

1 Introduction

1.1 Problem statement

Recent years have witnessed an increasing awareness of the relationship between diet and health in German public life. Nevertheless, many people still suffer from poor diets. German eating behaviour follows a long tradition tracing back to the time when the majority of people worked in manual jobs, whereas nowadays sedentary lifestyles are prevalent. As the adaptation of eating patterns is a slow process, the German government sees an increasing need to assist the population in making healthier food choices. To cite some examples, the German part of the worldwide “5 a day” campaign encourages Germans to eat five portions of fruits and vegetables per day. The campaign was established in 2000 by members of the health sector, retailers, producers and scientists (under the auspices of the Federal Ministry of Health and the Federal Ministry of Food, Agriculture and Consumer Protection). Another campaign initiated by the Federal Ministry of Food, Agriculture and Consumer Protection is e.g. “Fit im Alter” which aims at improving the dietary behaviour of the elderly.

Such health promotion actions are motivated by an increase in diet-related diseases.¹ Table 1 illustrates the frequency of significant diet-related diseases in Germany.

Table 1: Frequency of diet-related diseases in Germany

<i>Diet-related diseases</i>	<i>% of women</i>	<i>% of men</i>	<i>% of total population</i>
Caries	n.s.	n.s.	99
Overweight (BMI ≥ 25)	52	67	n.s.
Cholesterol in serum (≥ 250 mg/dl)	35	32	n.s.
Hypertension	27	30	n.s.
Chronic obstipation	n.s.	n.s.	20
Struma	n.s.	n.s.	17
Gall stones	6.3	5.8	6.8
Gout	6.1	11.3	n.s.
Diabetes	5.3	4.7	n.s.

n.s. = data not specified

Source: KOERBER ET AL., 2004, p.9

¹ Diseases are diet-related whenever nutritional deficiency (ELMADFA AND LEITZMANN, 2004) or overeating and food-borne diseases play an important role in the pathogenesis and course of diseases.

Diet-related diseases are one of the main causes of mortality and morbidity in developed countries (WORLD HEALTH ORGANIZATION, 2002) and place an increasing financial burden on the health care sector. In 1993, KOHLMEIER ET AL. estimated the health care costs occurring from diet-related diseases in Germany. Cost of illness are defined as an evaluated loss of resources, i.e. as opportunity costs of goods and services which are consumed or that cannot be produced at all as a result of the disease. The costs of diet-related diseases in 1990 amounted to 83.511 billion DM (42.699 billion €)² accounting for 30% of the total costs of the health care sector. Cardiovascular diseases contributed the most to diet-related diseases with 32.968 billion DM (16.856 billion €). Given the latest data on the prevalence of obesity, it can be suggested that the costs of diet-related diseases are likely to have increased since 1990. The number of overweight and obese people in Germany is rising considerably. HELMERT AND STRUBE (2004) report that from 1985 to 2002 the prevalence of moderate obesity³ in the male (female) adult population rose from 16.2% (16.2%) to 22.5% (23.5%). Among all OECD countries, only the U.S. report higher obesity prevalence.

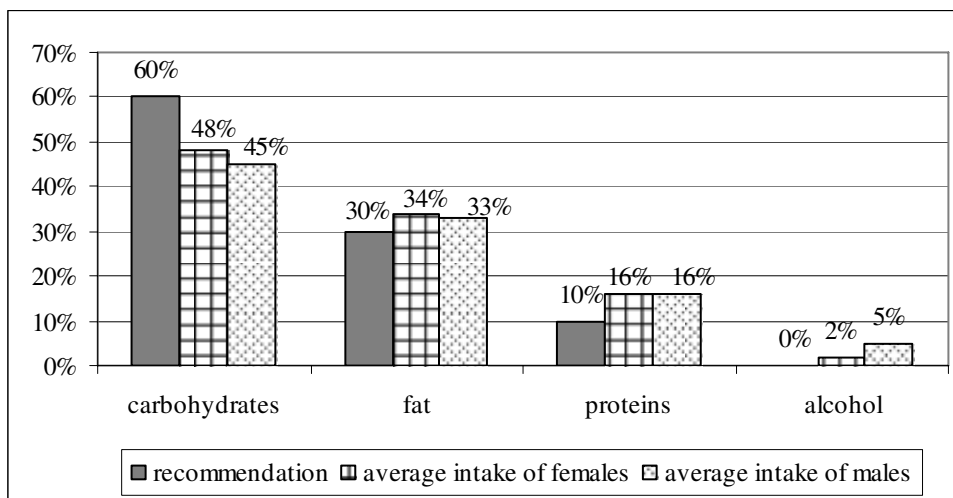
These data give reason to the need to analyse dietary behaviour in Germany against a health-economic background, which is the task of this thesis. Although the main part of the thesis is economic, nutritional questions are also considered due to the interdisciplinary context of the study.

Nutritional studies show that chronic overnutrition and oversupply especially with fat and alcohol are the main risk factors for the pathogenesis of diet-related diseases (cf. ELMADFA AND LEITZMANN, 2004). The development of e.g. cardiovascular diseases is mainly caused by risk factors such as total fat, cholesterol, saturated fatty acids, and sodium among other things (KOHLMEIER ET AL., 1993). Data from the German Nutrition Survey (GeNuS) in 1998 on the supply with macro- and micronutrients reveals the imbalance in average German diets. While the German Nutrition Society (DGE) recommends consuming 60% of energy from carbohydrates, 25-30% of energy from fat, and 10% of energy from proteins, females (males) consume 48% (45%) of energy from carbohydrates, 34% (33%) of energy from fat, 16% (16%) of energy from proteins and 2% (5%) of energy from alcohol (MENSINK, THAMM AND HAAS, 1999). Thus, Germans eat diets too rich in fat and proteins. This gap between recommended and actual dietary behaviour is presented in Figure 1.

² All DM values are converted into Euro using the official conversion rate of 1€ = 1.95583 DM.

³ Moderate obesity refers to a Body Mass Index (BMI=body weight in kg/body height in m²) in the range of 30-34.9.

Figure 1: Recommended and actual percentage of energy from macronutrients in female and male Germans in 1998



Source: Data from MENSINK, THAMM AND HAAS, 1999

At the same time, however, apart from overconsumption another dietary problem for affluent societies is the insufficient supply of certain nutrients. As indicated by GeNuS for mineral, nutrient, and trace element supply, the provision of fibre, vitamin D, vitamin E, folic acid, zinc, and iodine is still insufficient in the population (and the vitamins B₁, B₂, B₆ additionally in women) (MENSINK, THAMM AND HAAS, 1999).

Concurrent oversupply and undersupply of nutrients motivates this economic analysis of consumer demand for healthy diets. A better understanding of the forces that drive consumers to demand less energy-dense but more nutrient-dense diets is useful for governmental agencies to design food assistance programs and to help reduce the costs of diseases. Eating a large diversity of food items is an internationally consistent recommendation for a healthy diet. In 2006, 36 countries worldwide promoted food diversity (FAO, 2006). The first of ten guidelines for a wholesome diet of the German Nutrition Society also encourages eating diversely (DEUTSCHE GESELLSCHAFT FÜR ERNÄHRUNG, 2005). Nutritionists associate a broad dietary diversity with positive health outcomes (effects on mortality, cancer, diabetes etc.) (KREBS-SMITH ET AL., 1987; BERNSTEIN ET AL., 2002; FERNANDEZ ET AL., 2000). Therefore, food diversity is established as a concept of the quality of the diet⁴ in nutrition science.

⁴ In the following the terms ‘diet quality’, ‘dietary quality’, ‘nutritional quality’, ‘healthy diets’ and ‘healthiness of the diet’ will be used synonymously.

Food diversity is also an eminent consumer trend in industrialised countries. In these countries consumers face an increasing supply of various products (JEKANOWSKI AND BINKLEY, 2000). The demand for variety therefore has growing economic impact (CONNOR AND SCHIECK, 1997; SENAUER, 2001) but determinants of consumer demand for food diversity have only rarely been analysed (e.g. LEE AND BROWN, 1989; MOON ET AL., 2002). The number of German contributions in this field is also limited. THIELE AND WEISS (2003) show among other things that the demand for diversity increases with higher income and a higher number of children (7 to 17 years old) in the household in Germany.

Thus, food diversity is an important concept in both nutrition science and economics. So far these research fields have analysed the topic individually. This thesis aims at linking nutritional and economic aspects of a varied diet. An interdisciplinary analysis of food diversity is interesting for analysing socio-economic factors that detain consumers from demanding diets of high quality. For that purpose this thesis introduces the concept of healthy food diversity. Knowing the population groups with low demand for healthy food diversity as well as identifying the factors that affect consumer dietary behaviour could therefore give a better understanding of the dietary choice processes and could help health and nutrition policy to design appropriate public health strategies more efficiently. Results are furthermore important for entrepreneurs who aim their product innovations at certain target groups interested in healthy eating.

Apart from identifying the reasons why consumers do not achieve dietary recommendations it is important to address another economic question: will German consumers pay more to consume diets in conformity with dietary recommendations, i.e. are they willing to pay more for diets high in healthy food diversity than for less healthy diversity? An answer to this question could be provided by investigating objective and subjective dietary quality. The nutritional concept of food diversity is objective, while subjective dietary quality refers to consumer's self-perceived quality of the diet. From an economic point of view, subjective dietary quality is expressed in the consumer's monetary expenditure on objectively measurable dietary quality. Knowing the consumer's willingness to pay for healthy diets could be useful to fully understand the consumption process by revealing the purchasing behaviour of food items.

1.2 Statement of objectives

This thesis aims at contributing interdisciplinary findings to explain dietary behaviour in Germany. The overall objectives are to work out factors that initiate consumers to demand diets of high quality as well as their willingness to pay for healthy eating. In this thesis, the quality of the diet is reflected by healthy food diversity. First of all, it is therefore necessary to identify appropriate indicators for that concept.

In the literature food diversity has been calculated using different measures. Counting different food items is frequently applied to measure food diversity in nutrition science (KREBS-SMITH ET AL., 1987). Economists measure it by considering the distribution of food quantities (LEE AND BROWN, 1989). According to these measures diversity is higher if a consumer eats two food items in equal shares as opposed to eating 90% of the first and 10% of the second food. Among other things, the main problem with existing diversity indicators is that neither nutritional nor economic diversity indicators distinguish whether the observed variety is a combination of different healthy or unhealthy products (e.g. fruits and sweets, respectively). While economists do not consider health aspects of diversity at all, nutritionists merely focus on healthy food items and neglect unhealthy ones. This would be necessary to evaluate consumers' overall dietary quality, however. Using the concept of healthy food diversity this thesis suggests a new indicator that captures the healthiness of the overall diet.

As has become clear, Germany faces huge dietary problems that burden the health care sector to an increasing degree. In order to correct the latest health trends, explanations for observed consumption behaviour are needed. Another main target of this work therefore is to find evidence about socio-economic determinants of consumer demand for healthy food diversity in Germany based on the economic theory of consumer demand.

Public health strategies and dietary information actions could become more efficient if there is additional information also about the consumers' willingness to pay for high dietary quality. To the best of the author's knowledge, only one study has ever estimated consumer's willingness to pay for healthy diets in the U.S. (RANNEY AND MCNAMARA, 2002). Empirical evidence for Germany is missing. A third objective of this thesis refers to estimate consumers' willingness to pay for healthy food diversity in Germany. The hedonic analysis can provide information about the subjective evaluations consumers have for the objective quality of their diet. Moreover, a hedonic analysis could reveal whether consumers actually have a preference for

healthy food diversity. According to DRESCHER, THIELE AND WEISS (2006) German consumers have a preference for diversity. They are willing to pay 1.95% to 2.73% more for a 50% increase in variety, *ceteris paribus*. There is a lack of empirical evidence for consumer preference and willingness to pay for healthy food diversity in Germany.

One novelty of this thesis lies in the interdisciplinary approach applied to investigating consumer demand for food diversity. This interdisciplinary understanding is particularly reflected in the development of the Healthy Food Diversity-Index, which benefits from both economic and nutritional concepts. Furthermore, the newly developed indicator enters economic analyses of determinants and willingness to pay for healthy diets in Germany. Another novelty is the economic framework developed that considers the particularities of the demand and willingness to pay for healthy food diversity. The aims of this thesis can be outlined in the following research questions:

- How should healthy food diversity be defined and measured?
- What is the most suitable theoretical economic framework that allows the study of both consumer demand and willingness to pay for healthy food diversity?
- What are the main socio-economic determinants of consumer demand for objectively measurable healthy food diversity in Germany?
- Do consumers have positive implicit prices for healthy food diversity and to what extent are they willing to pay for an additional unit of a varied diet?

Altogether, the results of this interdisciplinarity enable scientists to give important suggestions regarding health and nutrition policy. The findings could provide the basis for successfully communicating public health strategies to consumers by assisting governmental agencies to design appropriate educational programmes and to inform the general public about improving their diets. Besides, such research allows an assessment of the marginal social values of dietary informational actions.

1.3 Organisation of the thesis

In order to work out the research questions this thesis is divided into six chapters. Chapters 2 and 3 are mainly concerned with nutritional questions. Chapter 2 introduces the concept and indicators of dietary quality. Among existing dietary quality indicators, food diversity is selected and reviewed in

chapter 3. It demonstrates why international dietary guidelines consistently recommend eating diversely by demonstrating the most important results of nutritional diversity studies (chapter 3.1). Chapter 3.2 is concerned with the prevailing definitions and terminologies of food diversity in interdisciplinary research fields followed by a newly developed definition of healthy food diversity. Subsequently, interdisciplinary measures of food diversity are described together with their assets and drawbacks (chapter 3.3). As a tool able to measure healthy food diversity is missing, a new index is suggested in chapter 3.3.4. This Healthy Food Diversity-Index is validated based on data of the German Nutrition Survey of 1998 provided by the Robert Koch-Institute in Berlin.⁵

In chapter 4 a theoretical economic framework is developed which is able to explain consumer demand for healthy food diversity and beyond that, consumer's willingness to pay for a gradual improvement in dietary quality expressed by healthy food diversity. The traditional theory of consumer demand (chapter 4.1) assumes that the consumer derives utility from the consumption of goods. As it is very restrictive to explain the demand for a varied diet, extensions of traditional theory are introduced (chapter 4.2) which are theories of diversity and extended food demand theories. Among the extended food demand theories, special attention is given to the characteristics approach by LANCASTER (1966) in chapter 4.2.4.1. This approach breaks away from traditional theory by assuming that not the good generates utility but the characteristics contained in it. One extension of the characteristics approach is the Consumer Goods Characteristics Model (CGCM) by LADD AND SUVANNUNT (1976) (chapter 4.2.4.2). Within the CGCM, the demand for healthy food diversity is a function of prices, income, and consumer-describing characteristics. By means of the hedonic theory that can also be embedded into CGCM, a consumer's food expenditure is a function of healthy food diversity and other nutritional characteristics, which lead to the hedonic price function.

Chapter 5 is devoted to empirical analyses. Chapter 5.1 examines consumer demand for healthy food diversity in Germany using the newly constructed index from chapter 3.3.4. Consumer consumption behaviour is linked with corresponding socio-economic variables that are also provided by the German Nutrition Survey. Consumers' willingness to pay for healthy food diversity is estimated in chapter 5.2. To this end, the consumption data is extended

⁵ The author is thankful to Dr. Gert Mensink (Robert Koch-Institute, Berlin) for making the German Nutrition Survey available and additionally for his valuable and continuous support throughout the project.

by two external price data sets. Both data sets are provided through a cooperation of the Department of Food Economics and Consumption Studies, Chair of Household and Consumer-Oriented Health Economics, University of Kiel, with the Department of Agricultural Economics, University of Kiel, as well as the Department of Agricultural Economics and Rural Development, University of Göttingen.⁶ Chapter 5.3 discusses the most important outcomes of chapters 5.1 and 5.2 in a joint framework.

Finally, chapter 6 summarises the most important findings of the thesis and provides some implications for nutrition and health policy.

⁶ The author is grateful to Prof. Dr. Stephan von Cramon-Taubadel (University of Göttingen) and Prof. Dr. Jens-Peter Loy (University of Kiel) for sharing the MADAKOM data as well as to Prof. Dr. Jens-Peter Loy who made the ZMP data set available.