60% of the Latvians and 48% of the Estonians reported consuming vegetables (raw or cooked, excluding potatoes) daily (6–7 days per week). In addition, despite the fact that the surveys were conducted during the summer, a period during which vegetables and fruit should be more easily accessible to the population, the results of the 24 h recall indicate that the median intake of vegetables and fruits of the participants was considerably below the recommended level, particularly in Latvia where it was only 200 g on the day before the interview. The median consumption of fruits was zero in each country among men and it varied between zero and 35 g per day among women. Reasons for the extremely low intakes of vegetables and fruits in the Baltic countries, particularly in the summer, should be explored further if effective promotion campaigns to increase the mean consumption are to be developed. In addition, easy access to vegetables and fruits should be promoted and increased.

Limitations of dietary information

Information on dietary intake was collected using a 24 h recall. This technique is flexible and it facilitates the inclusion of all types of foods and recipes. Estimates of dietary intake based on a single recall may provide reasonable estimates of mean intakes for a group or population sub-group (Willett, 1990). However, the standard deviations obtained with this technique are greatly overestimated because of normal day-to-day variation in dietary intakes. Thus, estimating the proportions of individuals with an intake above or below a certain cut-off could be misleading and was not done in this paper. Data collection using the 24 h recall method is relatively fast and inexpensive but data entry is not. The validity of the method may be affected by the memory, co-operation, and communication ability of the subjects, as well as by the skills of the interviewer (Witschi, 1990). To help increase the accuracy of the data, 24 h food recalls were administered only by trained interviewers and common sets of household measures, photographs and/or drawings of foods were used to facilitate the estimation of portion sizes. The interviewers

underwent a one-day training session. Although not all were nutritionists, all had previous training in interview techniques. Interviews were conducted over the course of a week, thus smoothing out daily dietary fluctuations. As the surveys were conducted during the summer, food consumption may have been affected by seasonal food choices. For example, the usual consumption of fresh vegetables and fruits may have been overestimated (Granado *et al*, 1996). Dietary intake estimates were also subject to the general limitations associated with the use of different nutrient databases to derive the nutrient composition of an individual's diet (West & van Staveren, 1997). The Estonian version of the Finnish Micro-Nutrica Nutritional Analysis Program and the Russian food composition database were the most complete ones adapted for diet in the Baltic countries. However, it is possible that the lower fat intake observed in Estonia could be partly related to the use of the Finnish database. This will need to be investigated further.

It is increasingly recognized that dietary intakes generally tend to be under-reported (Schoeller, 1990; Heymsfield *et al*, 1995). In Western countries, the average daily energy requirements for sedentary adults is approximately 1.55 times the basal metabolic rate; thus, ratios of energy intake to basal metabolic rate less than 1.55 would indicate potentially inaccurate (under) estimates of habitual food intakes. The average energy intakes of the participants in the Baltic surveys were generally lower than expected, particularly in women. In addition, the median ratio of energy intake to basal metabolic rate suggests potential under-reporting in some population sub-groups, particularly among Estonian respondents. This could explain why Estonians have lower mean crude intakes of nutrients than respondents from Latvia and Lithuania (except for alcohol and niacin intakes). This also suggests that caution is warranted when comparing crude intakes among countries in this report and that comparisons of macronutrient intakes expressed as percent of energy may be more appropriate.

Conclusions

Information on the macronutrient and food intake of the survey participants suggest that there is a pressing need, in the Baltic States, for a shift among the different sources of energy intake, particularly from fat to carbohydrates. Replacing high-fat energy-dense foods by foods rich in complex-carbohydrates and dietary fibres such as vegetables and fruits may confer simultaneously to the populations a reduced risk and increased protection against non-communicable diseases, and help them attain energy balance (Pomerleau *et al*, 2000). These issues will need to be tackled through comprehensive food and nutrition policies and health promotion campaigns.

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Dietary beliefs in the Baltic republics

Joceline Pomerleau[1], Martin McKee[1,*], Aileen Robertson[2], Kamelija Kadziauskiene[3], Algis Abaravicius[4], Roma Bartkeviciute[3], Sirje Vaask[5], Iveta Pudule[6] and Daiga Grinberga[6]

[1]European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, 50 Bedford Square, London WC1B 3DP, UK: [2]WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark: [3]National Nutrition Centre, Kalvariju str. 153, 2042 Vilnius, Lithuania: [4]Faculty of Medicine, Department of Physiology and Biochemistry, Vilnius University, Ciurlionio str. 21/27, 2009 Vilnius, Lithuania: [5]Public Health Department, Ministry of Social Affairs, Gonsiori str. 29 EE0100, Tallinn, Estonia: [6]Health Education Division, Health Promotion Centre, Skolas 3, LV-1010 Riga, Latvia

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Abstract

Objectives: As beliefs and knowledge about the possible effects of foods on health can influence food behaviours, this study examined selected dietary beliefs in the Baltic countries and the association of beliefs related to salt intake and to types of fat with food behaviours.

Design: A cross-sectional study.

Setting: Data from three surveys conducted in Estonia, Latvia and Lithuania in the summer of 1997 were used to describe the prevalence of dietary beliefs in these countries and to investigate the association between beliefs and behaviours (using logistic regression).

Subjects: Representative national samples of adults were selected in each country (Estonia, $n = 2018$; Latvia, $n = 2308$; Lithuania, $n = 2153$).

Results: Misunderstood concepts (myths) related to dietary salt, types of fat, meat consumption and bread and potatoes were observed in high proportions of the population. Education level was an important correlate of beliefs related to salt intake and types of fat, people with a higher education level being more likely to be familiar with these issues. Correct beliefs were not consistently associated with healthier behaviours (e.g. less frequent use of salt at the table and use of non-animal fats for cooking), except for salt intake in Estonia.

Conclusions: Several misunderstood dietary concepts (myths) are still prevalent in the Baltic countries. Correct beliefs related to salt intake and types of fat were not consistent predictors of healthier food behaviours. In-depth qualitative investigations are needed to better describe and understand dietary beliefs and attitudes in the Baltic countries, and to identify barriers to the adoption of healthy food habits.

Keywords
Estonia
Latvia
Lithuania
Beliefs
Dietary salt
Dietary fats

Dietary habits in Central and Eastern Europe are generally less favourable than those observed in western countries[1,2]. Diet tends to be relatively rich in saturated fat and poor in vegetables, fruits and antioxidants, and there is an acknowledged need for the development of food and nutrition action plans[3–8]. These dietary patterns are a legacy of postwar food policies in the Soviet Union, which transformed the diet into one of the most energy dense in the world[3]. Between 1961 and 1981 there were considerable increases in the per capita availability of sugar, meat and eggs (increases by 56%, 50% and 100%, respectively), while availability of staple foods such as cereals and potatoes declined by 24%[9]. However, in the early 1990s, the transition towards market economies affected food availability. In the Baltic Republics, for example, per capita availability of meat, eggs and milk decreased by 26%, 18% and 20%, respectively, between 1992 and 1997, while availability of starchy roots increased by over 20%. Despite these changes, the dietary animal foods and fat intake remain high[10], suggesting a need to develop and implement campaigns to improve dietary habits in these countries.

Understanding why people select unhealthy diets is a first step to improving diet in the Baltic republics. Several factors influence individual food choices, including cost, taste, availability, convenience, health concerns, current

**Corresponding author:* Email martin.mckee@lshtm.ac.uk

Table 1 Dietary beliefs by country

Group	Estonia				Latvia				Lithuania				
	n	Wrong (%)	Right (%)	Don't know (%)	*n*	Wrong (%)	Right (%)	Don't know (%)	*n*	Wrong (%)	Right (%)	Don't know (%)	*P* value*
'*More dietary salt in the diet is of no consequence to your health*'													
All men	902	68.0	20.3	11.8	1058	62.2	20.9	16.9	986	66.9	16.5	16.5	0.001
18–34 years	397	65.2	21.7	13.1	335	59.7	23.0	17.3	349	71.1	13.8	15.2	0.006
35–49 years	320	72.2	18.1	9.7	367	66.2	19.1	14.7	361	65.4	17.7	16.9	0.09
50+ years	185	66.5	21.1	12.4	356	60.4	20.8	18.8	276	63.8	18.5	17.8	0.36
All women	1116	76.3	15.1	8.5	1219	69.2	21.2	9.6	1161	73.6	17.5	8.9	0.002
18–34 years	459	77.6	15.0	7.4	339	73.8	20.1	6.2	358	76.5	17.6	5.9	0.39
35–49 years	376	77.9	15.2	6.9	387	73.6	18.4	8.0	407	73.5	18.2	8.4	0.62
50+ years	281	72.2	15.3	12.5	493	62.7	24.1	13.2	396	71.2	16.7	12.1	0.01
'*All fats give the same risk of various coronary diseases*'													
All men	902	39.7	36.8	23.5	1058	27.4	36.5	36.1	986	45.3	19.3	35.4	<0.001
18–34 years	397	44.6	33.8	21.7	335	27.8	32.8	39.4	349	47.3	17.8	35.0	<0.001
35–49 years	320	42.5	35.3	22.2	367	26.4	40.3	33.2	361	46.0	21.1	33.0	<0.001
50+ years	185	24.3	46.0	29.7	356	28.1	36.0	36.0	276	42.0	18.8	39.1	<0.001
All women	1116	46.5	35.6	17.9	1218	30.8	43.5	25.7	1162	58.1	20.7	21.2	<0.001
18–34 years	459	52.9	30.5	16.6	339	36.6	36.3	27.1	359	62.4	18.9	18.7	<0.001
35–49 years	376	46.8	40.7	12.5	387	32.0	44.2	23.8	407	59.5	22.6	17.9	<0.001
50+ years	281	35.6	37.0	27.4	492	25.8	48.0	26.2	396	52.8	20.5	26.8	<0.001
'*Meat is an essential component in everyday healthy diet*'													
All men	902	42.1	49.0	8.9	1058	33.0	51.0	16.0	986	44.5	43.3	12.2	<0.001
18–34 years	397	37.5	51.9	10.6	335	35.2	47.2	17.6	349	49.3	38.7	12.0	<0.001
35–49 years	320	47.5	45.3	7.2	367	32.4	54.5	13.1	361	40.7	47.9	11.4	0.001
50+ years	185	42.7	49.2	8.1	356	31.5	51.1	17.4	276	43.5	43.1	13.4	0.002
All women	1116	50.6	39.3	10.1	1219	50.1	36.3	13.5	1162	58.8	30.5	10.8	<0.001
18–34 years	459	46.2	42.3	11.6	339	52.8	31.0	16.2	359	61.6	27.0	11.4	<0.001
35–49 years	376	52.4	39.9	7.7	387	56.1	34.4	9.6	407	59.7	31.7	8.6	0.17
50+ years	281	55.5	33.5	11.0	493	43.6	41.6	14.8	396	55.3	32.3	12.4	0.003
'*Alcohol has a high calorie content*'													
All men	902	22.4	63.5	14.1	1058	18.4	47.7	33.8	986	10.3	55.9	33.8	<0.001
18–34 years	397	19.7	62.2	18.1	335	17.0	50.5	32.5	349	9.7	55.6	34.7	<0.001
35–49 years	320	27.5	62.8	9.7	367	19.6	49.1	31.3	361	8.9	61.5	29.6	<0.001
50+ years	185	19.5	67.6	13.0	356	18.5	43.8	37.6	276	13.0	48.9	38.0	<0.001
All women	1116	14.3	67.3	18.5	1219	17.2	45.3	37.5	1161	8.6	62.8	28.6	<0.001
18–34 years	459	14.6	68.4	17.0	339	14.8	54.0	31.3	359	9.2	70.2	20.6	<0.001
35–49 years	376	16.0	70.7	13.3	387	18.9	49.6	31.5	406	9.9	66.3	23.9	<0.001
50+ years	281	11.4	60.9	27.8	493	17.7	35.9	46.5	396	6.8	52.5	40.7	<0.001

* *P* value for differences between countries based on chi-square tests.

knowledge and beliefs and attitudes towards foods[11–13]. In this study, we examined the distribution of different dietary beliefs in the Baltic countries. We then focused on beliefs related to two acknowledged risk factors for hypertension and cardiovascular diseases, that is, excess dietary salt and saturated fats[14–16]. We also investigated how these beliefs correlated with the reported addition of dietary salt at the table and the type of fats used for cooking.

Methods

Details of the survey methods have been described previously[17]. In summary, the surveys were conducted during the summer of 1997. Each sought to include representative samples of the national population aged between 19 and 64 years (19–65 years in Lithuania) using national population registers as the sampling frames. In each country, a simple random sample of 3000 people was drawn. In Estonia, sampling was stratified by age group. In Latvia, it was stratified by region; for Riga, sampling also took account of age groups. In Latvia and Lithuania, substitution was not permitted but the interviewers returned to an address on multiple occasions if they were unable to find the subject. In Estonia, substitution was allowed if the response rate in the county in question was less than 60%; substitutes were selected on the basis of place of residence (usually neighbours, especially in the countryside). Overall, less than 5% of individuals, in seven Estonian counties, were substituted. The response rates were 67.3% in Estonia (males 63.2%, females 70.9%), 77.7% in Latvia (males 77.2%, females 78.2%) and 72.7% in Lithuania (males 69.3%, females 75.8%).

Survey interviews were conducted in the respondents' homes in the national language or in Russian. They included a 24-hour recall of dietary intake, the administration of a standardized questionnaire and the measurement

Table 2 Likelihood of believing that more dietary salt in the diet can have harmful health consequences (adjusted for all variables)

	Men						Women					
	Estonia		Latvia		Lithuania		Estonia		Latvia		Lithuania	
Variable	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Age group												
18–34 years	1.00		1.00		1.00		1.00		1.00		1.00	
35–49 years	1.53	1.10;2.14	1.35	0.97;1.89	0.75	0.54;1.05	1.05	0.74;1.47	0.92	0.65;1.31	0.90	0.64;1.27
50+ years	1.25	0.84;1.87	1.02	0.72;1.43	0.84	0.57;1.24	0.93	0.63;1.36	0.55	0.39;0.76	1.00	0.68;1.47
Nationality												
Estonian/Latvian/Lithuanian	1.00		1.00		1.00		1.00		1.00		1.00	
Russian	0.51	0.36;0.72	0.76	0.56;1.04	0.67	0.42;1.08	0.51	0.37;0.71	0.98	0.73;1.30	0.67	0.41;1.10
Other	0.38	0.21;0.68	1.81	1.10;2.99	0.51	0.31;0.86	0.33	0.20;0.54	0.99	0.64;1.54	0.40	0.24;0.67
Area of residence												
Urban	1.00		1.00		1.00		1.00		1.00		1.00	
Rural	0.95	0.71;1.28	0.87	0.64;1.18	0.71	0.52;0.98	0.65	0.48;0.89	0.86	0.64;1.14	1.14	0.84;1.56
Education level												
Primary	1.00		1.00		1.00		1.00		1.00		1.00	
Secondary	1.64	1.06;2.52	1.09	0.75;1.59	1.23	0.80;1.88	0.93	0.57;1.51	0.91	0.63;1.31	1.72	1.10;2.69
Secondary special or university	1.96	1.24;3.09	1.77	1.22;2.56	1.71	1.16;2.54	1.47	0.88;2.46	1.25	0.87;1.80	1.82	1.21;2.75
Income level												
Level 1 (low)	1.00		1.00		1.00		1.00		1.00		1.00	
Level 2	0.86	0.58;1.26	1.59	1.17;2.17	0.80	0.56;1.14	1.19	0.85;1.67	1.18	0.88;1.58	1.16	0.83;1.62
Level 3	0.91	0.60;1.37	1.65	1.03;2.62	0.71	0.44;1.15	1.45	0.94;2.24	1.42	0.86;2.35	1.14	0.71;1.81
Level 4 (high)	1.56	0.90;2.73	2.32	1.28;4.19	0.79	0.52;1.18	0.76	0.41;1.42	1.30	0.66;2.56	1.37	0.91;2.04

of height and weight. The questionnaire was translated by professional translators from English. It covered demographic and socioeconomic characteristics, selected dietary habits and food beliefs, and health behaviours. Nationality was classified as that of the native population, Russian or 'other' – which essentially equated to Ukrainian or Belarussian, or, in Lithuania, to Polish. The income variable related to average income per family member per month. In each country, it was divided into four categories based on national criteria for the poverty level, with the poorest category considered to be living in severe poverty.

Data were analysed using the statistical package STATA version 6.0 (College Station, Texas). All individuals with missing information on age were excluded from the analyses ($n = 18$), as were pregnant women (Latvia, $n = 35$). In Lithuania, three respondents were over 65 years of age but were kept in the analyses. Between-country differences in dietary beliefs, in the type of fat used for cooking and the use of salt at the table were assessed using chi-square tests, stratifying by age and sex. The odds of believing that 'all fats do not give the same risk of various coronary diseases' and that 'more dietary salt in the diet is of consequence to health' were calculated using multiple regression analyses according to a range of demographic and socioeconomic variables; all variables were included simultaneously in the regression model. The relationship between these two beliefs and the likelihood of adding salt at the table or of using lard or butter for cooking was investigated, adjusting for demographic and socioeconomic variables. Statistical significance was taken as $P < 0.05$.

Results

The samples included 2018 respondents in Estonia, 2308 in Latvia and 2153 in Lithuania. The proportions of men and women were similar to those found in the general adult population of each country[18–20]. However, in Estonia, respondents tended to be slightly younger than the general adult population; in Latvia and Lithuania they were slightly older. Distribution by area of residence and nationality was similar to that of the general population.

Dietary beliefs

Dietary beliefs are described in Table 1. The belief that too much dietary salt can have possible harmful effects on health was slightly commoner in Estonia (73%) than in Lithuania (71%) or Latvia (66%). In each country, women were more likely to have answered correctly than men, and younger women more likely to be right than women aged 50 years and over. In men, the belief that too much salt can affect health decreased with age in Lithuania, but in Estonia and Latvia it was highest in middle-aged men.

More than half the Lithuanian respondents (52%) believed that all types of fat do *not* give the same risk of various coronary diseases. The corresponding figures for Estonia and Latvia were 43% and 29%, respectively. In each country, women and younger respondents were more likely to believe in the importance of considering the type of dietary fat consumed.

Meat was *not* considered to be an essential component in an everyday healthy diet by only 52% of Lithuanians, 47% of Estonians and 42% of Latvians. Women were more likely than men to believe that meat does not need to be

Table 3 Likelihood of believing that all fats do not give the same risk of various coronary diseases (adjusted for all variables)

	Men						Women					
	Estonia		Latvia		Lithuania		Estonia		Latvia		Lithuania	
Variable	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Age group												
18–34 years	1.00		1.00		1.00		1.00		1.00		1.00	
35–49 years	1.00	0.73;1.36	0.99	0.70;1.42	1.06	0.78;1.46	0.80	0.60;1.06	0.83	0.60;1.15	0.90	0.66;1.22
50+ years	0.46	0.31;0.69	1.17	0.81;1.69	0.96	0.67;1.38	0.57	0.41;0.79	0.64	0.46;0.88	0.85	0.61;1.20
Nationality												
Estonian/Latvian/Lithuanian	1.00		1.00		1.00		1.00		1.00		1.00	
Russian	1.45	1.03;2.05	0.63	0.45;0.88	0.69	0.43;1.11	1.75	1.31;2.35	0.57	0.43;0.77	1.24	0.76;2.00
Other	0.80	0.42;1.51	0.57	0.34;0.95	0.54	0.31;0.92	1.25	0.76;2.07	0.83	0.54;1.28	0.68	0.41;1.13
Area of residence												
Urban	1.00		1.00		1.00		1.00		1.00		1.00	
Rural	1.21	0.90;1.62	1.03	0.74;1.44	0.95	0.70;1.28	0.72	0.55;0.94	0.76	0.56;1.02	0.76	0.58;1.00
Education level												
Primary	1.00		1.00		1.00		1.00		1.00		1.00	
Secondary	1.35	0.84;2.15	1.34	0.86;2.07	1.20	0.78;1.82	1.24	0.78;1.99	0.91	0.61;1.36	1.56	1.03;2.35
Secondary special or university	1.95	1.20;3.16	1.60	1.05;2.43	1.61	1.10;2.36	1.57	0.97;2.53	1.36	0.93;2.00	1.80	1.23;2.63
Income level												
Level 1 (low)	1.00		1.00		1.00		1.00		1.00		1.00	
Level 2	1.84	1.23;2.74	1.24	0.88;1.76	1.13	0.81;1.59	1.42	1.05;1.91	1.01	0.75;1.37	1.19	0.88;1.61
Level 3	2.36	1.56;3.58	2.01	1.25;3.22	1.21	0.76;1.92	1.61	1.13;2.30	1.75	1.12;2.76	1.11	0.73;1.68
Level 4 (high)	2.50	1.52;4.11	1.43	0.81;2.52	1.40	0.96;2.05	1.57	0.91;2.73	1.29	0.70;2.38	1.56	1.09;2.24

consumed daily. Variations by age were observed but they differed by country and sex.

The majority of the respondents (66% of Estonians, 60% of Lithuanians and 46% of Latvians) said that alcohol has a high energy content. In Estonia and Lithuania, women were more likely than men to say that alcohol was high in calories, while the reverse trend was observed (but only slightly) in Latvia.

Predictors of dietary beliefs related to dietary salt and types of fat

Table 2 shows the likelihood of believing that more dietary salt in the diet can have harmful health consequences by the levels of different demographic and socioeconomic characteristics. After adjusting for all other variables (taken simultaneously in the regression model), age was not a significant predictor of this belief except in Latvia where women aged 50 years and over were less likely to know about the possible harmful effects of salt than young women.

Variations by nationality were observed in each country. In Estonia and Lithuania, individuals of Russian and 'other' nationalities were less likely to know about the possible health effects of salt than Estonian and Lithuanian nationals, respectively; however, in Lithuania, significance was reached only for differences between 'other' nationalities and Lithuanian nationals. Conversely, in Latvia, men of 'other' nationalities were more likely to believe that more dietary salt can have health consequences compared with Latvian nationals. There was a small tendency (except in Lithuanian women) for people living in rural areas to believe that salt is inconsequential

Table 4 Proportion of respondents adding salt at the table by country, sex and age group

	Estonia				Latvia				Lithuania				
Group	*n*	Never (%)	If food is not salty enough (%)	Almost always before tasting (%)	*n*	Never (%)	If food is not salty enough (%)	Almost always before tasting (%)	*n*	Never (%)	If food is not salty enough (%)	Almost always before tasting (%)	*P* value*
All men	902	42.9	46.9	10.2	1062	22.4	64.1	13.5	986	37.0	52.8	10.1	<0.001
18–34 years	397	41.3	48.9	9.8	336	24.4	62.8	12.8	350	35.7	56.0	8.3	<0.001
35–49 years	320	40.9	46.9	12.2	369	20.9	63.4	15.7	360	34.7	52.8	12.5	<0.001
50+ years	185	49.7	42.7	7.6	357	22.1	66.1	11.8	276	41.7	48.9	9.4	<0.001
All women	1116	51.9	44.9	3.2	1232	40.8	47.6	11.6	1165	56.0	39.6	4.5	<0.001
18–34 years	459	45.5	51.0	3.5	339	40.1	53.4	6.5	359	52.7	43.2	4.2	0.007
35–49 years	376	53.5	43.9	2.7	396	40.7	48.0	11.4	410	54.4	40.7	4.9	<0.001
50+ years	281	60.1	36.3	3.6	497	41.5	43.3	15.3	396	60.6	35.1	4.3	<0.001

* *P* value for differences between countries based on chi-square tests.

Table 5 Type of fat used for cooking by country, sex and age group

	Estonia					Latvia					Lithuania					
Group	*n*	Butter	Marg.	Veg. oil	Animal fat/lard	*n*	Butter	Marg.	Veg. oil	Animal fat/lard	*n*	Butter	Marg.	Veg. oil	Animal fat/lard	*P* value*
All men	902	9.3	12.3	68.6	9.8	1060	5.9	9.8	72.9	11.4	987	6.2	8.1	50.8	35.0	<0.001
18–34 years	397	8.6	10.3	76.1	5.0	334	6.6	9.9	74.6	9.0	350	7.4	7.7	53.7	31.1	<0.001
35–49 years	320	11.9	13.1	62.8	12.2	369	8.7	9.5	72.9	8.9	361	5.5	6.9	52.9	34.6	<0.001
50+ years	185	6.5	15.1	62.7	15.7	357	2.2	10.1	71.4	16.3	276	5.4	10.1	44.2	40.2	<0.001
All women	1116	5.6	12.4	75.7	6.4	1232	4.0	7.0	81.9	7.1	1165	5.5	7.3	63.1	24.1	<0.001
18–34 years	459	6.1	13.3	77.1	3.5	341	7.6	5.9	79.8	6.7	358	5.6	5.9	67.0	21.5	<0.001
35–49 years	376	4.8	12.2	75.5	7.5	393	3.6	7.6	81.2	7.6	411	4.9	7.3	64.0	23.8	<0.001
50+ years	281	5.7	11.0	73.7	9.6	498	1.8	7.2	83.9	7.0	396	6.1	8.6	58.6	26.8	<0.001

Marg., margarine; veg., vegetable.
* *P* value for differences between countries based on chi-square tests.

for health compared with people living in urban areas. However, statistical significance was reached only in Lithuanian men and Estonian women. Education level was positively associated with the belief that salt can have some health consequences in men from each country (test for trend $P < 0.005$) and in Estonian and Lithuanian women (trend $P < 0.05$). Income also was positively associated with this belief, but only consistently in Latvian men (test for trend $P < 0.001$): men in the highest income category were more than twice as likely as men in the lowest one to believe more dietary salt to be harmful.

Table 3 shows demographic and socioeconomic correlates of the likelihood of believing that all fats do *not* give the same risk of various coronary diseases. Education level was the most consistent predictor. In each country, educational achievement was positively related to this belief (test for trend $P < 0.01$ in Estonia and Lithuania, $P < 0.05$ in Latvia). Income level was also positively related, particularly in Estonian men (*P* value for trend <0.001) and women ($P = 0.01$). In Latvia, respondents in the third income level category were significantly more likely than those in the lowest income category to know that all fats may not give the same coronary disease risk.

Variations in the odds of believing that all types of fat do *not* give the same risk of coronary disease were also observed by age and nationality, but few with area of residence. Age was inversely related to this likelihood in Estonians (test for trend $P < 0.01$), and individuals aged 50 years and over were significantly less likely to believe

Table 6 Likelihood of adding salt at the table (adjusted for all variables)

	Men						Women					
	Estonia		Latvia		Lithuania		Estonia		Latvia		Lithuania	
Variable	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Age group												
18–34 years	1.00		1.00		1.00		1.00		1.00		1.00	
35–49 years	1.11	0.81;1.51	1.42	0.97;2.10	0.99	0.72;1.38	0.71	0.53;0.94	1.09	0.80;1.50	0.88	0.66;1.19
50+ years	0.73	0.50;1.06	1.19	0.80;1.77	0.81	0.56;1.17	0.49	0.35;0.68	0.96	0.70;1.30	0.71	0.50;0.99
Nationality												
Estonian/Latvian/Lithuanian	1.00		1.00		1.00		1.00		1.00		1.00	
Russian	0.91	0.65;1.27	0.72	0.50;1.02	1.12	0.69;1.83	0.76	0.56;1.02	0.90	0.69;1.18	2.17	1.36;3.47
Other	1.23	0.67;2.26	0.64	0.39;1.05	1.21	0.70;2.09	0.76	0.46;1.26	0.59	0.39;0.88	2.42	1.44;4.07
Area of residence												
Urban	1.00		1.00		1.00		1.00		1.00		1.00	
Rural	0.96	0.72;1.27	1.62	1.10;2.39	0.94	0.69;1.28	0.93	0.71;1.23	1.30	0.98;1.71	1.21	0.92;1.60
Education level												
Primary	1.00		1.00		1.00		1.00		1.00		1.00	
Secondary	0.90	0.59;1.39	0.85	0.52;1.37	1.27	0.83;1.95	0.69	0.43;1.09	0.97	0.67;1.40	1.45	0.95;2.20
Secondary special or university	0.68	0.43;1.06	0.71	0.45;1.13	1.06	0.72;1.56	0.83	0.52;1.33	0.74	0.52;1.06	1.07	0.72;1.57
Income level												
Level 1 (Low)	1.00		1.00		1.00		1.00		1.00		1.00	
Level 2	1.06	0.73;1.53	0.71	0.49;1.04	1.05	0.74;1.48	0.90	0.66;1.21	0.87	0.66;1.15	0.95	0.70;1.29
Level 3	1.30	0.88;1.93	1.27	0.72;2.25	1.31	0.80;2.15	0.99	0.69;1.41	0.94	0.60;1.46	0.97	0.64;1.48
Level 4 (High)	1.35	0.83;2.18	0.63	0.35;1.15	0.99	0.67;1.46	1.02	0.58;1.79	0.82	0.45;1.48	1.03	0.72;1.45
Dietary salt is of no consequence for health												
Wrong	1.00		1.00		1.00		1.00		1.00		1.00	
Right	2.06	1.44;2.96	1.12	0.75;1.69	1.05	0.72;1.51	2.55	1.79;3.64	1.45	1.06;1.98	0.88	0.63;1.21
Don't know	1.87	1.20;2.92	0.86	0.56;1.32	1.44	0.97;2.13	3.07	1.93;4.88	1.28	0.84;1.97	1.26	0.81;1.95

Table 7 Likelihood of using lard or butter for cooking (adjusted for all variables)

	Men						Women					
	Estonia		Latvia		Lithuania		Estonia		Latvia		Lithuania	
Variable	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Age group												
18–34 years	1.00		1.00		1.00		1.00		1.00		1.00	
35–49 years	1.75	1.17;2.64	1.10	0.72;1.68	1.12	0.80;1.56	1.31	0.83;2.06	0.77	0.49;1.22	1.13	0.80;1.58
50+ years	1.54	0.93;2.54	1.15	0.74;1.78	1.24	0.85;1.81	1.24	0.73;2.08	0.55	0.34;0.89	1.14	0.78;1.66
Nationality												
Estonian/Latvian/Lithuanian	1.00		1.00		1.00		1.00		1.00		1.00	
Russian	2.60	1.75;3.88	1.68	1.13;2.48	0.86	0.52;1.41	2.16	1.41;3.31	1.08	0.70;1.66	1.38	0.83;2.29
Other	2.37	1.23;4.58	1.62	0.94;2.81	1.56	0.92;2.64	1.47	0.72;2.97	1.50	0.83;2.71	1.01	0.57;1.79
Area of residence												
Urban	1.00		1.00		1.00		1.00		1.00		1.00	
Rural	1.56	1.08;2.25	1.51	1.02;2.23	2.78	2.05;3.78	1.25	0.82;1.89	1.98	1.30;3.00	2.68	2.01;3.59
Education level												
Primary	1.00		1.00		1.00		1.00		1.00		1.00	
Secondary	0.50	0.30;0.81	0.82	0.50;1.35	0.69	0.45;1.06	0.44	0.25;0.79	0.62	0.35;1.09	0.91	0.58;1.43
Secondary special or university	0.52	0.31;0.87	1.00	0.62;1.60	0.68	0.46;1.01	0.41	0.22;0.76	0.98	0.58;1.65	0.95	0.63;1.44
Income level												
Level 1 (low)	1.00		1.00		1.00		1.00		1.00		1.00	
Level 2	0.49	0.31;0.78	0.79	0.53;1.19	0.92	0.65;1.30	0.60	0.37;0.95	0.69	0.44;1.06	0.76	0.54;1.05
Level 3	0.59	0.36;0.96	1.15	0.65;2.03	0.84	0.51;1.37	0.78	0.45;1.38	1.16	0.61;2.21	0.88	0.55;1.38
Level 4 (high)	0.97	0.53;1.76	1.56	0.84;2.89	0.97	0.65;1.44	1.86	0.90;3.84	1.24	0.54;2.87	0.65	0.43;0.96
All fats give the same risk of various coronary diseases												
Wrong	1.00		1.00		1.00		1.00		1.00		1.00	
Right	0.73	0.47;1.13	0.82	0.54;1.26	1.23	0.84;1.79	0.67	0.43;1.07	1.41	0.89;2.21	1.40	1.00;1.96
Don't know	1.05	0.67;1.64	0.81	0.53;1.24	1.49	1.08;2.04	0.96	0.58;1.58	1.20	0.72;2.00	1.15	0.82;1.62

that different types of fat can give different risks of coronary diseases than their younger counterparts (18–34 years).

The observed differences by nationality varied among countries. In Estonia, respondents of Russian nationality were more likely to believe that different types of fat can give different risks of coronary diseases than respondents of Estonian nationality; the reverse was true in Latvia. In Latvia and Lithuania, men of 'other' nationalities were less likely to have this belief than their counterparts of Latvian and Lithuanian nationality.

Use of salt at the table and type of fat used for cooking

The habit of using of salt at the table (if the food is not salty enough or almost always before tasting the foods) varied among countries (Table 4). Its prevalence was particularly high in Latvia compared with the other Baltic countries. Overall, in Latvia, 78% of men reported using salt at the table at least occasionally compared with 57% of men in Estonia and 63% in Lithuania. The corresponding figures for women were consistently lower: 59%, 48% and 44%, respectively. Overall, one in nine men and one in 16 women almost always used salt at the table before tasting the foods. Respondents aged 50 years and over were more likely to abstain from using salt at the table than younger respondents, except in Latvia. In this country, the men least likely to use salt at the table were aged 18–34 years.

In Estonia, 19% of the respondents reported using salt that contains additives. This was the case in only 5% of Latvians and Lithuanians. The types of salt with additives most commonly used were iodized salt and Pansalt (low sodium content) in Estonia, and iodized salt in Latvia and Lithuania.

In all three countries, oil was the type of fat most commonly used for cooking (Table 5). Oil was more frequently used in Latvia (78%) and Estonia (73%) than in Lithuania (57%), and more often by women than men in each country. Lithuanians were more than three times as likely as respondents from the other countries to use lard for cooking (Lithuania, 29%; Estonia, 8%; Latvia, 9%). Higher proportions of Estonians than Latvians and Lithuanians reported cooking with butter and margarine. In each country, men more frequently reported using animal fats (lard or butter) for cooking than women (26% vs 18%). In general, the use of oil decreased with age and that of lard increased with age except in Latvian women; in these women, the use of oil increased with age and few differences were observed for the use of lard.

Predictors of the likelihood of using salt at the table (if the food is not salty enough or always) are described in Table 6. This likelihood was inversely related to age in women from Estonia and Lithuania (P value for trend <0.05), but not in other groups. Variations by nationality were strongest among Lithuanian women: those of Russian or 'other' nationalities were more than twice as likely as women of Lithuanian nationality to add salt at the table at least occasionally. In Estonian men and women, there was an inverse relationship between the likelihood

of using salt at the table and educational achievement ($P < 0.05$). A similar trend was observed in Latvia but it did not reach statistical significance. Finally, in Estonia, respondents who thought that it is wrong to believe that more dietary salt in the diet is of no consequence to health were less likely than other respondents to add salt at the table.

Predictors of the likelihood of using lard or butter for cooking are shown in Table 7. When adjusting for all other variables included in the model, a few differences in this likelihood were observed by age and nationality. Age was positively related to the use of these types of fat in Estonian men (P value for trend = 0.04), but it was negatively related to their use in Latvian women ($P < 0.02$). Among Estonian men and women and among Latvian men, those of Russian nationality more often used animal fats for cooking than their counterparts of Estonian or Latvian nationality, respectively. Estonian men from 'other' nationalities were more than twice as likely as Estonian nationals to use butter and lard for cooking. Respondents in rural areas were generally more likely to use lard or butter for cooking than those in urban areas. In Estonia, education level was inversely related to the odds of using lard or butter for cooking; respondents having at least a secondary degree were approximately 40–60% less likely to use these types of fats for cooking than those with primary education. Income level was also associated with this likelihood in Estonian men: those in the second and third income categories less frequently reported using animal fats for cooking than men in the lowest income group. The belief that all types of fat give the same risk of various coronary diseases was not consistently associated with the use of lard or butter for cooking. Significant differences were observed only in Lithuania. Women who believed that all types of fat confer the same risk of coronary diseases and men who did not know whether this statement was true or false were 40–50% more likely to use animal fat for cooking than their counterparts who said that this statement was wrong.

Discussion

A fundamental assumption of many nutrition promotion programmes is that many individuals will adopt a healthy diet if they are given clear information. However, knowledge and beliefs are not the only determinants of behaviours – other factors such as the availability and cost of food, their taste, and other psychological and environmental barriers to choosing and using these foods may have more impact on food choices. Nevertheless, several studies have reported that beliefs and knowledge were positively related to dietary behaviours[12,13,21,22]. In a prospective study, Patterson *et al.* also reported that the belief of a connection between diet and cancer preceded healthy dietary changes[23].

In this study, we observed that more people knew about possible harmful effects of excess dietary salt than about the differential risks of various types of fat. More than two-thirds of the respondents answered the question about salt correctly. However, this proportion was lower in Latvia than in Estonia and Lithuania, a finding that agrees with the higher use of salt at the table among Latvians. The belief that all types of fat do not give the same risk of various coronary diseases was generally low: in Latvia, less than a third of the respondents answered this question correctly compared with 53% of the Lithuanians. This last observation is surprising as Lithuanians were at least three times as likely as other participants to use lard for cooking (29% vs 9%), and 23% less likely to use oil for cooking (58% vs 75%). It should be noted that this difference in use of lard was also found in the FinnBalt surveys, which reported that it was used by 24.5% of Lithuanians in 1996[7] compared with 8.2% of Latvians in 1998[24].

Socioeconomic status was an important predictor of dietary beliefs in the Baltic countries, an observation consistent with other studies[21,25]. In all groups of men and in Lithuanian women, higher educational achievement was associated with the belief that dietary salt may have possible harmful effects on health. We also observed that the belief that all types of fat do not give the same risk of various coronary heart diseases was positively related to education level and with income level in most groups of respondents. Variations in dietary beliefs by nationality and area of residence were also observed, but they tended to vary by country and sex.

Beliefs in the possible effects of dietary salt and types of fat were not consistently associated with healthier behaviours. In Estonia, men and women who believed that excess dietary salt is of *no* consequence for health and those who did not know if it is or not were about two to three times as likely as other respondents to add salt at the table, even after differences in education level and other demographic characteristics were taken into account. Elsewhere a similar significant finding was observed only in Latvian women: those who thought that salt does *not* influence health status were almost 50% more likely to use salt at the table than those who believed that it does.

Believing that different types of fat have different effects on the risk of coronary diseases was a poor predictor of the choice of fat used in food cooking. The likelihood of using lard or butter for cooking was increased significantly only in two groups of Lithuanian respondents: in men who did not know whether different types of fats provide the same risk of various coronary diseases and in women who believed that they do not. The generally high use of vegetable oil for cooking, particularly in Latvia and Lithuania, is thus probably related to other psychological and environmental factors, such as relative cost and increased availability.

The belief that meat is an essential component of an

everyday healthy diet was widespread in each Baltic country. This belief could lead to an overconsumption of meat, which could in turn lead to an intake of excess dietary saturated fat and protein. This phenomenon has been observed in Russia where the overconsumption of fat and protein in the form of meat and meat products remains high despite the price of these products[26]. This could be a legacy from the original high recommended daily intake in the Soviet Union in perpetuating a belief that high intakes of protein are necessary to maintain good health. As high animal protein diets are also likely to be high in fat, the perpetuation of this belief is of concern considering the high risk of obesity and cardiovascular diseases among the populations of the Baltic countries[27].

In contrast, potatoes have an important role in a healthy diet as they are a good source of complex carbohydrate, dietary fibre and vitamin C[28,29]. However, in Estonia, 57% of the population either believed these are fattening or did not know whether they are or not, and only 35% believed that potatoes are a good source of vitamin C (data not shown). Results from the 24-hour recall (data not shown) indicated that the median intake of potatoes was around 200–225 g day^{-1} in men and 125–150 g day^{-1} in women. Data from the Food and Agriculture Organization food balance sheet statistics suggest that potato availability over the 30-year period between the 1960s and 1990s fell by approximately 25%, to an average of around 200 g day^{-1} in 1991 in Europe[9]. Countries such as the Baltic states should thus be encouraged to increase or maintain their current levels of intake. Future information campaigns will need to address current popular beliefs.

Finally, we observed that the type of salt used by the participants in the surveys did not usually contain additives. When salt with additives was used, iodized salt was used less than 50% of the time in Estonia, 70% of the time in Latvia and 84% in Lithuania. Iodine deficiency remains one of the main nutritional deficiencies in Europe and survey data have suggested the presence of mild to moderate iodine deficiency disorders in Estonia and Lithuania, with a prevalence of goitre of 26–38% in Lithuania; in Latvia, data suggest that there is probably little or no iodine deficiency[30]. As the World Health Organization (WHO) recommends that salt intake be limited to 6 g day^{-1} in view of its link with hypertension and cardiovascular diseases[22], universal iodization should be promoted in the Baltic states to ensure that all salt used by food manufacturers (especially for the preparation of bread), the mass catering sector and households is iodized. In addition, the iodization of all animal fodder would ensure that iodine enters the human food chain via milk and milk products, while having the benefit of limiting the amount of salt consumed by the population. This approach would reduce current concerns regarding the quality of household and retail iodized salt, and would ensure that all the population have adequate iodine intakes, particularly lactating women and breast-fed infants. For example, in the UK and the Nordic countries, it has been reported that around 45–70% of the iodine intake in humans originates from milk and milk products[31,32].

Advantages and limitations of the study

The Baltic Nutrition and Health Surveys have the advantage of being based on samples of the general population of Estonia, Latvia and Lithuania, and their overall response rates were high. Their generalizability is thus an important strength. In addition, the interviews were made in the natural settings of the population, which is an additional advantage, and the response rate for each individual question in the surveys was high. However, the cross-sectional study design does not allow for inferences regarding cause and effect relationships. In addition, the study may have been affected by recall or reporting bias as the information is based on self-report; however, as the questions were generally non-stigmatizing, reporting bias should be small. One issue to be considered is the extent to which men, who often play little part in food preparation, would know about matters such as which types of fat are used in their home cooking. The survey was conducted mainly in peoples' homes so it was possible to seek clarification from other family members if they were unsure.

Finally, the surveys were not designed to specifically investigate food beliefs and thus the number of questions asked was limited.

Conclusions

In conclusion, we observed that several erroneous beliefs are prevalent in the Baltic countries, including the belief that more dietary salt is of no consequence to health, that all fats give the same risk of various coronary diseases, that meat is an essential component in an everyday healthy diet, and that bread and potatoes are fattening. Education level was an important determinant of beliefs related to salt and types of fat, more highly educated people being more likely to be familiar with these issues. However, positive beliefs were not consistent predictors of healthier food behaviours. Although the belief that too much dietary salt can have negative effects on health tended to predict less frequent use of salt at the table in Estonia, believing that all types of fat do not give the same coronary disease risk was a poor predictor of the type of fat used for cooking in most subgroups of respondents.

In-depth qualitative investigations are now needed to better describe and understand dietary beliefs and attitudes in the Baltic countries, and to identify barriers to the adoption of healthy food habits. Nutritionists and policy makers would benefit from this information when developing nutrition education activities designed to

change dietary habits and help prevent cardiovascular diseases in these countries.

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Alcohol consumption in the Baltic Republics

Martin McKee, Joceline Pomerleau, Aileen Robertson, Iveta Pudule, Daiga Grinberga, Kamelija Kadziauskiene, Algis Abaravicius, Sirje Vaask

Abstract

***Study objectives*—Premature mortality associated with alcohol intake is of particular concern in several countries of the former Soviet Union. This study explored self reported alcohol consumption (beer, wine, spirits) and its determinants in the Baltic Republics.**

***Design*—Cross sectional surveys conducted in 1997.**

***Settings*—Estonia, Latvia and Lithuania.**

***Participants*—Representative samples of adults age 19–64 (Estonia n=2010; Latvia n=2258; Lithuania n=2139).**

***Methods*—Between country differences in the frequency of alcohol intake were estimated. The odds of consuming alcohol weekly according to socioeconomic characteristics (age, ethnicity, rural/urban area, education, income) were calculated using multiple logistic regression analyses, adjusting for all variables simultaneously.**

***Main results*—The proportion of respondents consuming alcohol weekly varied by country (p<0.001) (men: Estonia=61% Latvia=41% Lithuania=55%; women: Estonia=26% Latvia=8% Lithuania=14%). Within each country, this proportion decreased with age in both sexes (p<0.001), and increased with income in women (p<0.01). In Estonia, the odds of drinking alcohol weekly was significantly lower in respondents of Russian than of Estonian ethnicity (odds ratios (OR) and 95% confidence intervals (95%CI): men=0.51 (0.36, 0.71); women=0.57 (0.39, 0.81)). In Lithuania, the odds was higher in highly educated men than in those with a low education level (OR=1.48 (1.01, 2.17)). Daily alcohol intake was higher in Estonia than in the other countries, as was the percentage of respondents drinking heavily (equivalent to 80 g/day).**

***Conclusions*—Approximately half the men and one in six women in the Baltic States reported consuming alcohol at least weekly. Age and income were the strongest and most consistent correlates of the likelihood of consuming alcohol weekly. Ethnic differences were observed only in Estonia.**

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European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, London WC1E 7HT
M McKee
J Pomerleau

WHO Regional Office for Europe, Denmark
A Robertson

Health Education Division, Health Promotion Centre, Riga, Latvia
I Pudule
D Grinberga

National Nutrition Centre, Vilnius, Lithuania
K Kadziauskiene

Department of Physiology and Biochemistry, Vilnius University, Vilnius, Lithuania
A Abaravicius

Public Health Department, Ministry of Social Affairs, Tallinn, Estonia
S Vaask

Correspondence to:
Professor McKee

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Alcohol is increasingly recognised as an important factor in the burden of premature mortality in all of the countries of central and eastern Europe, causing high death rates from, among others, injuries, cirrhosis, and heart disease. All of the republics in the European part of the former Soviet Union experienced marked improvements in life expectancy after the imposition of Gorbachev's anti-alcohol campaign in 1985.[1] There is now considerable evidence that these changes can be attributed to the reduction in traditionally extremely high rates of alcohol related death.[2 3]

However, these improvements were short lived and life expectancy in each of the Baltic Republics has fallen since 1989, accompanied by removal, or failure to enforce, controls on alcohol imports and production. Again, work in Russia, which has experienced similar, although greater changes, has confirmed the importance of alcohol in these events.[4]

Although only one measure of alcohol related mortality, rates of chronic liver disease and cirrhosis have the advantage of relative specificity, compared with other causes where the contribution of alcohol may be more variable, such as injuries, and can be used to give an idea of the scale of the problem. Between 1990 and 1995, age standardised death rates from chronic liver disease and cirrhosis doubled in Estonia and Latvia, and increased by 50% in Lithuania, although each country experienced a slight fall in 1996, the latest year for which comparable data are available.[5] These rates are, however, still almost double that seen in, for example, the United Kingdom.

Effective policy responses are required, which should, preferably, take account of information on how much is drunk and by whom. Unfortunately, there is a lack of such information in this region.

Official statistics on consumption are often derived from official sales data. However, this is of limited value in situations such as those in the Baltic Republics where there is extensive smuggling and illicit production. It has been estimated that 45% of alcohol consumed in Estonia is from illegal sources. The corresponding figure for Lithuania is 60–65%.[6] Furthermore, such data provide no information on the distribution of drinking within the population.

The alternative is to conduct surveys that identify who is drinking and that can indicate what are the socioeconomic determinants of drinking. This paper reports the results of three such surveys, undertaken among the populations of each of the three Baltic Republics.

Methods

Surveys were conducted in each country in June 1997. The principal focus of the surveys was on nutrition but, in addition, questions on alcohol consumption were included. Respondents were asked how often they drank spirits

Table 1 Characteristics of the study sample

	Men			*Women*		
Characteristics	*Estonia*	*Latvia*	*Lithuania*	*Estonia*	*Latvia*	*Lithuania*
Age group (y)						
19–34	44.1	31.8	35.8	41.4	28.3	31.0
35–49	35.5	35.2	36.5	33.9	32.8	35.2
50–64	20.4	33.1	27.8	24.7	39.0	33.9
(n)	(901)	(1055)	(979)	(1109)	(1203)	(1160)
Ethnicity						
Estonian	71.7			68.4		
Latvian		55.6			53.7	
Lithuanian			83.0			86.2
Russian	22.4	33.5	9.3	24.9	36.1	7.5
Other	5.9	10.9	7.7	6.7	10.2	6.3
(n)	(901)	(1055)	(979)	(1109)	(1202)	(1155)
Region of living						
Urban	60.7	65.7	65.8	70.6	67.2	67.6
Rural	39.3	34.3	34.2	29.4	32.8	32.4
(n)	(901)	(1055)	(979)	(1109)	(1203)	(1160)
Education						
Low	15.1	21.0	22.2	10.4	17.3	18.4
Medium	47.6	31.3	26.3	44.6	33.6	25.0
High	37.3	47.7	51.5	45.0	49.1	56.6
(n)	(901)	(1034)	(974)	(1109)	(1179)	(1153)
Income						
Level 1-lowest	24.6	34.9	40.3	30.8	38.5	36.5
Level 2	33.5	44.1	26.9	40.4	47.2	30.6
Level 3	28.2	12.9	11.1	22.8	9.5	11.9
Level 4-highest	13.7	8.1	21.7	6.0	4.8	21.0
(n)	(901)	(1006)	(903)	(1109)	(1169)	(1114)

(>22°proof), beer, or wine. Possible responses were daily, 2–3 times per week, once per week, 2–3 times per month, a few times per year, and never. Eleven respondents from Latvia and 11 from Lithuania were excluded from the analyses because they did not provide information on their usual intake of spirits, beer or wine. For the purposes of analysis, people were categorised as drinking at least weekly or less often.

Respondents were also asked how much of specified measures they had consumed in the preceding week. These were: spirits (50 ml measures), wine (100 ml glasses) and beer (500 ml bottles). These were converted to grams of alcohol, summed, and divided by seven to give the mean daily consumption.

The survey sought to include 3000 persons who were representative of the national population aged between 19 and 64 years (20 and 64 in Lithuania). In each country, the sampling frames were the National Population Registers. All interviews were conducted in the person's own homes during the summer of 1997. Interviews were conducted in both the national language of the country concerned and in Russian.

In Estonia, a simple random sample was drawn from the register. Interviewers did not return to a house if there was no reply and substitution was allowed if the response rate in the county in question was less than 60 per cent, which happened in seven of the 15 counties. Overall less than 5% of people were substituted. Interviews were conducted by public health specialists, nutritionists and people with previous interviewing experience. Each attended a one day initial training session. The response rate was 67.3%.

In Latvia, two stage sampling was used, with the first stage selecting a sample for each of the 26 regions of Latvia according to population size. In the second stage, a random sample within the strata was selected. The exception was for the city of Riga, were there appeared to be problems with the population register data, with a disproportionate number of people registered in with ages over 60. Consequently, in Riga, the second stage sample was also stratified by age group. Interviewers were recruited from the regional environmental health centres. Substitution was not permitted and interviewers would return to an address up to five times. Each received interviewer received training. The response rate was 77.7%.

In Lithuania a sample of 3000 names was drawn at random from those people listed on the National Population Register who were living at addresses in Lithuania and were aged between 20 and 65. Interviewers were mainly assistants working in hygiene stations, who underwent an initial training session. In most cases the interviewers returned to an address on multiple occasions if they were unable to find the subject. There was no substitution. The response rate was 74.1%.

Most of the variables analysed are self explanatory. Education levels were divided into three categories. Low includes those with only primary level education. Medium includes those who have completed secondary education. High includes those who have completed specialist secondary or university education. The income variable relates to family income. In each country it was divided into four categories based on national criteria for the poverty level, with the poorest category considered to be living in severe poverty.

Data were analysed using the statistical package STATA (version 5.0; College Station, Texas). Between country variations in the proportion of respondents consuming alcohol at least once a week and in the proportion of heavy drinkers were assessed using χ^2 tests. Differences in mean daily alcohol intake were estimated using analysis of variance (with Bonferroni multiple comparison tests). Age adjusted proportions were calculated as the values predicted by the logistic regression model with age held at its mean value. The odds of consuming alcohol weekly according sociodemographic characteristics were estimated using multiple logistic regression analyses with adjustment age only and for all the

Table 2 Frequency (%) of drinking each type of beverage

		Estonia		*Latvia*		*Lithuania*	
		Men	*Women*	*Men*	*Women*	*Men*	*Women*
Spirits	daily	2.8	0.3	0.5	0.3	0.9	0.1
	2–3 times per week	8.2	1.8	8.1	1.1	6.8	0.8
	once per week	17.4	7.2	8.1	1.1	13.8	1.8
	2–3 times per month	36.4	25.0	40.9	17.7	38.8	15.3
	several times per year	23.9	43.3	31.7	52.3	31.8	57.7
	never	11.3	22.5	10.9	27.4	8.0	24.3
Beer	daily	12.6	1.5	3.6	0.0	7.5	0.1
	2–3 times per week	21.0	4.9	9.9	3.4	24.9	3.2
	once per week	15.5	9.2	19.4	1.0	16.3	5.7
	2–3 times per month	18.6	12.6	24.8	9.5	22.0	13.1
	several times per year	11.2	19.5	20.1	26.7	13.4	25.7
	never	21.1	52.2	22.1	59.3	15.9	52.2
Wine	daily	0.8	0.4	0.0	0.2	0.3	0.3
	2–3 times per week	3.1	2.5	2.2	1.2	3.8	1.9
	once per week	5.7	6.6	1.5	1.4	5.5	4.5
	several times per month	16.0	20.8	17.2	29.4	16.0	17.4
	several times per year	43.8	47.5	29.3	36.8	33.8	47.3
	never	30.7	22.1	49.8	31.0	40.6	28.6

Table 3 Proportion of respondents consuming alcoholic beverages at least once a week, by gender, country and age group

Type of alcohol and age group (y)	Men			Women		
	Estonia %	*Latvia %*	*Lithuania %*	*Estonia %*	*Latvia %*	*Lithuania %*
Any type of alcohol						
All	60.5	41.3	55.3***	25.5	8.2	14.1***
19–34	66.0	45.1	64.9***	35.3	13.5	20.3***
35–49	63.4	47.4	56.6***	26.6	8.9	15.2***
50–64	43.5	31.2	41.2**	7.7	3.8	7.1*
Beer						
All	49.2	33.2	48.4***	15.8	4.6	9.0***
19–34	59.2	38.8	61.4***	23.1	6.5	13.4***
35–49	47.2	35.0	48.7***	16.5	5.6	9.1***
50–64	31.0	25.8	31.3	2.6	2.4	4.8
Wine						
All	9.5	3.7	9.7***	9.7	2.9	6.6***
19–34	11.1	3.3	10.6***	13.1	6.8	10.9*
35–49	9.7	4.3	12.0**	11.2	1.5	6.1***
50–64	6.0	3.4	5.5	1.8	1.3	3.3
Spirits						
All	28.4	16.6	21.3***	9.3	2.7	2.6***
19–34	27.2	14.0	20.6***	10.9	4.1	1.7***
35–49	31.3	22.1	25.5*	10.6	3.6	3.4***
50–64	26.1	13.2	16.5***	4.7	0.9	2.5**

*Significant variations among countries within the gender specific age group, p<0.05; **p<0.01; ***p<0.001.

variables taken simultaneously. Because of their skewed distribution, values of daily alcohol intake were $\log_e$ transformed before testing for significance; transformed values were returned to their original units in the results section. As sex is a strong determinant of drinking rates, results were analysed separately for men and women.

Results

Table 1 shows the sociodemographic characteristics of the samples.

Table 2 shows the frequency with which each type of alcohol is drunk. Very few people drink alcohol daily. The only group for whom this is at all common is male beer drinkers in Estonia. Many people who are not normally wine or spirit drinkers will do so a few times per year.

KEY POINTS

- Alcohol has played an important part in changing mortality patterns in the Baltic Republics in recent years.
- Although the three countries are superficially similar, there are important differences in patterns of alcohol consumption.
- Levels of consumption among the Russian populations in each country vary considerable and, in Estonia and Lithuania, differ significantly from that of the majority population.
- The three Baltic Republics, while sharing some similarities, also exhibit important differences.

The proportion of people consuming alcohol every week varied by country (table 3), with, for both sexes, the highest rates found in Estonia, followed by Lithuania, and then Latvia. For both men and women, consumption declined with age. This was especially marked among women, where the proportion of those aged 50–64 drinking weekly was between a third and a fifth of that among those aged 19–34.

The commonest beverage, among both men and women and in all three countries, is beer, followed by spirits among men and wine among women (table 3). However, many men regularly consume more than one type of beverage, most often combining beer and spirits (fig 1).

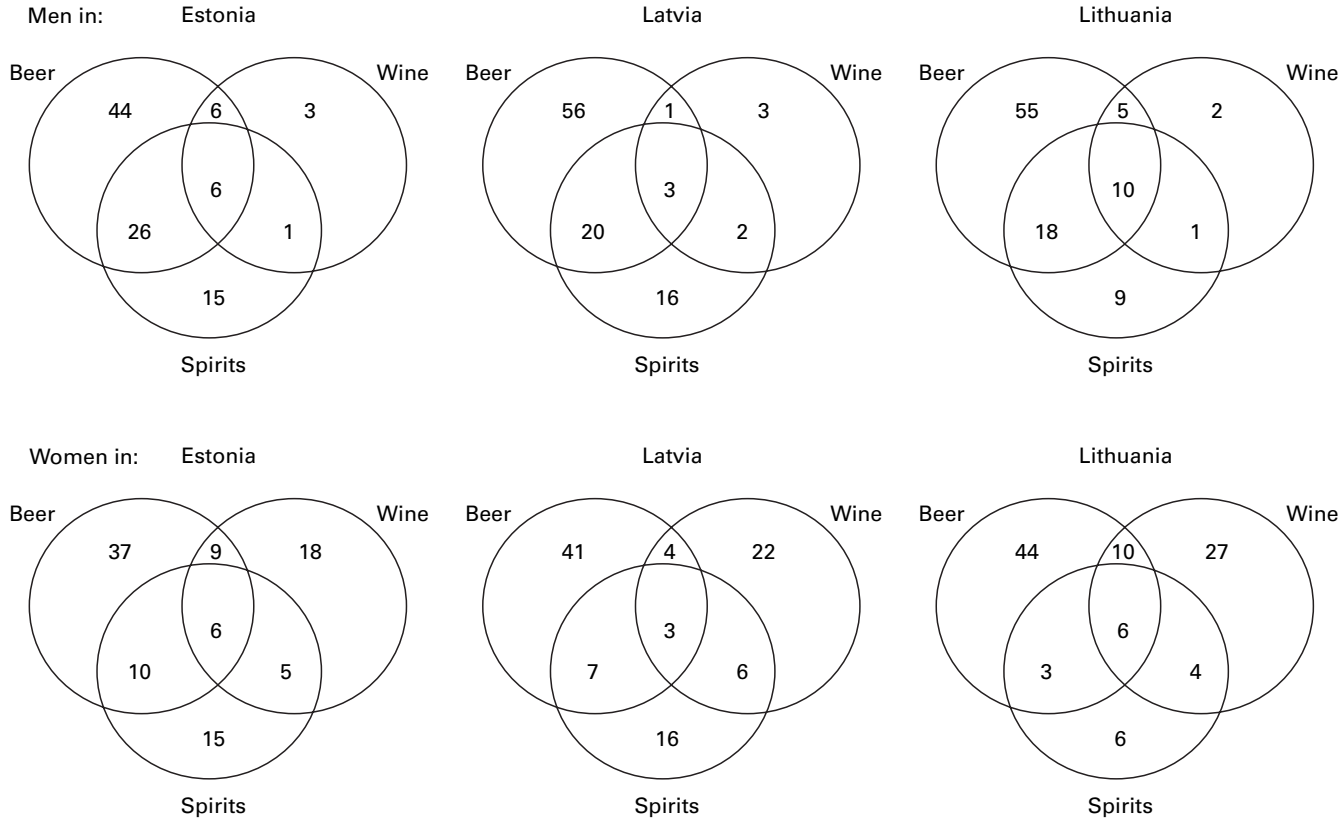

Figure 1 Proportion (%) of respondents consuming beer, wine and spirits at least once a week, singly and in combination, by country and gender.

Table 4 Age adjusted proportion of respondents consuming different types of alcohol at least once a week by gender, country and nationality

Type of alcohol and ethnic group	Men			Women		
	Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
All drinks						
Estonian	64.9			26.9		
Latvian		41.2			7.1	
Lithuanian			53.1			12.1
Russian	51.2**	40.4	69.4**	17.1**	8.4	24.4**
Other	46.3**	43.9	64.0	13.5*	4.7	12.5
Beer						
Estonian	53.1			16.7		
Latvian		32.1			4.4	
Lithuanian			46.5			8.1
Russian	38.9**	33.0	58.5*	7.6***	4.2	11.9
Other	38.7	37.7	54.6	7.4	3.2	6.2
Wine						
Estonian	11.2			10.0		
Latvian		3.1			1.6	
Lithuanian			8.6			4.9
Russian	4.4**	5.1	17.7**	5.6*	3.6*	14.9***
Other	5.7	2.6	10.7	4.4	0.7	7.1
Spirits						
Estonian	29.0			9.3		
Latvian		16.6			2.5	
Lithuanian			19.4			2.1
Russian	26.2	16.1	28.7*	9.3	2.6	7.0**
Other	30.1	17.6	32.1	4.4	0.8	4.1

*Different from Estonian ethnicity (for Estonia), Latvian ethnicity (for Latvia) or Lithuanian ethnicity (for Lithuania), p<0.05; **p<0.01; ***p<0.001.

Each of the countries is heterogeneous in terms of nationality, with large Russian minorities in Estonia and Latvia and, to a lesser extent in Lithuania. Lithuania also has significant Polish, Ukrainian and Belarussian populations. Examination by nationality in each of the countries, after adjusting for age, produces a mixed picture (table 4). In Estonia, among both men and women, Estonians are more likely to drink weekly than are Russians, although the gap is wider for beer and wine than for spirits. In Latvia, there is very little difference between Latvians and Russians. In Lithuania, Russians are more likely to drink than are Lithuanians, with the other groups occupying an intermediate position. There are also considerable differences in the rates among Russians in each of the three countries and there is no consistent relation to the overall rates of consumption in each country.

Associations with age, nationality, area of residence, education and income were explored in a model in which odds ratios within categories of each variable were fully adjusted for all of the variables (table 5). In each country, for both sexes, increasing age was strongly associated with a lower likelihood of consuming alcohol weekly (p value for trend <0.001). Differences associated with nationality in Estonia and in Lithuanian men remained significant, showing that they could not be accounted for factors such as income or education. Among men, analysis by education showed a mixed picture, with no difference in Estonia, a

Table 5 Odds ratios (OR) for the likelihood of consuming alcoholic beverages at least once a week, by country and gender

	Estonia				Latvia				Lithuania			
	Adjusted for age		Adjusted for all variables		Adjusted for age		Adjusted for all variables		Adjusted for age		Adjusted for all variables	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Men												
Age (y)												
19–34	1.00		1.00		1.00		1.00		1.00		1.00	
35–49	0.89	0.66 ; 1.22	0.91	0.66 ; 1.25	1.04	0.77 ; 1.42	1.09	0.80 ; 1.50	**0.70**	0.51 ; 0.97	**0.69**	0.50 ; 0.95
50–64	**0.40**	0.28 ; 0.57	**0.37**	0.25 ; 0.54	**0.53**	0.38 ; 0.73	**0.52**	0.36 ; 0.73	**0.37**	0.26 ; 0.52	**0.41**	0.28 ; 0.59
Nationality												
Native*	1.00		1.00		1.00		1.00		1.00		1.00	
Russian	**0.53**	0.38 ; 0.74	**0.51**	0.36 ; 0.71	0.93	0.70 ; 1.23	0.87	0.64 ; 1.18	1.51	0.93 ; 2.46	1.54	0.94 ; 2.51
Other	**0.45**	0.25 ; 0.79	**0.43**	0.24 ; 0.77	1.09	0.72 ; 1.67	0.95	0.61 ; 1.47	**1.72**	1.01 ; 2.93	**1.77**	1.03 ; 3.05
Area												
Urban	1.00		1.00		1.00		1.00		1.00		1.00	
Rural	1.10	0.83 ; 1.45	1.07	0.80 ; 1.42	**0.76**	0.58 ; 1.00	0.80	0.59 ; 1.09	0.84	0.63 ; 1.11	0.95	0.70 ; 1.29
Education level												
Low	1.00		1.00		1.00		1.00		1.00		1.00	
Medium	1.04	0.69 ; 1.57	0.96	0.62 ; 1.47	**0.64**	0.44 ; 0.93	**0.59**	0.40 ; 0.87	1.40	0.93 ; 2.12	1.35	0.88 ; 2.05
High	1.08	0.71 ; 1.64	0.97	0.62 ; 1.52	0.90	0.64 ; 1.28	0.77	0.53 ; 1.11	**1.61**	1.12 ; 2.31	**1.48**	1.01 ; 2.17
Income level												
Very low	1.00		1.00		1.00		1.00		1.00		1.00	
Low	0.85	0.59 ; 1.22	0.75	0.51 ; 1.10	1.10	0.82 ; 1.49	1.09	0.80 ; 1.49	0.83	0.60 ; 1.16	0.79	0.56 ; 1.11
Medium	0.72	0.49 ; 1.05	0.67	0.45 ; 1.00	**1.95**	1.28 ; 2.96	**1.88**	1.20 ; 2.95	0.95	0.61 ; 1.50	0.82	0.51 ; 1.31
High	0.98	0.61 ; 1.57	0.85	0.52 ; 1.41	1.55	0.94 ; 2.53	1.48	0.88 ; 2.49	**1.70**	1.18 ; 2.46	**1.52**	1.02 ; 2.27
Women												
Age (y)												
19–34	1.00		1.00		1.00		1.00		1.00		1.00	
35–49	**0.66**	0.49 ; 0.90	**0.67**	0.49 ; 0.91	0.66	0.41 ; 1.07	0.67	0.41 ; 1.12	**0.67**	0.46 ; 0.99	0.62	0.41 ; 0.93
50–64	**0.15**	0.09 ; 0.25	**0.18**	0.11 ; 0.29	**0.23**	0.13 ; 0.43	**0.25**	0.13 ; 0.47	**0.30**	0.19 ; 0.49	**0.32**	0.19 ; 0.55
Nationality												
Native*	1.00		1.00		1.00		1.00		1.00		1.00	
Russian	**0.55**	0.39 ; 0.78	**0.57**	0.39 ; 0.81	1.07	0.68 ; 1.71	1.00	0.61 ; 1.65	**2.38**	1.38 ; 4.09	2.34	1.32 ; 4.14
Other	**0.40**	0.19 ; 0.84	**0.40**	0.19 ; 0.85	0.67	0.28 ; 1.60	0.59	0.24 ; 1.45	0.93	0.43 ; 2.01	0.95	0.43 ; 2.09
Area												
Urban	1.00		1.00		1.00		1.00		1.00		1.00	
Rural	1.05	0.77 ; 1.44	1.04	0.76 ; 1.44	0.73	0.45 ; 1.18	0.98	0.57 ; 1.69	**0.52**	0.34 ; 0.79	0.70	0.44 ; 1.10
Education level												
Low	1.00		1.00		1.00		1.00		1.00		1.00	
Medium	1.48	0.76 ; 2.89	1.10	0.55 ; 2.19	1.13	0.49 ; 2.61	1.04	0.44 ; 2.44	0.78	0.38 ; 1.62	0.62	0.30 ; 1.30
High	**1.95**	1.00 ; 3.78	1.31	0.65 ; 2.64	2.00	0.92 ; 4.35	1.58	0.71 ; 3.52	1.58	0.83 ; 2.98	1.07	0.55 ; 2.08
Income level												
Very low	1.00		1.00		1.00		1.00		1.00		1.00	
Low	0.99	0.69 ; 1.41	0.90	0.63 ; 1.30	1.31	0.77 ; 2.24	1.20	0.68 ; 2.11	1.14	0.69 ; 1.88	1.03	0.62 ; 1.72
Medium	1.45	0.99 ; 2.14	1.31	0.87 ; 1.96	**2.42**	1.20 ; 4.88	**2.15**	1.03 ; 4.47	**1.90**	1.05 ; 3.45	1.54	0.83 ; 2.85
High	**2.48**	1.41 ; 4.34	**2.33**	1.31 ; 4.15	**6.12**	2.94 ; 12.72	**5.33**	2.44 ; 11.61	**3.65**	2.32 ; 5.74	**3.07**	1.90 ; 4.96

*Native designates Estonians in Estonia, Latvians in Latvia and Lithuanians in Lithuania respectively.

Table 6 Mean daily alcohol intake (grams of alcohol) during the previous week and proportion of heavy drinkers (>80 g/d) by country, gender and age

	Estonia				*Latvia*				*Lithuania*			
	n	*Mean (SD) g/d*	*Geometric mean*	*>80 g/d %*	*n*	*Mean (SD) g/d*	*Geometric mean*	*>80 g/d %*	*n*	*Mean (SD) g/d*	*Geometric mean*	*>80 g/d %*
All respondents												
Men												
All	901	29 (42)	2.1	9.3	1055	15 (23)	0.5[a]	2.7	978	18 (24)	1.2[b,c]	2.5[d]
19–34	397	29 (43)	2.7	8.8	335	16 (25)	1.0[a]	3.6	350	20 (22)	2.4[c]	2.6[d]
35–49	320	33 (46)	3.8	11.9	371	16 (22)	0.8[a]	2.4	357	20 (28)	1.7[b]	2.8[d]
50–64	184	20 (31)	0.5	6.0	349	13 (22)	0.3	2.0	271	14 (20)	0.3	1.9[e]
Women												
All	1109	6 (12)	0.1	0.5	1203	3 (7)	0.02[a]	0.2	1159	3 (7)	0.04[a,f]	0.2
19–34	459	7 (14)	0.1	0.9	340	4 (8)	0.1[b]	0.0	359	4 (6)	0.1	0.0[e]
35–49	376	6 (12)	0.1	0.5	394	4 (9)	0.0[b]	0.5	407	3 (6)	0.0	0.0
50–64	274	3 (8)	0.0	0.0	469	2 (4)	0.01[b]	0.0	393	3 (8)	0.0	0.5
Respondents who consumed alcohol during the previous week												
Men												
All	694	37 (45)	21.1	12.1	693	22 (25)	14.6[a]	4.0	711	25 (25)	17.0[a,f]	3.4[d]
19–34	315	37 (46)	21.6	11.1	224	23 (27)	14.8[a]	5.4	279	25 (22)	17.1[b]	3.2[d]
35–49	263	40 (48)	22.4	14.4	258	23 (24)	15.9[a]	3.5	271	27 (29)	17.4[b]	3.7[d]
50–64	116	31 (35)	17.4	9.5	211	21 (25)	13.1[b]	3.3	161	23 (21)	16.1	3.1[e]
Women												
All	523	13 (15)	8.0	1.1	426	8 (10)	5.6[a]	5.6	483	8 (9)	5.6[a]	0.4
19–34	246	13 (16)	8.4	1.6	159	9 (10)	5.7[a]	0.0	186	7 (6)	5.5[a]	0.0
35–49	189	13 (14)	8.2	1.1	159	9 (13)	6.0[b]	1.3	181	7 (7)	2.0[a]	0.0
50–64	88	10 (12)	6.3	0.0	108	7 (7)	5.0	0.0	116	9 (13)	6.1	1.7

[a]Different from Estonia, p<0.001; [b]Different from Estonia, p<0.05; [c]Different from Latvia, p<0.001; [d]Variations among countries for the proportion of heavy drinkers, p<0.001; [e]Variations among countries for the proportion of heavy drinkers, p<005; [f]Different from Latvia, p<0.05.

higher frequency of drinking among those with the highest level of education compared with the lowest in Lithuania, and a lower rate among those with middle level education than those with the lowest category in Latvia. Among women, a higher consumption rate among women with higher education in Estonia failed to reach significance in the fully adjusted model.

In Latvia and Lithuania, the odds of consuming alcohol at least once a week tended to be higher among men in higher income categories; however, the gradient was much more marked among women from each country (p value for trend <0.005), with those in the highest income categories between twice and five times as likely to drink as those in the lowest category. The gradient was especially marked in Latvia.

Turning to the amount drunk, the mean daily consumption, in grams, is shown in table 6, as is the percentage of heavy drinkers (respondents drinking greater than 80 g/day). Mean daily consumption was lower in Latvia than in the other countries, with Lithuania being in an intermediate position below Estonia. The percentage of heavy drinkers is much higher in Estonia than in the other countries, at almost one in 10 men. Heavy drinking is rare among women in all countries. Considering only those who reported drinking in the previous week, amounts drunk, as well as the percentage who drink heavily, are very much lower among women than men in all of the countries.

Discussion

Before discussing the results, the limitations of the survey must be considered. Although the overall sample was relatively large, the small size of certain groups reduced the power to detect significant differences. However, the major weakness was that, because the survey was primarily designed to obtain data on nutrition rather than on alcohol consumption, the questions on drinking were rather basic and did not include any of the standard instruments to detect problem drinking or to generate a quantity/frequency matrix. Consequently, these surveys do not provide information on pattern of drinking and, in particular, binge drinking, a phenomenon that is increasingly being recognised as important in this region.[7] None the less, the surveys do provide information against which future trends can be measured.

All surveys of alcohol consumption are notoriously problematic.[8] Difficulties include inaccurate categorisation of alcohol intake as people underestimate or distort their consumption.[9] However, in countries such as these, where heavy drinking is common it may be that there is less social stigma about admitting to it. Importantly, where it is possible to make direct comparisons, these data are very similar to those from the FinnBalt surveys on health behaviour,[10 11] undertaken at intervals since 1990 in all three countries. The only differences are a slightly higher frequency of beer drinking among Estonian men and a lower frequency of spirit drinking among Lithuanian women in this survey.

With these caveats, several observations can be made. In each country, most men drink regularly. Among women, drinking is less common in each country but there is also a marked decline with age, so that less than one in 12 women aged over 50 drinks regularly. In general, higher education and income are associated with a greater probability of drinking.

Although the three countries are frequently considered together, in view of their shared recent history, there are marked differences between them. Perhaps the most surprising finding is that the relations between rates in the majority population and the Russian minorities are so variable, and that the rates in the Russian populations in each country vary so much. The finding that urban-rural and educational and income differences are much

greater in Lithuania than in Estonia is consistent with data on patterns of smoking.[12] Lithuania still has a very large, and quite traditional, rural agricultural sector whereas many Estonians living in rural areas work in towns and cities.

These data indicate that alcohol should be a concern for public health in this region, with almost one in 10 Estonian men drinking at a level that equates to 80 g per day. This level is associated with a greatly increased risk of many of the manifestations of physical harm attributable to drinking.[13] This is very much higher than in the other two countries, although even there the rates among younger men are approximately one in 30. However, the absence of data on pattern of drinking means that this may underestimate the harmful effects and, on the basis of data from a comparable, but more detailed survey from Russia, there may be many more people who, while recording only moderate weekly consumption, may be drinking huge quantities during a single episode.[14]

Although, at an aggregate level, it is impossible to assess the impact of particular factors to the patterns recorded, it may be helpful, when interpreting these data, to take account of changes in policies related to alcohol. In the period 1989 to 1994, it is reported that prices of beer and wine increased in real terms in Estonia, with the price of spirits remaining stable. In Lithuania, prices of all types of alcohol increased, whereas in Latvia they all decreased.

These findings must, however, be interpreted in the light of the earlier comments on the scale of smuggling and illicit production. Estonia bans advertising of alcohol on television and radio but a ban on advertising in print media and on billboards only covers wine. Lithuania has a general ban on advertising of spirits and wine but no restriction on beer. The legal restrictions in Latvia are confined to the capital, Riga. In each country, however, enforcement varies. In Latvia, there have been discussions on hypothecation of taxes on alcohol for prevention and treatment of alcoholism.

Evidence of the adverse health effects of high levels of alcohol consumption in the three Baltic Republics has been apparent for some time. These surveys now provide some information that will help create integrated, intersectoral policies to tackle them, although clearly much more detailed research is needed to understand the reasons why people drink heavily and the context in which they do so.

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Patterns of body weight in the Baltic Republics

Joceline Pomerleau[1], Iveta Pudule[2], Daiga Grinberga[2], Kamelija Kadziauskiene[3], Algis Abaravicius[4], Roma Bartkeviciute[3], Sirje Vaask[5], Aileen Robertson[6] and Martin McKee[7,*]

[1]European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK: [2]Health Education Division, Health Promotion Centre, Skolas 3, LV-1010 Riga, Latvia: [3]National Nutrition Centre, Kalvariju str. 153, 2042 Vilnius, Lithuania: [4]Faculty of Medicine, Department of Physiology and Biochemistry, Vilnius University, Ciurlionio str. 21/27, 2009 Vilnius, Lithuania: [5]Public Health Department, Ministry of Social Affairs, Gonsiori str. 29, EE0100 Tallinn, Estonia: [6]WHO Regional Officer for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark: [7]European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK

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Abstract

Objective: Previously recorded rates of obesity in the Baltic Republics have been among the highest in the world although little is known about how they vary within the population. This study investigates the distribution of body mass index (BMI) and obesity in these countries.

Design: Three cross-sectional surveys conducted in the summer of 1997.

Setting: Estonia, Latvia and Lithuania.

Subjects: Representative national samples of adults with measured weight and height (Estonia: $n = 1154$; Latvia: $n = 2292$; Lithuania: $n = 2096$).

Results: Between-country differences are particularly large among women: women from Latvia and Lithuania are approximately three times as likely to be obese as those from Estonia (17.4%, 18.3%, 6.0% respectively); only about one-third of this difference is explained by the sociodemographic and behavioural factors studied. In men, the prevalence of obesity varied only slightly among countries (Estonia: 9.9%; Latvia: 9.5%; Lithuania: 11.4%). While the prevalence of obesity increases with age within each republic, particularly in women, it is not associated with nationality or urban/rural region, and no consistent association is observed with income. Obesity is inversely related to education in Latvia and in Lithuanian women. Latvian men and women and Lithuanian men who smoked had a lower prevalence of obesity than non-smokers. Leisure time physical activity was not associated with obesity.

Conclusions: Obesity is a major health problem in the Baltic Republics, particularly among Latvian and Lithuanian women. The lack of association between obesity and most demographic, socioeconomic and behavioural factors suggests that the problem is generalized. Health promotion strategies aiming at preventing and controlling excess weight gain in the Baltic Republics will need to target the general population.

Keywords
Obesity
Diet
Latvia
Lithuania
Estonia

There is now a large volume of evidence showing that obesity is strongly associated with rates of total mortality, with those having a BMI greater than $30\,kg\,m^{-2}$ (the standard definition of obesity) typically experiencing a relative risk of death that is more than double that of people of average weight[1–3]. Obesity is associated specifically with a range of common non-communicable diseases, such as hypertension[4], cardiovascular disease[5,6], stroke[7], certain cancers[8,9] and diabetes mellitus[10,11].

Obesity is an issue of particular concern in the Baltic Republics and in other parts of the former Soviet Union, where data from multinational surveys have found rates that are among the highest in the world. For example, data from the WHO MONICA study, collected between 1983 and 1988, placed the five centres in the former Soviet Union among the top six positions of 48 centres world-wide in terms of female obesity, with Kaunas in Lithuania occupying the highest position[12]. Among men the position of the former Soviet centres was not so bad, although here Kaunas ranked third overall.

These countries also have extremely high levels of many of the diseases associated with obesity. For example, the age-standardized death rates per 10 000 people from ischaemic heart disease in 1994 were 410 in Estonia, 406 in Latvia and 397 in Lithuania, which contrast with the European Union average of 117[13]. However, while overall

*Corresponding author: Email m.mckee@lshtm.ac.uk

rates have been described, an effectively targeted public health strategy requires more detailed information, such as the distribution of obesity within the population. In this paper we describe the results of three surveys that address this question and that were undertaken in the Baltic Republics in 1997.

Methods

Surveys were conducted in each country during the summer of 1997. Each survey sought to include a representative sample of the national population aged between 19 and 64 years (19–65 in Lithuania). In each country, the sampling frames were the National Population Registers. All interviews were conducted in the individuals' own homes in the national language or in Russian.

In Estonia, a simple random sample of 3000 individuals, stratified by age, was drawn from the register. Interviewers did not return to a house if there was no reply. Substitution was allowed if the response rate in the county in question was less than 60%. Overall, less than 5% of individuals, in seven counties, were substituted. Interviews were conducted by public health specialists, nutritionists and individuals with previous interviewing experience. Each attended a 1 day initial training session. The response rate was 67.3% and the final sample size was 2108.

In Latvia, two-stage sampling was used to draw a sample of 3000 persons from the National Population Register. The first sampling stage selected a sample for each of the 26 regions in Latvia according to population size. In the second stage, random samples within strata were selected. The exception was for the city of Riga, where there appeared to be problems with the population register data, with a disproportionate number of people registered with ages over 60. Consequently, in Riga, the second stage sample was also stratified by age group. Interviewers were recruited from the regional environmental health centres. Substitution was not permitted and interviewers would return to an address up to five times. Each interviewer received training. The response rate was 77.7% and the final sample was 2331.

In Lithuania, a sample of 3000 names was drawn at random from those individuals listed on the National Population Register who were living at addresses in Lithuania and who were aged between 20 and 65. Interviewers were mainly assistants working in hygiene stations, who underwent an initial training session. In most cases the interviewers returned to an address on multiple occasions if they were unable to find the subject. There was no substitution. The response rate was 72.7% and the final sample size included 2182 respondents.

The proportion of men and women in the final samples was similar to that found in the general adult population of each country based on *Statistical Yearbook* data (1997 for Estonia and Latvia, and early 1998 for Lithuania – data available upon request). However, in Estonia, the respondents tended to be slightly younger than the general adult population; in Latvia and Lithuania they were slightly older. The distribution of the study groups by area of residence and nationality compared favourably with those of the general population.

Interviews included three parts: a 24-hour recall of dietary intake, the administration of a standardized questionnaire, and the measurement of height and weight. Results from the 24-hour recall are not described in this paper. The interviewer-administered questionnaire was developed and agreed by all countries. It was translated by professional translators from English into Estonian, Latvian, Lithuanian and Russian. Each country used the same Russian version of the questionnaire. The questionnaire covered demographic and socioeconomic characteristics (sex, age, nationality, educational achievement, income), health behaviours (cigarette smoking, physical activity level at work and during leisure time), selected dietary habits (e.g. vegetable intake, type of water used, etc.) and dietary beliefs. Respondents were also asked about their height without shoes and their weight without clothes or shoes. Nationality was classified as that of the native population, Russian or 'other'; the latter essentially equated to Ukrainian or Belarussian, or, in Lithuania, to Polish. The income variable related to average income per family member per month. In each country, it was divided into four categories based on selected national criteria for the poverty level, with the lowest category considered to be living in severe poverty. In Estonia, the cut-off point used for this lowest category was equivalent to the 'minimum basket for living' in 1997 ($<$US\$75 person^{-1} month^{-1}). In Latvia and Lithuania, as salaries are lower than in Estonia, a cut-off point of $<$US\$50 person^{-1} month^{-1} was selected.

Measurements of height and weight were performed by the interviewers according to standardized procedures, with respondents without shoes in light clothing. Body mass index (BMI) was calculated as the weight in kilograms divided by the height in metres squared. Patterns of body weight described in this paper are based on measured height and weight. Standard definitions of relative body-weight status were used (underweight: BMI $< 18.5\,kg\,m^{-2}$; normal: BMI 18.5–24.9; overweight: BMI 25–29.9; obese BMI $\geqslant 30$)[14].

In this study, we excluded pregnant women and respondents who did not have their height and weight measured. The numbers of male and female respondents in Latvia and Lithuania (Table 1) allowed a relative precision of between 15% and 28% ($\alpha = 0.05$) for prevalence estimates between 5% and 15% in men and women[15]. However, the precision level decreased in the case of Estonia where a large proportion of respondents did not have their height and weight measured.

Data were analysed using the statistical package STATA version 5.0 (College Station, Texas). Between-country

Table 1 Unadjusted mean BMI and relative body-weight status by country, sex and age group

	Estonia							Latvia							Lithuania						
		BMI							BMI							BMI					
	n	Mean (SD)	GM	Under-weight (%)	Normal weight (%)	Over-weight (%)	Obese (%)	*n*	Mean (SD)	GM	Under-weight (%)	Normal weight (%)	Over-weight (%)	Obese (%)	*n*	Mean (SD)	GM	Under-weight (%)	Normal weight (%)	Over-weight (%)	Obese (%)
Men																					
All	525	25.1 (3.7)	24.8	1.3	56.8	32.0	9.9	1062	25.5 (3.7)	25.2	0.9	48.7	41.0	9.5	966	25.8 (3.8)	25.6*	0.4	46.3	41.9	11.4†
19–34 years	258	24.5 (3.8)	24.2	1.9	62.8	27.1	8.1	335	24.2 (3.0)	24.0	0.6	65.7	30.2	3.6	345	24.8 (3.3)	24.6	0.6	59.4	33.9	6.1
35–49 years	174	25.5 (3.5)	25.3	1.2	52.9	35.1	10.9	368	25.8 (3.7)	25.6	0.5	44.8	44.3	10.3	352	26.1 (3.8)	25.8	0.3	41.8	45.5	12.5
50+ years	93	25.9 (3.5)	25.6	0.0	47.3	39.8	12.9	359	26.4 (4.0)	26.1	1.4	36.8	47.6	14.2	269	26.8 (4.1)	26.5	0.4	35.3	47.6	16.7
Women																					
All	629	23.3 (4.1)	23.0	7.3	62.8	23.9	6.0	1230	25.8 (4.9)	25.3*	2.7	46.9	33.0	17.4	1130	25.9 (5.4)	25.4*	3.7	45.3	32.7	18.3†
19–34 years	305	21.5 (2.9)	21.3	12.8	75.7	10.2	1.3	338	22.7 (4.0)	22.4*	6.8	75.7	13.0	4.4	348	23.2 (4.6)	22.9*	8.1	67.0	18.7	6.3†
35–49 years	196	24.2 (4.2)	23.8	3.6	59.2	30.1	7.1	394	25.3 (4.2)	25.0*	1.5	52.0	34.3	12.2	403	25.7 (4.6)	25.3*	3.5	44.9	36.2	15.4†
50+ years	128	26.3 (4.0)	26.1	0.0	37.5	46.9	15.6	498	28.2 (4.8)	27.9*	0.8	23.9	45.6	30.3	379	28.7 (5.6)	28.2*	0.0	25.9	41.7	32.5†

GM, geometric mean.
*Significantly different ($P < 0.005$) from Estonia, using analysis of variance and Bonferroni multiple comparison tests.
†Significant variations ($P < 0.01$) in body-weight status distribution among countries, using chi-square tests.

differences in unadjusted mean BMI and in the distribution of respondents by body-weight status were assessed using analyses of variance (with Bonferroni multiple comparison tests) and chi-square tests. As age and sex were strong determinants of obesity, the results were adjusted for age and they were presented separately for men and women. Age-adjusted means and proportions were calculated as the values predicted by the regression model with age held at its mean value. The odds of being obese according to a range of sociodemographic and behavioural variables were calculated using multiple logistic regression analyses with adjustment for all of the other variables. Log_e-transformed values of BMI were used in the statistical analyses so that the skewness of the regression residuals was close to zero; transformed values were returned to their original units in the results section.

Results

The unadjusted mean BMIs and distribution of respondents by body-weight status are shown in Table 1. In each republic, the unadjusted mean BMI and prevalence of obesity increase with age. The increase in the prevalence of obesity is particularly striking in women: in Estonia, the prevalence is 12 times higher in women aged 50 years and over than in women less than 35 years old, in Latvia it is six times higher, and in Lithuania it is five times higher. In men, the prevalence of obesity increases with age by more than 50% in Estonia, it more than triples in Latvia and it more than doubles in Lithuania.

Among men, mean BMI is slightly higher in Lithuania and Latvia than in Estonia although the difference is only significant when all age groups are combined. Among women, there is rather more diversity. In all age groups, mean BMI is significantly higher in Latvia and in Lithuania than in Estonia. While there are relatively small differences in the distribution of BMI values in men (Fig. 1), the distribution of the whole population is shifted to the right in women from Latvia compared with women from Estonia, and it is shifted slightly further to the right in women from Lithuania (Fig. 2).

When the combined prevalence of overweight and obese people (BMI $\geqslant 25\,\mathrm{kg\,m^{-2}}$) is examined, over 40% of men from Estonia and more than half the male respondents from Latvia and Lithuania have an excess weight. This is the case in 30% of women from Estonia, in 50% of those from Latvia and in 51% of those from Lithuania. Excess weight is particularly prevalent in women aged 50 years and over in Latvia and Lithuania, three-quarters of them being overweight or obese. There are rather more obese men among the over fifties in Lithuania than in the other countries. Among women, the proportion who are obese in Latvia and Lithuania is almost three times that in Estonia. The difference is especially marked in women aged under 35, with over four times as

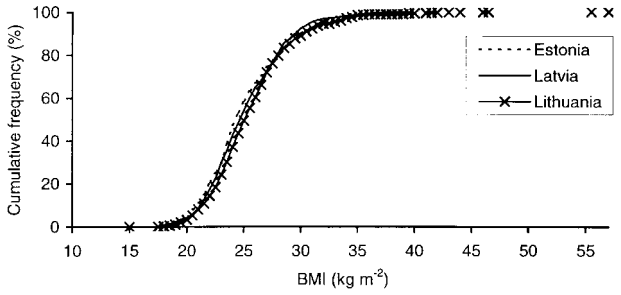

Fig. 1 Age-standardized cumulative frequency distribution of body mass index (BMI) by country in men

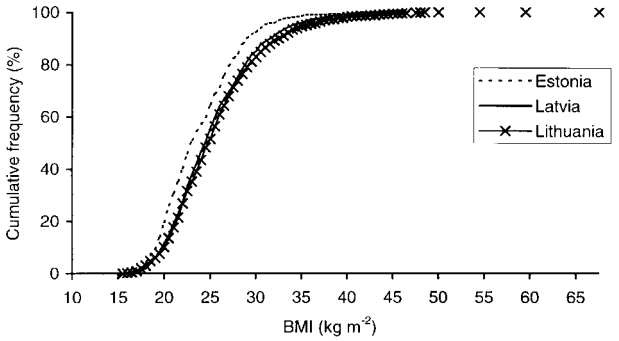

Fig. 2 Age-standardized cumulative frequency distribution of body mass index (BMI) by country in women

many women in Lithuania being obese compared with those in Estonia. Within each country, there were no clear differences between nationalities (Table 2), except for Russian men living in Latvia and Lithuania who were significantly less likely to be obese than Russian men living in Estonia ($P < 0.05$).

Table 3 shows the age-adjusted prevalence of obesity and the odds ratios for the likelihood of being obese in each country in relation to a range of sociodemographic variables. Consistent with the results in Table 2, there is no clear relationship with nationality in either men or women. In Latvia and Lithuania there is a clear increase in the likelihood of obesity with age in men (test for trend: $P < 0.01$) and a suggestion that this is also the case in Estonia although the difference does not reach statistical significance. In women, the odds of obesity increases significantly with age in all three countries (test for trend: $P < 0.001$). There is no significant urban–rural difference in men and women and no consistent pattern with income. However, in Latvia, women in the highest income group are more than twice as likely to be obese than those in the lowest income group, and in Estonia, women in the third income category are eight times less likely to be obese than those in the lowest income group. In Latvia, men with a secondary education or university degree are significantly less likely to be obese than men with lower education levels. In women, the likelihood of obesity is inversely related to educational achievement in both Latvia and Lithuania (test for trend: $P < 0.05$); in Estonia, there is a tendency for women with higher educational achievement to be less obese than women having only primary level education but the differences do not reach statistical significance. In Latvia and Lithuania, men who are current smokers are less than half as likely as non-smokers to be obese. A similar finding is observed in women from Latvia. In Lithuania, the likelihood of obesity is inversely related to the level of physical activity at work in men (test for trend: $P = 0.008$); men engaged in sedentary work are twice as likely to be obese as those in semisedentary or moderate/heavy work. There is no consistent pattern with leisure-time physical activity in either men or women. However, there appears to be a non-significant inverse relationship between leisure-time physical activity and obesity in Estonia.

Forward regression analyses were performed to

Table 2 Age-adjusted BMI and prevalence of obesity by country, sex and ethnicity

	Estonia			Latvia			Lithuania		
	n	Mean BMI ($kg\,m^{-2}$)	Obesity (%)	*n*	Mean BMI ($kg\,m^{-2}$)	Obesity (%)	*n*	Mean BMI ($kg\,m^{-2}$)	Obesity (%)
Men									
Estonian	455	24.8	9.0						
Latvian				593	25.2	8.1			
Lithuanian							802	25.6	11.7
Russian	62	24.9	14.7	356	25.3	7.6	89	25.3	6.2
Others	8	24.8	14.0	113	25.3	13.0	75	25.3	6.0
Women									
Estonian	531	22.9	3.3						
Latvian				664	25.4	14.5			
Lithuanian							965	25.5	15.9
Russian	75	23.2	5.1	439	25.2	12.0	88	25.1	12.1
Others	23	23.4	10.4	126	25.8	16.6	15	25.5	10.5

Table 3a Age-adjusted prevalence of obesity and adjusted* odds ratios (OR) for the likelihood of being obese, by country, in men

	Estonia				Latvia				Lithuania			
			Adjusted* odds of obesity				Adjusted* odds of obesity				Adjusted* odds of obesity	
Varable	*n*	Obesity (%)	OR	95%CI	*n*	Obesity (%)	OR	95%CI	*n*	Obesity (%)	OR	95%CI
Nationality												
Estonian	455	9.0	1.00		555	8.5	1.00		707	11.5	1.00	
Russian	62	14.7	1.83	0.80–4.20	323	7.8	1.04	0.61–1.78	73	7.6	0.64	0.26–1.56
Other	8	14.0	1.92	0.20–18.32	106	12.9	1.42	0.75–2.69	64	4.3	0.38	0.11–1.24
Age group												
< 35 years	258	8.1	1.00		307	3.6	1.00		295	6.1	1.00	
35–49 years	174	10.9	1.30	0.66–2.57	338	10.4	3.17	1.55–6.47	314	12.1	2.43	1.33–4.44
50+ years	93	12.9	1.92	0.84–4.36	339	15.0	3.74	1.83–7.64	235	16.2	2.42	1.27–4.60
Region												
Urban	336	10.2	1.00		637	8.5	1.00		558	11.5	1.00	
Rural	189	8.9	1.04	0.55–1.99	347	9.2	1.18	0.71–1.97	286	8.9	0.81	0.48–1.37
Education												
Primary	52	3.2	1.00		212	12.8	1.00		189	10.2	1.00	
Secondary	250	10.7	3.47	0.76–15.98	310	5.3	0.35	0.19–0.67	213	10.5	0.96	0.49–1.91
University†	223	10.2	2.99	0.65–13.82	462	9.3	0.57	0.33–0.98	442	10.9	0.87	0.46–1.61
Income												
Level 1 (lowest)	108	9.6	1.00		341	8.1	1.00		333	9.8	1.00	
Level 2	202	9.6	0.89	0.40–2.00	439	8.0	1.07	0.63–1.83	229	9.5	0.79	0.44–1.42
Level 3	147	7.6	0.73	0.29–1.85	125	9.1	1.41	0.63–3.12	97	11.6	1.02	0.47–2.18
Level 4 (highest)	68	14.9	1.56	0.58–4.20	79	14.9	1.96	0.85–4.54	185	13.1	1.07	0.56–2.02
Smoking												
Non-smoking	184	12.1	1.00		327	13.4	1.00		291	16.3	1.00	
Current smoker	341	8.5	0.65	0.35–1.21	657	6.5	0.43	0.27–0.67	553	7.7	0.42	0.26–0.66
Work activity												
Sedentary	166	12.3	1.00		167	6.7	1.00		150	17.1	1.00	
Semisedentary	156	12.1	1.04	0.52–2.08	353	9.3	1.57	0.79–3.12	280	10.8	0.54	0.30–0.97
Moderate/heavy	203	5.8	0.53	0.25–1.14	464	9.0	1.51	0.77–2.99	414	8.2	0.43	0.24–0.78
Leisure-time physical activity												
Sedentary	261	11.9	1.00		522	7.8	1.00		540	10.8	1.00	
Moderate	149	8.0	0.69	0.33–1.45	275	8.1	0.92	0.54–1.57	128	8.3	0.57	0.28–1.16
High	115	7.0	0.54	0.23–1.27	187	12.2	1.39	0.79–2.47	176	11.8	0.93	0.53–1.62

*Odds ratio are adjusted for all the other variables in the multivariate logistic regression analysis.
†University and secondary special.

Table 3b Age-adjusted prevalence of obesity and adjusted* odds ratios (OR) for the likelihood of being obese, by country, in women

	Estonia				Latvia				Lithuania			
			Adjusted* odds of obesity				Adjusted* odds of obesity				Adjusted* odds of obesity	
Variable	*n*	Obesity (%)	OR	95%CI	*n*	Obesity (%)	OR	95%CI	*n*	Obesity (%)	OR	95%CI
Nationality												
Estonian	531	3.3	1.00		624	14.5	1.00		881	14.8	1.00	
Russian	75	5.1	1.03	0.33–3.20	413	12.0	0.83	0.57–1.19	77	13.1	0.85	0.42–1.69
Other	23	10.4	2.87	0.76–10.84	121	17.1	1.06	0.63–1.80	64	10.2	0.62	0.28–1.37
Age group												
< 35 years	305	1.3	1.00		314	4.1	1.00		320	5.6	1.00	
35–49 years	196	7.1	5.63	1.75–18.13	372	12.6	3.41	1.79–6.49	369	15.2	3.07	1.75–5.37
50+ years	128	15.6	10.54	3.14–35.35	472	30.5	7.47	4.06–13.73	333	31.2	6.22	3.49–11.08
Region												
Urban	447	3.5	1.00		775	13.7	1.00		694	13.0	1.00	
Rural	182	4.3	1.26	0.58–2.74	383	14.2	0.83	0.57–1.22	328	17.5	1.26	0.86–1.86
Education												
Primary	39	8.5	1.00		213	22.8	1.00		177	20.1	1.00	
Secondary	282	3.9	0.40	0.15–1.09	376	12.0	0.41	0.26–0.64	250	15.4	0.63	0.37–1.07
University†	308	3.2	0.38	0.13–1.07	569	12.4	0.41	0.27–0.62	595	12.6	0.54	0.33–0.88
Income												
Level 1 (lowest)	163	4.9	1.00		441	14.8	1.00		370	17.4	1.00	
Level 2	282	4.6	1.01	0.47–2.16	555	12.9	1.02	0.70–1.47	316	14.6	0.91	0.61–1.38
Level 3	145	0.5	0.12	0.01–0.97	108	10.1	0.82	0.41–1.63	123	12.4	0.76	0.42–1.37
Level 4 (highest)	39	5.8	1.28	0.25–6.59	54	23.5	2.30	1.08–4.88	213	10.3	0.65	0.37–1.12
Smoking												
Non-smoking	367	3.3	1.00		923	15.0	1.00		846	13.5	1.00	
Current smoker	262	4.3	1.08	0.49–2.36	235	9.9	0.52	0.31–0.87	176	18.5	1.40	0.86–2.30
Work activity												
Sedentary	254	4.1	1.00		265	15.2	1.00		263	13.5	1.00	
Semisedentary	253	2.2	0.53	0.21–1.33	669	13.0	0.78	0.52–1.15	526	15.5	1.03	0.66–1.60
Moderate/heavy	122	6.7	1.65	0.65–4.24	224	14.9	0.86	0.52–1.43	233	12.8	0.70	0.41–1.20
Leisure-time physical activity												
Sedentary	212	5.4	1.00		584	15.5	1.00		578	14.3	1.00	
Moderate	311	2.6	0.52	0.23–1.19	386	12.5	0.78	0.53–1.15	219	11.5	0.79	0.49–1.27
High	106	3.6	0.49	0.15–1.66	188	11.8	0.66	0.40–1.11	225	17.3	1.29	0.85–1.95

*Odds ratios are adjusted for all the other variables in the multivariate logistic regression analysis.
†University and secondary special.

Table 4 Odds ratios for the likelihood of being obese in women from Latvia and Lithuania compared with women from Estonia

Variables included in the multiple regression model*	Country	OR	95%CI
	Estonia	1.00	
	Latvia	3.33	2.32–4.77
	Lithuania	3.28	2.28–4.73
Age	Estonia	1.00	
	Latvia	2.31	1.59–3.36
	Lithuania	2.60	1.79–3.80
Age + Education	Estonia	1.00	
	Latvia	2.18	1.50–3.17
	Lithuania	2.38	1.62–3.48
Age + Education + Leisure-time physical activity	Estonia	1.00	
	Latvia	2.10	1.44–3.06
	Lithuania	2.24	1.52–3.30
Age + Education + Leisure-time physical activity + Income	Estonia	1.00	
	Latvia	2.02	1.38–2.95
	Lithuania	2.20	1.48–3.25

*Factors were included in the model using a stepwise approach using $P < 0.25$. Factors were selected among: age, region (urban/rural), education level, income level, current smoking, work activity and leisure-time physical activity.

investigate whether between-country differences in the prevalence of obesity in women could be explained by selected sociodemographic factors and health behaviours (Table 4). When variations in age, educational achievement, leisure-time physical activity level and income status are taken into account, the difference in the odds of being obese between Estonia and Latvia decreases by 39% and the difference between Estonia and Lithuania by 33%. However, the differences remain significant.

Discussion

For the first time, these data provide evidence about the distribution of body weight in national samples in the Baltic Republics. The proportion of women in Lithuania who are obese is lower than in the earlier MONICA sample. This could conceivably be due to differences in sampling and it cannot be assumed that the difference is due to a real change. The rates for men in the two studies are broadly comparable.

The present study demonstrates a general shift to the right in the distribution of BMI in women from Latvia and Lithuania compared with women from Estonia, and corresponding higher rates of obesity. In contrast, rates of obesity in Estonia, at least among young women, compare favourably with those in countries such as Sweden[16] and the Netherlands[17], although even here there are no grounds for complacency. The difference in the prevalence of obesity between women from Estonia and those from Latvia and Lithuania could not be explained entirely by the sociodemographic and behavioural factors investigated in this study. Only approximately one-third of the difference is explained by variations in age, educational achievement, leisure-time physical activity level and income status, and the odds of being obese remain twice as high in Latvia and Lithuania than in Estonia after adjusting for these variables.

Within each country, the prevalence of obesity does not vary significantly with ethnicity. Furthermore, contrary to findings reported by other researchers[18], there is no consistent variation in the odds of being obese according to demographic and socioeconomic characteristics, suggesting that the problem affects most population subgroups in the Baltic Republics. The only exception is for the inverse relationship between education level and the likelihood of obesity in women (although not significant in women from Estonia) and in men from Latvia.

In accordance with findings from other investigators[18–20], smoking is associated with a lower prevalence of obesity in some respondents, that is, men and women from Latvia, men from Lithuania, and a suggestion that this is also the case in men from Estonia. However, the odds of being obese is seldom related to physical activity level at work or during leisure time[20–22]. This lack of association could be related to the fact that the questionnaires used in the surveys included only general questions on physical activities. More detailed assessment of physical activity level in men and women from the Baltic Republics will be necessary for the development of effective strategies for the prevention of obesity.

The steady increase in mean BMI and in the prevalence of obesity with age in all three countries suggests that the underlying effects of weight gain with age could accentuate the risks of cardiovascular diseases in the Baltic states. It also suggests that obesity prevention in young adults should be a primary goal in health promotion strategies in order to prevent weight gain with ageing.

In conclusion, this study suggests that obesity is a major health problem in the Baltic Republics, particularly among women in Latvia and Lithuania. The lack of association observed between obesity and most demographic, socioeconomic and behavioural factors studied suggests that the problem is more generalized than expected and that health promotion strategies aiming at preventing and

controlling excess weight gain in each Baltic Republic will need to target the population as a whole. A more complete exploration of the correlates of obesity in the Baltic Republic, including more precise assessments of modifiable lifestyle behaviours such as physical activity and dietary intake, would contribute not only to understanding the determinants of obesity in these countries but also to defining what strategies are most likely to be effective in preventing and reducing obesity in each republic. Finally, the establishment of national surveillance systems of obesity in the Baltic Republics would facilitate the planning of preventive and obesity management programmes in order to prevent any upward trend in the prevalence of obesity in these countries.

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NorBaGreen uuring: tervisliku toitumise indikaatoritena käsitletavate toidurühmade tarbimine Eestis

Sirje Vaask – Tallinna Tehnikaülikooli toiduainete instituut

tervislik toitumine, tarbimisharjumused, toidusoovitused

Puu- ja köögiviljade, marjade, leiva ja kala tarbimist on rahvusvahelised eksperdid soovitanud jälgida kui tervisliku toitumise indikaatoreid. NorBaGreen projekti eesmärgiks oli saada võrreldavad andmed Põhja- ja Baltimaade tervisliku toitumise indikaatoritena käsitletavate toidurühmade tarbimissageduse kohta ning töötada välja valideeritud metoodika tarbimise seireks. Igast riigist osales ligikaudu tuhat täiskasvanut vanuses 15–74 aastat. Võrreldes varasemate uuringutega on Eesti inimeste toitumine muutunud tervislikumaks, eelkõige kõrgema hariduse ja suurema sissetulekuga inimeste hulgas.

Hinnanguliselt on ligi kolmandikul südame-veresoonkonnahaigused seotud tasakaalustamata toitumisega. Epidemioloogilised uuringud on tõendanud, et puu- ja köögiviljade kasutamine toidus vähendab südame-veresoonkonnahaiguste tekke riski (1). Euroliidu (EL) projekt EFCOSUM on välja toonud eurooplaste toitumise tähtsamad tegurid, millele tuleb tähelepanu pöörata kroonilise haiguste ennetamisel ja toitumisharjumuste seirel. Jälgida tuleb köögiviljade, puuviljade, leiva, kala, küllastatud rasvade, samuti kogu rasva (% toiduenergiast) ja etanooli (g/päevas) hulka. Teisteks toitumise indikaatoriteks, mida käsitletakse biomarkeritena, on folaadid, jood, raud, naatrium ja D-vitamiin (2). Puu- ja köögiviljade soodus mõju organismile on tingitud nende antioksüdantsest aktiivsest toimest immuunsüsteemi stimuleerivate ensüümide, kolesterooli ja steroidhormoonide ainevahetusele, vererõhku alandavatest ja ka antibakteriaalsetest omadustest (1). Leiva soodsat toimet organismile seostatakse eelkõige täisteratoodete kiudainete sisaldusega, vere kolesterooli, eriti LDL-kolesterooli alandavate ja ka antioksüdantsete omadustega (3). Kalas sisalduvate oomega-3-rasvhapetega ja oluliste vitamiinide (D-vitamiin) ning mineraalainete ja mikroelementide sisalduse (jood ja seleenium) tõttu peetakse seda vajalikuks ainevahetuse tasakaalustamiseks. Oomega-3-rasvhapped suurendavad HDL2 kolesterooli sisaldust ja vähendavad lipoproteiinide kontsentratsiooni organismis, parandavad endoteeli funktsiooni ja arterite elastsust (4). Arvestades EFCOSUM projektis toodud soovitusi, seatigi NorBaGreeni projekti eesmärgiks saada võrreldavad andmed Põhja- ja Baltimaade elanike köögiviljade, kartuli, puuviljade, marjade, leiva ja kala tarbimise kohta toidus ning ühtlasi töötada välja metoodika tervisliku toitumise indikaatoritena käsitletavate toidurühmade (köögiviljade, puuviljade, leiva ja kala) tarbimise seireks. Uuringut koordineeris Soome Kansanterveyslaitos (5). 2002. aastal korraldatud uuringu tulemusel oli Eesti puu- ja köögiviljade tarbimise osas kõige halvemal positsioonil Põhja- ja Baltimaade seas. Sellest lähtuvalt alustati Eestis 2003. aastast puu- ja köögiviljade tarbimise edendamise projektiga. Projekti tulemuslikkuse hindamiseks tehti Eestis 2004. aasta kevadel NorBaGreeni uuringu lühendatud küsimustikuga kordusuuring.

Käesoleva töö **eesmärgiks** on hinnata Eesti inimeste köögiviljade, puuviljade, leiva ja kala tarbimist võrreldes Põhja- ja Baltimaadega, samuti erinevate elanikkonna rühmadega. Uuringu andmed ja võrdlus teiste maadega on publitseeritud ja kättesaadavad aadressilt www.norden.org/pub/velfaerd/livsmedel/sk/TN2003556.asp.

Tabel 1. Erinevate toidurühmade keskmine tarbimissagedus päevas aastal 2002 (köögiviljad, kartul, puuviljad/marjad ja kala (korda päevas), leib (viilu päevas))

	Köögiviljad, kokku	Puuviljad/ marjad, kokku	Kartulid, kokku	Kala, kokku	Leib, kokku
Soome (n = 1009)	1,1	1,0	0,8	0,2	4,7
Rootsi (n = 1005)	1,3	1,2	0,6	0,2	3,7
Norra (n = 1000)	0,9	1,0	0,6	0,3	4,6
Taani (n = 999)	0,9	0,9	0,6	0,2	3,6
Island (n = 1002)	0,8	0,7	0,8	0,3	2,6
Eesti (n = 996)	0,7	0,6	0,9	0,2	4,7
Läti (n = 1060)	1,2	0,7	0,9	0,3	5,0
Leedu (n = 1076)	1,1	0,7	0,9	0,2	4,4

Uurimismaterjal ja -meetodid

NorBaGreeni 2002. aasta uuringus võrreldi toitumisharjumusi kokku 8397 inimesel kaheksas riigis: Taani, Soome, Island, Norra, Rootsi, Eesti, Läti ja Leedu. Uuringus osales igast riigist ligikaudu tuhat inimest vanuses 15–74 aastat (Rootsis ja Taanis vanuses 16–80). Valimis arvestati sugu, vanust ja elukohta. Baltimaades koguti andmed intervjuumeetodil (*Paper Assisted Personal Interviews*), Skandinaavia maades telefoniintervjuu meetodil (*Computer Assisted Telephone Interviews*). Intervjuud korraldasid kõigis riikides 2002. aasta aprilli ja maikuu jooksul professionaalsed uuringufirmad. Eestis tegi intervjuud ES Turu-Uuringute AS.

Kasutatud küsimustik põhineb Nordgrönti rühma väljatöötatud erinevate toiduainete tarbimise sagedusküsimustikul (*Food Frequency Questionnaire*), mida kohandati ja testiti kõigis osalenud riikides. Küsimustik valideeriti Soomes, Leedus ja osaliselt ka Rootsis. Küsitletutel paluti hinnata valitud toidurühmade keskmist tarbimist möödunud aasta jooksul. Puu- ja köögiviljade ning marjade, kartuli ja kala uuringus hinnati tarbimise ühikuna üht portsjonit. Puuviljade ja marjade hulka ei arvestatud suhkruga valmistatud puuvilja- ja marjakeediseid ega marmelaade. Puu- ja köögiviljade, kartuli ja kala toidurühmades küsiti ka nende toiduainete erinevate valmistusviiside eelistusi. Leiva tarbimissageduse ühikuks kasutati viilu. Küsimused leiva kohta rühmitati kiudainesisalduse alusel kolmeks, et tagada riikidevaheline võrreldavus: suure (üle 6 g / 100 g või 3 g/viil, edaspidi *rukkileib*), keskmise (3–6 g / 100 g või 1,5–3 g / viil, edaspidi *sepik*) ja vähese (alla 3 g / 100 g või alla 1,5 g/viil, edaspidi *sai*) kiudainesisaldusega leivad. Eestis eristati leibade kiudainesisaldus nende keemilise koostise tabelite (6) ja tootja info alusel.

Uuringu andmete tegelikkusele vastavuse võrdlemiseks toimusid valideerimisuuringud National FINDIET 2002 Study raames ja Leedus (n = 99) CINDI Health Monitor Study raames. Viimased teostati 2 korral 6–8kuuse vahega, et hõlmata erinevaid aastaaegu (Soome: jaanuar-mai/ oktdets; Leedu: mai-juuni / august-sept). erinevate toiduainete tarbimissagedus, mille määramiseks kasutati Soomes ja Leedus erinevat meetodit, jagati faktoriga 5 ja 7,5 ning esitati tarbimissagedusena ühe kuu kohta (5).

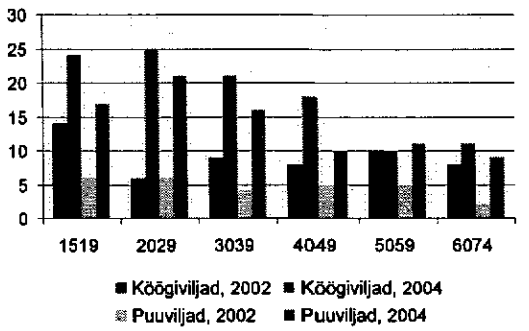
Kordusuuring 2004. aasta aprillis tehti ainult Eestis, kusjuures kasutati lühendatud küsimustikku iga toidurühma (v.a kartul) kohta. Ka kordusuuringu intervjuud tegi ES Turu-Uuringute AS.

Tulemuste analüüs toimus, arvestades 95% usaldusvahemikku ning sugu, vanust ja elukohta. Keskmine tarbimine kuus arvestati nädalasageduseks koefitsiendiga 4,3 ja päevasageduseks koefitsientiga 30 (5).

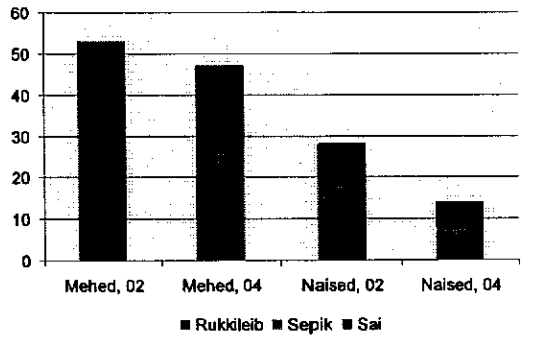
Tulemused

Tulemuste riikidevaheline võrdlus

Uuringu tulemuste alusel on Eestis puu- ja köögiviljade tarvitamine kõige väiksem Põhja- ja Baltimaade seas, seda ka siis, kui võrdlusena arvestada juurde kartul. Naised söövad iga päev köögivilju sagedamini kui mehed, v.a Lätis ja Leedus. Sagedamini kasutatavad köögiviljad



Joonis 1. Kaks korda päevas või enam köögiviljade ja puuviljade/marjade tarbijate osakaalu muutus vanuserühmade kaupa



Joonis 2. 5 või enam viilu päevas leiva tarbijate osakaal leiva kiudainesisalduse ja soo lõikes aastatel 2002–2004, %

on sibul ja küüslauk, kurk, tomat ja porgand. Puuviljadest/marjadest eelistatakse enam õuna, tsitrusvilju ja banaani. Rohelist salatit ja paprikat kasutatakse enam Põhjamaades, Balti riikides ja Soomes tarvitatakse seevastu marju, sh metsamarju sagedamini kui teistes Põhjamaades.

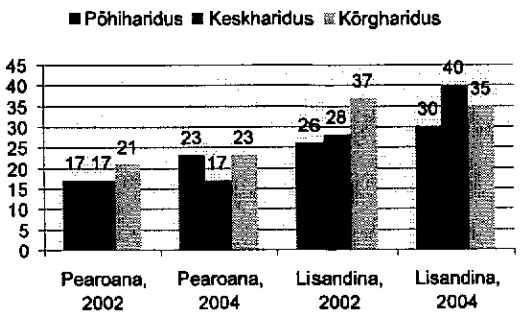
Kui Põhjamaades valmistatakse kala enamasti pearoaks, siis Balti riikides kasutatakse kala pigem lisandina teistele toiduainetele (nt võileivale). Leiva ja saia söömises on Eesti Läti järel teisel positsioonil koos Soomega, rukkileiva söömises aga Soome järel teisel kohal. Osalenud riikides on kõige eelistatum rukkileib, v.a Islandil ja Leedus, kus kasutatakse vastavalt rohkem sepikut ja saia. Suurem saiasöömine on iseloomulik kõigile Balti riikidele. Leiva tarbimissagedus meeste hulgas on oluliselt suurem kui naistel kõigis osalenud riikides.

Puu- ja köögiviljade tarbimine (vt jn 1)
Rahvusvaheliste soovituste alusel peaks puu- ja köögiviljade (siia alla ei arvestata kartulit) tarbimine olema kokku 5 portsjonit päevas (5). Eesti inimene sõi aga 2002. aastal puu- ja köögivilja keskmiselt 1,3 korda päevas. Eestis eelistatakse köögiviljadest sagedamini sibulat ja küüslauku, mida kasutab iga päev peaaegu (vähemalt 5 korda nädalas) 58% vastanutest, porgandit (21%) ja kurki (18%). Puuviljadest/marjadest eelistatakse õuna (iga päev peaaegu 51% vastanutest), tsitrusvilju (26%) ja banaani (19%). Puu- ja köögivilja igapäevaste sööjate osa on kahe uuringuaasta vahel oluliselt suurenenud. 2002. aastal oli Eestis köögiviljade igapäevaseid tarbijaid vaid 35% rahvastikust, 2004. aastal aga 47%, puuvilju/marju tarvitas iga päev vastavalt 27% ja 46% vastanuist.

Puu- ja köögiviljade tarbimise muutus on olnud kõige suurem vanuserühmas 20–29 aastat, vanemates earühmades on kasv ainult puuviljade osas. Sarnaselt 2002. aastaga söövad kõrgharidusega inimesed rohkem puu- ja köögivilju. 2002. aastal sõi neist 2 või enam korda päevas köögivilja 9% ning puuvilju 7%, 2004. aastal vastavalt 21% ja 15%. Värske puu- ja köögivilja tarvitamine on suurem noorte earühmade seas.

Leiva ja saia tarbimine (vt jn 2)
NorBaGreeni uuringu järgi sõi 2002. aastal Eesti inimene rukkileiba keskmiselt 2,7 viilu päevas, sepikut 1,4 viilu päevas ja saia 2,3 viilu päevas. Eesti elanikud peaksid Eesti toidusoovituste alusel tarbima rukkileiba (siia alla ei arvestata sepikut ega saia) vähemalt 5 viilu päevas (7). 5 või enam viilu päevas rukkileiva sööjaid oli 2002. aastal 19%, 2004. aastal vaid 12%.

Seega on 2002. a vähenenud nende inimeste arv, kes sõid rukkileiba vastavalt soovitusele. Rukkileiba süüakse kõige vähem suuremates linnades, samal ajal tarvitavad sealsed elanikud rohkem saia. Kõrgema hariduse ja suurema sissetulekuga inimeste toidulaual on rukkileiba vähem, ent kokku leiba/saia on toidulaual kõige enam madalaima sissetulekuga inimestel. Lastega peredes süüakse



Joonis 3. Kala tarbimine põhiroana ja lisandina vähemalt kaks korda nädalas haridustaseme järgi aastatel 2002–2004.

oluliselt enam saia, iseäranis peredes, kus on 3 või enam last.

Kala ja mereannid (vt jn 3)
Kala soovitatakse süüa vähemalt 2 korda nädalas põhiroana (7). Kala 2 või enam korda nädalas tarbijaid oli 2002. aastal 20%, 2004. aastal 24%. Kala kasutamine toiduks ei ole võrreldes 2002. aastaga oluliselt muutunud. Kala söövad rohkem suurema sissetulekuga inimesed ning põhiliselt lisandina teistele toiduainetele, vähem põhiroana.

Uuringu valiidsus ja reprodutseeritavus
NorBaGreeni valideerimisuuringud näitasid, et erinevate metoodikate puhul (FFQ) saadud tulemused olid korrelatsioonis köögiviljade (Spearmani korrelatsioonikoefitsient 0,71 Soomes ja 0,6 Leedus), puuviljade/marjade (0,59; 0,53) ja leiva tarbimisega (0,59; 0,65). Kartuli ja kala tarbimise osas oli tulemuste korrelatsioon nõrgem (kartuli puhul vastavalt 0,49 ja 0,83; kala puhul vastavalt 0,75 ja 0,51). Küsimustiku andmete reprodutseeritavus korduvate valideerimisuuringute korral, mis tehti 6–8 kuu möödudes, oli hea (5).

Arutelu
Küsitlusega hõlmatud riikides on ka varem tehtud toidutarbimise ja toitumisuuringuid, ent metoodika ja küsimustike erinevus ei võimalda teha rahvusvaheliselt võrreldavat analüüsi. Võrreldavaid toiduainete tarbimissageduse andmeid on alates 1990. aastast kogutud FINBALT-uuringu raames, viimasena, 1998. aastal liitus uuringuga Läti. Uuring tehakse postiküsitluse teel (8). Kui FINBALT-uuring hindab tarbimise sagedust viimasel nädalal, siis NorBaGreen hindab tarbimissagedust keskmiselt viimase aasta jooksul. FINBALT uuringu tulemusi ei ole ka valideeritud.

Andmete kogumise meetodi erinevus Põhja- ja Baltimaades on tingitud riikide iseärasustest. Nii ei ole näiteks telefoniintervjuu meetodil küsitlus Eestis veel piisavalt levinud ning see oleks võinud mõjutada inimeste valmisolekut uuringus osaleda. Samuti oli riigiti valimite moodustamises erinevusi. Valimi moodustasid, intervjuusid korraldasid ja andmeid analüüsisid uuringufirmad. Ulatusliku uuringu tegemiseks oli see ainus võimalus, kuna riiklikul või teadusasutusel puuduvad ressursid ühekordse suuremahulise uuringu jaoks. Eeltoodud asjaolude mõju andmete võrreldavusele ei ole teada. Nordgrönti rühma algselt koostatud küsimustik oli planeeritud vaid puu- ja köögiviljade tarbimissageduse hindamiseks. Küsimused leiva ning kala tarbimise kohta lisati seoses nende toidurühmade kuulumisega tervisliku toitumise indikaatorite hulka. Kartuli tarbimise küsimus oli tingitud eelkõige huvist selgitada välja, kas võib kartuliga asendada toidus puu- ja köögivilju ja vastupidi. NorBaGreeni uuringu algselt rootsikeelne küsimustik tõlgiti kõigepealt inglise keelde, seejärel inglise keelest kohalikesse keeltesse. Samuti kasutati kontrolltõlget rahvuskeelest inglise keelde, et tagada mõistete ühtsus ja andmete võrreldavus. Küsimuste esitamine tarbimise kohta portsjonites võis olla vastajatele eksitav, ehkki asjakohane selgitus oli küsimustikus ka antud. Seetõttu jäeti valideerimisuuringust välja näiteks need korrad, kus tarbimine oli alla 40 g. Leiva kiudainesisaldus oli esitatud märksõnadena ning nendest arusaamine võib teatud osas mõjutada vastuse vastavust tegelikkusele. Kuna aga valideerimisuuringud näitasid saadud andmete head korrelatsiooni, on sellega tõestatud küsimuste sobivus ja arusaadavus.

Leiva söömise erinevus naiste ja meeste vahel võiks olla seotud eelkõige erineva energiavajadusega. Sarnaselt on tarbimise muutus seostatav vanu-

sega: üle keskea jõudnud inimestel energiavajadus väheneb ning esmalt vähendatakse toiduenergia allikana leiva söömist. Võrreldes NorBaGreeni uuringu tulemusi on need suhteliselt lähedased teiste analoogsete uuringute andmetega. Näiteks Statistikaameti leibkonnauuringute alusel osteti 2002. aastal inimese kohta leiba 2,52 kg kuus ja saia 1,76 kg kuus, mis ümberarvutatuna viiludesse (viil = 35 g) teeb 2,4 viilu leiba ja ligikaudu 3 viilu saia (viil = 20 g) päevas. Eesti täiskasvanud elanikkonna tervisekäitumise uuringu andmetel on päevas musta leiba 5 või enam viilu sööjate osakaal meeste hulgas 37% ja naiste hulgas 22% (9). Naised hoolivad tervisest enam ja söövad ka enam puu- ja köögivilju (9). Võrdlusel kasutati peamiselt küsimusi kogu toidurühma tarbimissageduse kohta, kuna alaliikide kaupa summeerides tuleb tarbimine kokku suurem. See on toidu tarbimise uuringutes sageli esinev erinevus (10).

Kokkuvõte

NorBaGreeni uuring näitas, et on võimalik korraldada ühesuguse küsimustikuga riikidevaheliselt võrreldav toiduainete tarbimise uuring. Eestis ei ole varem teostatud representatiivset toidutarbimise uuringut, mille andmete kvaliteet on valideeritud. Uudne on ka leiva kasutuse analüüs leiva kiudainesisalduse järgi.

Mitte üheski uuringus osalenud riigis ei vastanud keskmised toiduainete tarbimissagedused riigi või rahvusvaheliselt aktsepteeritud soovitustele. Puu- ja köögiviljade söömise osas on toimunud oluline positiivne nihe, mida saab seostada 2003. aastal Eestis korraldatud teavituskampaaniaga. Samal ajal tarbib ka 2004. aasta uuringu tulemuse alusel 5 või enam kordi päevas puu- ja köögivilju alla 15% täiskasvanutest. See näitab järjepideva selgitustöö vajalikkust puu- ja köögiviljade vajalikkuse teadvustamiseks. Leiva tarbimisharjumust Eestis võrreldes Põhjamaade ja Baltimaadega võib pidada heaks. Arvestades saia suuremat tarvitamist Baltimaades, peaks kavandatav tervisedenduse töö olema suunatud saia tarbimise vähendamisele rukkileiva kasuks. Kala toidurühmas peaks enam tähelepanu pöörama kala põhiroana kasutamise teadvustamisele.

Kokkuvõttes on Eesti inimeste toitumine muutunud tervislikumaks, ent eelkõige kõrgema hariduse ja suurema sissetulekuga isikute hulgas. Samal ajal ei vasta enamiku elanikkonna tarbimisharjumused toidusoovitustele, mistõttu teavitamist tuleb jätkata kõigi eeltoodud toidurühmade osas.

NorBaGreeni uuringu korraldamisega töötati välja ja valideeriti lihtne tervisliku toitumise hindamise metoodika, mida on võimalik edaspidi süstemaatiliselt kasutada muutuste hindamisel tervisliku toitumise indikaatoritena käsitletavate toiduainete tarbimise osas (6).

Tänuavaldus

Uurimistöö on valminud Põhjamaade Ministrite Nõukogu rahastatud projekti NorBaGreen uuringuandmete ja Eesti Haigekassa rahastatud projekti Tervisliku toitumise tegevuskava hindamiseks tehtud uuringu andmete alusel.

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Summary

NorBaGreen survey: consumption of food groups as dietary indicators of health in Estonia

The food groups fruit, vegetables, bread and fish are proposed to be monitored as dietary indicators of health. The aim of the NORBAGREEN study was to examine, with a comparable method, the consumption frequency of these foods in the Nordic and the Baltic countries and to produce a validated instrument for future monitoring. The survey was performed in spring 2002 by using telephone interviews in the Nordic countries and personal interviews in the Baltic countries. The number of completed interviews was approx. 1000 persons/country aged 15–74 years. Validation studies were carried out in Finland and in Lithuania.

Estonia is characterised by the lowest consumption of fruit/berries and vegetables among the Nordic and the Baltic countries. Considering the situation, a fruit and vegetable promotion project has been carried out since 2003 in Estonia. For the evaluation of the project a repeat survey was executed in spring 2004 using similar methodology and a brief questionnaire.

There has been a significant positive increase in the consumption of fruit and vegetables in Estonia. The proportion of persons who consumed vegetables at least once a day was 35% in 2002 and 47% in 2004. Fruits were consumed daily among 26% and 47% of adults, respectively. Of the individual vegetables, onions, carrots and cucumbers were among the most popular ones. Of the individual fruits, apple, citrus fruits and banana were the three most popular ones. A slight increase was noted in the consumption of bread and fish. Five slices or more a day were consumed by 52% of adults in 2002 and by 58% in 2004. Fish was consumed twice a week and more often by 20% of adults in 2002 and by 24% in 2004.

The food consumption patterns in Estonia have changed in a positive way, especially in the groups with higher education and higher income. However, as the food consumption habits do not yet correspond to the dietary objectives, there is a great need for improving these dietary indicators of health.

sirjevaask@hot.ee