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**STATISTICAL OFFICE OF THE
EUROPEAN COMMUNITIES
(EUROSTAT)**

**FOOD AND AGRICULTURAL
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**ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT
(OECD)**

CALCULATIONS AND ANALYSES OF FOOD SUPPLY

Submitted by Statistics Denmark*

Summary

The human food consumption is at the macro level measured by constructing supply balances, which constitute simple statistics easy to compile at reasonable costs. However, the statistics do not give data on the population's consumption of food and nutritional intake but only on the supply of food which is available for human consumption. As it appears from the examples given in this paper, there are many possibilities of reducing the statistical errors linked to constructing supply balances, and thus of enabling the supply balances to provide more information for analysing the food consumption.

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In general the largest errors are found in external trade statistics. As human food consumption is estimated as the residual of the supply balance the errors in external trade statistics also affect statistics on human food consumption. This applies to the national as well as the international level. There are on the one hand differences in the lower limits of when to include imports and exports of business enterprises in the external trade statistics, and on the other hand differences in the production methods, and consequently differences among the coefficients of conversion applied in connection with imports and exports. Other statistical errors are linked to what share of the original product is used for food, which is, e.g. dependent on a country's traditions, level of income and development of prices.

Conducting dietary surveys based on the uses is an essential supplement but these surveys are cost-intensive. However, they open up possibilities of analysing the nutritional intake and the developments of this intake. It is possible to conduct analyses in relation to the population's state of health and the consumption of recommended dietary items. The attention of the surveys is focussed on consumption and nutrition, and does not give a picture of the global consumption, for which continual improvements of the supply balances are considered to be better suited.

I. INTRODUCTION

1. National and international statistics analysing human food consumption form an essential basis for national food and nutritional policies, for example in connection with the issue of setting up goals for the consumption of food, and to be able to follow changes in this consumption. The statistics must provide the basis for analysing food supplies, food security and food quality.
2. Health policies have implied that there is a steadily increasing focus on the population's food habits. This is due to the fact that an increasing number of surveys have shown that dietary habits play an important part in developing the major public diseases: cardiovascular diseases and cancer. This has implied that food and nutritional policies have in a number of countries been given higher priority as part of the national preventive programmes.
3. In order to examine to what extent the political objectives regarding the nutritional state of the population have been fulfilled, knowledge is required with respect to development in especially the food items that are most important for public health, i.e. food contributing significantly to the dietary content of fat and starch, including dietary fibres. The products concerned are butter, margarine, milk products, cheese, meat and bread, potatoes, vegetables and fruit. It is also necessary to make estimates of the diet's energy distribution and content of important nutrients, which will put demands on the primary statistical data, whose purpose is to analyse food supplies.

4. Statistics have traditionally focussed on consumption of food per capita, which has been used for describing the intake of food and nutritional items. Great weight is still attached to the analysis of food supplies on this basis.

5. Attention is now increasingly focussed on producing food of a high quality, which is generally understood to mean that the various food items are nutritionally correct, and that they do not contain harmful substances of, e.g. pesticide residues, pharmaceutical residues and unwanted bacteria, etc. Furthermore, environmental issues surrounding the production of food are taken into account, including the use of fertilizers and pesticides. The welfare of animals is also a parameter that is used in assessing the quality of food.

6. The statistics on food supplies are thus the basis for analysing:

- the consumers' selection between different types of food (e.g. between meat, dairy products, bread, fruit and vegetables, etc.);
- the consumers' selection between different qualities of the same type of food (e.g. food with various levels of environmental or animal welfare, convenience, etc.);
- the consumers' behaviour in relation to food security (e.g. salmonella, BSE, pesticide residues, GMO, etc.).

7. The present paper is concerned with basic calculations and analyses of the supplies of food and methods for improving the compilation methods. Statistics on the population's quantitative consumption of food and the developments in this consumption still constitute an essential element of the statistics on food and form the basis for including the new aspects described above, which are discussed in other papers in relation to item 7.

II. FOOD SUPPLIES AVAILABLE FOR CONSUMPTION

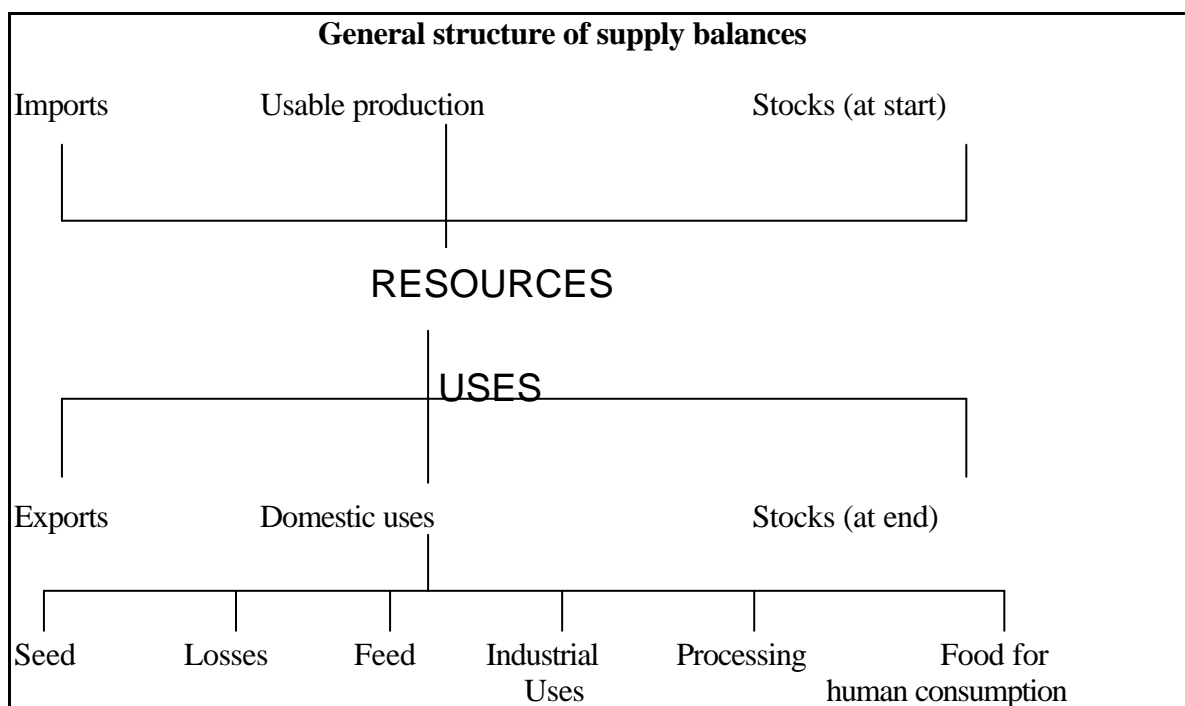
8. The most commonly used method in order to obtain an overview of the food supplies available for human consumption is probably to compile supply balances for products or product groups at the most detailed level possible.

9. This method is used in many countries as the general basis for providing a complete picture of the total consumption of food in the country.

10. Dietary surveys, and to some extent household surveys, probably give a more precise picture of the direct consumption by households but these surveys do not give any information on the considerable part related to, e.g. public meals and consumption in restaurants and catering. To this is added that considerable resources are required for conducting the surveys.

11. Denmark has compiled supply balances for more than 100 years. It has always been the general impression that these estimates did, of course, indicate the total human

consumption of food but in former times the balance sheets could also provide information on whether there was enough food available to feed the population. However, this has not been a problem in Denmark in recent years. It was also the impression that the development would indicate the trend in the population's consumption. This is, to some extent, probably the case but there are several factors influencing this trend – some of these factors are discussed below.



Individual elements of the balances

12. The general structure of the balances appears from the above figure. However, countries treat each individual element differently. One problem involved in using the balances as an indication of the consumption is that all errors and inaccuracies are cumulated in the residual – supply for consumption.

13. In the following, the Danish approaches and treatments are briefly described as well as some of the factors that have an impact on the calculations and on international data comparability.

14. As a small homogeneous country, the information on products in Denmark must be considered to be of a high quality and to provide complete coverage. Although, there are some areas, such as harvest statistics and losses, to which statistical errors, to some degree, can be attached. As far as animal livestock products, etc. are concerned, statistics are continuously compiled on the basis of data from, e.g. dairies and slaughterhouses. The most important data sources are the businesses engaged in production, and to this information from the public supervisory authorities is added.

External trade – imports and exports

15. Handling external trade statistics is one of the elements in the balance sheets to which most problems are attached. The greater the external trade is the greater the problems are in calculating the human consumption of food. The external trade of Denmark is relatively large, and Denmark is, e.g. the largest exporter of pigmeat.

16. The basis for the calculations is formed by the definitions adopted by the UN with further level of detail in the EU, e.g. cereals with fixed water content, sugar beets with fixed sugar content and animals to be slaughtered as carcass weight.

17. Only a small part of, e.g. pigmeat is sold in shops as whole carcasses. It is sold in various cuttings of meat and forms part of ready-made dishes.

In order to convert the various parts sold to the definition of products, a set of conversion factors is applied, which is intended to return each individual product sold to its origin. For example, a large part of the meat is sold without bones, and as the origin is the slaughtered carcass, which includes bones, a conversion must be made.

18. The conversion factor for bones is not calculated homogeneously for the same cutting of meat as the method of processing is important. The bone can either be removed mechanically from the piece of meat or by boning the meat using a knife whereby the quantity of meat remaining on the bone differs. This difference in the processing gives rise to differences in the conversion factor, i.e. it is, in principle, necessary to know the production methods and their shares in the production.

19. This factor becomes even more obvious, when processed meat is concerned, e.g. when it is included in ready-made dishes, when the meat is smoked and/or salted. Another issue for products such as sugar is their further use in processed products, which can be imported as well as exported. Sugar, which in Denmark originates from sugar beet and is converted into refined sugar, can even be replaced by artificial sweeteners in processed products.

20. A similar factor is the use of cereals, where the first stage is whole seeds. Following grinding of the seeds, several fractions are created. Flour is used for a number of manufactured goods, such as bread, biscuits, pasta, pizza bases, etc., and the question is then where the limit for the balance of cereals is to be drawn, and where other balances will be constructed, showing goods that have been manufactured. In this respect, there is always an inherent risk of duplicate counting, and thereby a greater extent of statistical errors in the estimates of consumption.

21. As it is necessary to adapt the conversion factors to the production processes, a new question arises in connection with imports from countries that use a different form of production and/or recipe of production.

22. This would imply that the conversion factors applied to the imported products should perhaps be those of the exporting country, or it is alternatively assumed that the imported products are equal to those produced in the importing country.

23. What remains then is that there may be a difference in the nutritional content and that single elements in the manufactured product are disregarded with respect to balancing the supplies of food.

Stock changes

24. There are great differences among countries in the data on stocks that are reported. Annual questionnaire-based surveys of farmers' stocks and semi-annual surveys of cereal brokers, etc. are conducted in Denmark. Stocks of animal products are examined quarterly, as the calculations of the supply of food for consumption are conducted quarterly for these products. The function of stock statistics is to establish a reference period for the calculations, which is particularly important in the case of animal products in order to compile valid statistics.

Domestic uses

25. In order to estimate the supply of food for consumption as a residual, it is essential that other elements in the domestic uses are described and calculated.

26. As far cereals are concerned, cereals for feeding are calculated as a residual, and not the human food consumption, as data are available on grinded cereals for human consumption. Furthermore, seed grains have to be deducted. The seed grains are certified and the data are obtained from cereal brokers. These data are also checked using information on sown areas and the recommended seeds for sowing. The processed supplies are divided into cereals used for human consumption and a remaining item – e.g. bran, etc. used for feeding.

27. The industrial uses are intended for brewing of beer, brewing of aquavit, etc. Data on the supplies of these beverages are directly reported via questionnaires. These supplies are then divided into alcoholic beverages and residual products used for feeding.

28. Meat is a balance where the estimated residual represents the supply available for human consumption. The residual which is estimated thus covers the supply that is approved to be fit for human consumption. This implies that discarded animals are removed in advance and so are, e.g. material at risk in connection with BSE. This material and animals that died from accident or disease are no longer used for animal feedstuffs but are transferred for incineration.

29. Discarded products from materials approved to be fit for human consumption are used for feeding poultry and furred animals.

30. The fraction approved for human consumption, but which has been discarded, has an impact on the residual that could have been consumed. If this fraction remains constant, it will not influence trends in the consumption but a detailed analysis has shown that this is not the case in Denmark. For example, the development in waste quantities from slaughtering of pigs at slaughterhouses has been analysed.

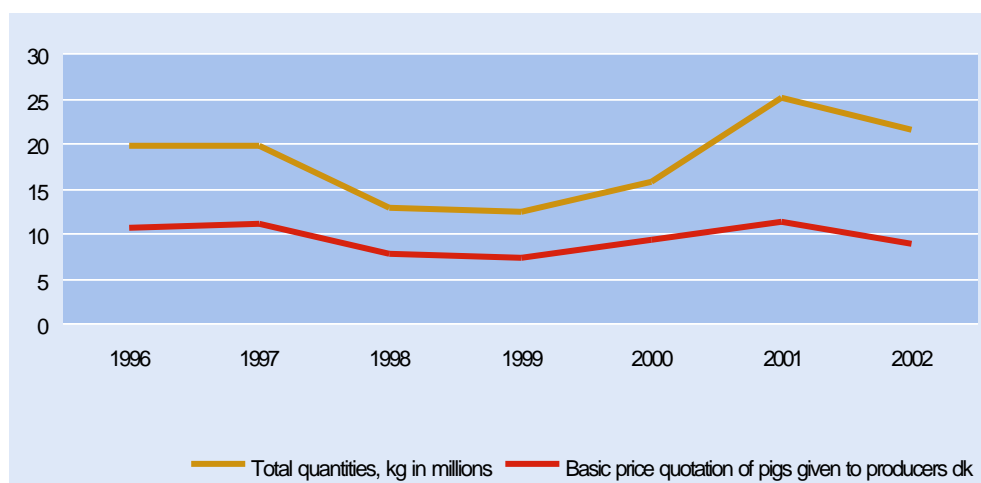
31. The definition of carcasses comprises, e.g. heads and toes, which are partially consumed. However, the fraction of meat used for human consumption is also dependent on the existing economic trends, i.e. if the price for pigs and pigmeat is high, the meat on the head is used to a far greater extent than in the case of low prices.

32. The overview given below shows that there is a relationship between the quantity of meat, which has been cut from/picked from the head and the price paid to the pigmeat producer. There is a close relationship, and this shows one of the mistakes made if a fixed ratio between the weight of a pig's head, which is incorporated into the definition, and the actual uses is applied.

33. The difference is 10 to 12 million kg over the period under review. As the population of Denmark is just over 5 million inhabitants, this analysis shows that there is a difference of 2 kg per capita.

**Meat used from the
heads of pigs**

	1996	1997	1998	1999	2000	2001	2002
Meat used from the heads – kg per pig	1.0	1.0	0.6	0.6	0.8	1.2	1.0
Total number of slaughtered pigs in millions	19.1	19.2	20.3	20.6	20.3	21.2	21.7
Total quantities, kg in millions	19.8	19.8	12.8	12.5	15.7	25.2	21.6
Basic price quotation of pigs given to producers DKK per kg	10.71	11.02	7.73	7.32	9.43	11.23	8.86



34. Similar factors apply to other parts/cuttings of meat, which will have to be taken into account if further calculations of the figures are to be made in order to assess the population's nutritional intake. This is the reason why the concept of food available for human consumption provides a more complete picture.

35. Parts, such as bones, on average 10 kg per pig, are of course not consumed, as is the case for a great part of fats, etc. The waste in households – and in connection with the general cooking – is a phenomenon, of which it is difficult to estimate the quantity as it varies with, e.g. household incomes. Not only the waste in connection with cooking but also other types of waste increase with rising household incomes.

36. A factor, which may seem somewhat curious, but which does have some significance, is the feedstuffs consumed by pets as a share of the food consumption by households.

37. Statistics Denmark has conducted a survey of Danish families' pets, and on the basis of this survey we have estimated the feeding requirements of dogs and thus the recommended quantity of meat.

Feeding requirements of Danish dogs				
	Average weight Kg per dog	Number of dogs 1,000s.	Total requirements kg/year	Recommended 1/4 meat
Small	7	209	22.961.785	5.740.446
Medium	19	162	35.951.040	8.987.760
Large	40	175	81.760.000	20.440.000
Total		546	140.672.825	35.168.206

38. It appears from the above that the estimated meat quantity fed to dogs is 35 million kg. As meat for dogs with regard to health is, in principle, approved for human consumption, although pet food contains some feeding items, which are normally not consumed by human beings, there is nevertheless a quantity of about 7 kg per capita in Denmark.

39. As illustrated by the above examples, there are many elements in the estimations of balance sheets, which have to be considered if the domestic uses of food for human consumption derived from the balance sheets can reasonably be said to reflect intake of food.

III. INTERNATIONAL COMPARABILITY OF FOOD BALANCE SHEETS

40. With respect to data on consumption extracted from the primary statistics, most countries are able to provide high-quality data on food items, such as milk and dairy products, meat and meat products, sugar, eggs and cereals. There are commodity groups, such as fish, potatoes, vegetables and fruit, with far greater inconsistencies in the primary statistics.

41. A more focussed development in the field of statistics has already been well under way for some time, and the agenda for this meeting is an obvious example of this. Work will still have to be carried out with respect to a coordinated extension of the primary statistics, coordination of the conversion coefficients and a more coordinated presentation of statistics in international forums.

IV. STATISTICAL SOURCES

Balance sheets

42. As mentioned initially, supply balances are the most frequently used method for keeping up with developments in the country's food consumption and for the further comparisons among countries, with respect to the degree of self-sufficiency and food consumption per capita.
43. Supply balances are constructed for the following main areas in Denmark – which are further subdivided into a number of items: Cereals; Rice; Oil seeds, (rape) and oil cake; Vegetable fats; Wine; Potatoes; Sugar; Pulses (peas); Tomatoes; Meat and edible offal; Milk and dairy products; Eggs; Animal fats; Fish.
44. The advantages of constructing supply balance sheets to reflect the food consumption are partly that the statistics are relatively inexpensive to compile as a number of sub-statistics are already available, such as production statistics, external trade, etc. They are statistics that are in many cases compiled for other purposes and only need to be combined in different ways and/or supplemented.
45. A secondary product from these supply balances is also that the independent elements that have been processed in the supply balances are compared in such a manner that quality controls are, at the same, applied to each individual element, when these are put into a context.
46. The greatest advantage is probably that on the basis of the supply balance sheets, the total quantity of food available for human consumption is estimated.

Uses

47. For the purpose of making a basic estimate of production and of consumption of food from the use side as independently as possible from the statistics on the production side, it is important to supplement with statistics compiling household consumption directly from the use side. This enables the analysis of other aspects of the food consumption. In the following, statistics taking this aspect into account are briefly described.

Household surveys

48. The household survey describes purchases of food by households. In Denmark, this survey is part of the overall consumer surveys conducted by Statistics Denmark, where incomes and consumption of private households are analysed – and as a specialised part of the consumption, food consumption is compiled at a rather detailed level, consisting of about 300 food items.
49. The information is collected partly via interviews and partly via households keeping accounts of their purchases, including food. However, for estimating food consumption the statistics only give data on values. Against this background, estimations of nutritional content

further require that data on prices are collected in order to be able to determine the quantities. The large number of produced food items also makes it difficult to construct homogeneous groups, where comparisons are made with the total quantities on the basis of the available supply of food.

50. The results can, to some extent, be used to provide a picture of trends in the food consumption of private households, especially in relation to other consumption and to the use of incomes.

Consumption analysed by the socio-economic status of the main recipient of income
1998-2000

	Total	Self-employed	Employees	Pensioner, etc.	Economically inactive
	DKK per household				
Total income	401 160	567 111	491 909	229 090	235 642
Total consumpt.	225 375	325 219	257 943	156 896	165 949
Food	24 905	33 505	27 792	18 557	20 920
	number (1,000)				
Households	2470	119	1460	714	178

51. Other limitations are that only data on consumption by private households are available, whereas institutional households, public meals, restaurants, catering, etc. are not covered. It is therefore not possible to fully estimate in this way the food consumption of the Danish population. Furthermore, the data relate to purchased food and household waste is not known and consequently nor is information on food intake.

Dietary surveys

52. Dietary surveys should, in principle, be the best suited for describing the actual food intake of private households, and thereby open up the possibility of conducting further analyses of the nutritional content, etc.

53. For the years 1985, 1995 and 2000, dietary surveys were conducted by the Danish Veterinary and Foodstuffs Directorate. However, it turned out that the survey method is instrumental in influencing the results, e.g. when interview-based surveys are conducted problems arise with respect to loss of memory, when people have to remember facts at a detailed level. When the participants in the survey enter their daily food intake in diaries, there may be a tendency for, e.g. overweight people not to enter all details, and we are thereby not able to monitor the actual trends.

54. In Denmark, an interview is first conducted in order to establish background information and then participants register all food and beverages that are consumed over a period of 7 days. The information gives, e.g. recipes of the dishes included, portion sizes, fats

and water loss, etc. The information registered is compared with tables concerning foodstuffs where the composition of food can be established and the nutritional intake estimated.

55. The surveys comprise persons aged 4-74 at an individual level, and thus open up a number of possibilities of conducting analyses. The trends in consumption over time and how the nutritional intake compares with the “political” objectives for the population’s diet can be analysed. It can also be established whether the advice as to consuming more fruit and vegetables and less fat and sugar is followed.

Intake of fruit, vegetables and juice in grammes per day

	1995		2000/01	
	4-10 years	11-75 years	4-10 years	11-75 years
Number in the survey	649	2080	145	931
Vegetables	93	116	109	144
Fruit	117	114	132	170
Juice	70	49	81	65
Total	280	279	322	379

56. An intake of fruit and vegetables of 400 grammes per day for people aged 4-10 and 600 grammes per day for people over 10 years is recommended in Denmark. It can be seen from the table that the intake of fruit and vegetables is still too low, although there has been a great increase over the 5-year period that is surveyed.

57. There are also questions regarding physical exercise by the population, which can again be incorporated into the comparisons that are conducted. Furthermore, comprehensive analytical work is carried out to conduct, as far as possible, comparisons of the dietary intake and the progress of diseases, of which cancer is the most important disease.

58. All initiatives are undertaken at a detailed level, which in many cases can be further analysed and applied to the population as a whole. However, there is still the issue of food intake outside the home, for which data are not available, and also dietary surveys have to be supplemented by data when a description of the population’s total consumption of food is to be provided.

59. Another factor, which is generally not incorporated into the assessments, is tourists. Some countries have a great number of tourists and others a low number, and this may give rise to a bias when comparisons are made among countries, as the consumption per person is estimated for the internal population. Similar factors may apply with respect to cross-frontier shopping and ship’s provisions.

60. Dietary surveys are very close to the actual consumption of food for each individual person in his/her home, and on this basis a nutritional intake can be estimated. These close

estimates open up a variety of possibilities for analysing the nutritional character in order to underpin the dietary policy and health aspects.

61. It is necessary to conduct such surveys at regular annual intervals in order to supplement the calculations of the supply balances. They are rather expensive to conduct and they need to be supplemented by other data, as the surveys are not global and cannot be expected to reflect food consumption in the country.

Statistics on demand and supply

62. Linking the statistics on manufacturers' sales of commodities, containing data on industrial sales broken down by commodity, with the external trade statistics, showing imports and exports in quantities and value broken down by commodity, it is possible to compile the so-called statistics on demand and supply, which contain data on the total quantity and value for each commodity available in the national market.

Index of retail sales

63. Value indices as well as quantity indices can be derived from the index of retail sales broken down by industries. The index of retail sales analyses the trends in sales of the different industries included in retailing, and thereby contributes to the development in private consumption. Indices of sales are published for 49 industries in Denmark, and it is thus possible to keep track of the development in consumption of, e.g. food and other groceries purchased from retail shops.

Organic products

64. In a number of international forums and in a number of countries, attention is at present increasingly focussed on establishing statistics, whose purpose is to analyse the production and consumption of organic products. Over the next couple of years, this will be an activity area that will be given higher priority, although the share of production and consumption is rather low for most products. In the opinion of Denmark, it is considered expedient and not very resource-consuming to build up the organic statistics that are to monitor organic production and organic consumption in close connection with the existing statistical systems, comprising the different areas. At present, high-quality data of the structure for the organic producers and for the production of selected organic products are available in Denmark. In connection with our work on expanding the statistics, we have given priority to constructing statistical models monitoring retail sales (final consumption), external trade and price developments for organic products.

V. CONCLUDING REMARKS

65. The food supply and thereby the population's consumption of food are covered by a large number of statistical surveys. There is a broadly-based interest in statistics showing food items and food consumption.

66. Today, dietary habits are a topic of current interest, not least because of the importance of food for developing and preventing a number of diseases. Greater emphasis is put on food and nutritional policies, and public health programmes are, to a far greater extent, prepared.

67. Greater attention is also focussed on the quality and security of food items, and in this context a number of specific initiatives have been carried out in recent years, both nationally as well as internationally. These initiatives are to be instrumental in ensuring that the food items produced and purchased by the consumers are still healthy and of a high quality.

68. The attention focussed on the status with respect to food quality and security will have to be considered against the background of the generally increasing prosperity, falling food prices, and not least a number of food crises, which have had an impact on the mass media over recent years (for example, the occurrence of BSE and salmonella). To this is added that there is now a more broadly-based quality concept. From mainly being linked to being a question of high-quality taste and health, the quality concept now also encompasses convenience represented by the cooking quality of the products and qualities in the process of production, such as taking animal welfare into consideration.

69. The increasing attention on food supplies also makes demands on the existing food statistics concerning reliability and coverage. The existing statistics with respect to food supplies, where the balance sheets constitute a key point, are still a considerable and essential basis for analysing food supplies, but there are demands to expand the statistics, which will make it possible to monitor the new aspects. It is important to supplement the statistics which are based on the production side with statistics based on the use side.

VI. QUESTIONS TO PARTICIPANTS

Data sources for compiling consumption in households?

The data source quality?

Assessments of the statistical margins of error attached to the calculations?

New aspects linked to calculations?

What is the impact of the production methods on the calculations?

Analysis of food consumption, from the production side and the use side?
