SHARE ERIC
SURVEY OF HEALTH, AGEING AND RETIREMENT IN EUROPE

SHARE WORKING PAPER SERIES

Meat Consumption in Old Age:

An Exploration of Country-specific and Socio-economic Patterns of Eating Habits of the European Population

Johanna Schütz, Fabio Franzese

Working Paper Series 32-2018

SHARE-ERIC | Amalienstr. 33 | 80799 Munich | Germany | share-eric.eu

mea | MAX-PLANCK-INSTITUT FÜR SOZIALRECHT UND SOZIALPOLITIK
Munich Center for the Economics of Aging

Horizon 2020

Federal Ministry of Education and Research

DFG

NIH National Institute on Aging

Meat Consumption in Old Age:

An Exploration of Country-specific and Socio-economic Patterns of Eating Habits of the European Population

*Johanna Schütz and Fabio Franzese**

Munich Center for the Economics of Aging (MEA),
Max Planck Institute for Social Law and Social Policy

Abstract: Diet is an important element of health behaviour. As studies show, changes in lifestyle and strategies of prevention can positively affect age-related diseases. Nevertheless, existing research on diet in old age as an element of health behaviour has been insufficient. To date, information about the eating habits of older Europeans is primarily procured from national surveys, but comparison is limited due to different methodological approaches. Employing data from the Survey of Health, Ageing and Retirement in Europe (SHARE), this article aims to empirically describe the meat and fish consumption of the European population aged 50 and older and to present similarities and differences between countries. Furthermore, we explore gender and age differences among the "passionate meat-eaters" – individuals who eat meat on a daily basis. We also consider elderly individuals who rarely eat meat and explore whether they do so due to economic reasons. In all 15 European countries included in the analysis, meat is eaten regularly, and meatless diets are rare. Daily meat consumption is more common among men. In the majority of countries, the share of older people who eat meat infrequently due to financial restrictions is rather small.

* Corresponding author: Fabio Franzese; E-mail: franzese@mea.mpisoc.mpg.de

Table of Contents

Introduction

Europe is experiencing demographic changes and has to adapt to the complex social and economic consequences. Human life expectancy has continuously increased during the last two centuries and western societies are now facing the challenge of older individuals constituting the fastest growing population group – a population group which has also an increased risk of disease and disability (Oeppen and Vaupel 2002; Christensen et al. 2009). Despite this increased risk, age-related diseases can be somewhat mitigated by changes in personal lifestyle patterns and prevention strategies (Kouvari, Tyrovolas, and Panagiotakos 2016), as has been shown by research on physical activity in old age, for instance (Rea 2017).

In addition to physical and mental activity, nutrition can be considered an essential element of health behaviour. Yet, nutrition is insufficiently researched as a component of health behaviour in old age (Kouvari, Tyrovolas, and Panagiotakos 2016). Studying the eating habits of older populations is relevant in many respects, since knowing the eating habits of older people is not only beneficial for tackling health-related aspects and challenges of the healthcare system, but also matters for organising food supplies and food services for the continuously growing older population (Fjellström, Sidenvall, and Nydahl 2001; Koehler and Leonhaeuser 2008).

Information on individual eating habits of older Europeans have been collected almost exclusively through national studies that differ in methodology, period of data collection, and

sample composition, among other dissimilarities. Ultimately, the numerous differences between these studies limit their comparability with each other (Volkert 2005). Dietary patterns of older individuals with an emphasis on meat consumption have not been sufficiently researched so far. This research gap is of particular relevance in this population since the meat consumption of the European population has doubled during the last 100 years and meat has ceased to be a luxury good and an indicator of wealth (Trummer 2015). Moreover, meat consumption has become a controversial topic that is discussed with regard to ethical, ecological, and health aspects (Kanerva 2013). The objective of our article is to empirically describe the meat consumption of the European population over the age of 50, using data collected from questionnaires administered in the Survey of Health, Ageing and Retirement in Europe (SHARE).

We will explore whether and how often people eat meat in their "second half" of life. Is meat a fixed or an irregular component of meals? Furthermore, we will show the similarities and differences between European countries in the frequency of meat consumption. Is it possible to identify general patterns of meat consumption among older Europeans or does every country have its peculiar habits? Past studies on the dietary behaviours of older people in different European countries have pointed towards a large variation between countries (Volkert 2005). The following analysis will clarify whether this also holds true when focusing solely on meat consumption. Beyond that, we will take a closer look at the "passionate meat eaters", meaning the people who eat meat or fish daily in old age. In this context, the existence of gender and age disparities will be explored. Finally, we will focus on older individuals who rarely eat meat or fish and examine the role of economic factors in their dietary behavior.

Meat and fish consumption in old age: Current state of research and research gaps

Although nutrition constitutes a core component of health behaviour, this factor has been insufficiently researched so far with regard to the older population (Kouvari, Tyrovolas, and Panagiotakos 2016). Concerning the diet of the older European population, there is no substantial research landscape (Irz et al. 2014). Furthermore, past studies on nutrition in old age in European countries have not focused on meat consumption (Fjellström, Sidenvall, and Nydahl 2001; Koehler and Leonhaeuser 2008). The existent studies examining the individual meat and fish consumption in the older population have concentrated mainly on the effects on mortality or health outcomes (e.g., cognitive functions, sarcopenia, cancer, or cardiovascular

diseases). Methodologically, many of these studies have focused on specific countries or have relied on non-representative samples, such as clinical samples (see Kouvari, Tyrovolas, and Panagiotakos 2016 for a summary). In the following section, we will present insights from selected national and transnational European studies of meat consumption of the older population.

Meat consumption of the older population in Europe: National studies

The most comprehensive study of eating behaviour in Germany, the "Nationale Verzehrstudie II" [National food consumption study], was conducted in 2005 and 2006 by means of two 24h-recalls (Max Rubner-Institut 2008a). The data showed that meat consumption slightly declines with age. Regardless of gender, the consumption of meat and meat products was lowest in the highest age group (65 to 80 years). For women, this amounted to an average of 46 grams of meat and meat product per day and for men, this amounted to an estimated 79 grams per day (Max Rubner-Institut 2008b). This decreasing trend in meat consumption was supported by the results of a later German study from 2013, in which 1,174 individuals were asked about their attitudes towards meat in an online survey (Cordts et al. 2013). Again, a weak relationship between meat consumption and age could be observed, as older participants reported lower meat intake than younger participants.

The 2012 "Österreichischer Ernährungsbericht" [Austrian nutrition report] (Elmadfa 2012) collected data on the eating behaviour of 419 adults, aged between 18 and 64 years, and 196 senior citizens, aged between 65 and 80 years. Study participants documented their food intake of nine food groups in two 24h-recalls. The consumption of meat and sausages (in grams per day) was lower for male senior citizens than for adult men under 65 years. In contrast, female senior citizens consumed more meat and sausages than adult women under 65 years (Elmadfa 2012).

In Great Britain, the dietary habits of the population is assessed periodically through the National Diet and Nutrition Survey, where participants document their nourishment in a diary on four consecutive days (Public Health England 2016). The study's 2016 report indicated that the average consumption of red and processed meat was 47 grams per day for women between 19 and 64 years, and 57 grams per day from 65 years onwards. For men, the amount was considerably higher with men between 19 and 64 years consuming an average of 84 grams of meat per day, and men 65 years and older consuming an estimated 81 grams of meat daily (Public Health England 2016).

Together, the various national studies present inconsistent patterns of meat intake among the older population in Europe. Though older people tended to eat less meat than the younger

population in Germany, this was only true among men in Austria, and no differences between age groups were found among British men. Among women in Austria and Great Britain, the meat consumption of older women was slightly higher than the meat consumption of younger women, contrary to the results of the German studies.

Meat consumption of the older population in Europe: multi-country studies

Transnational statistics on meat consumption in Europe can be accessed from the Eurostat (statistics office of the EU) and FAOSTAT (statistics department of the Food and Agriculture Organization of the UN (FAO)) databases. These data offer insight into the production and the supply of meat and fish in different countries. However, it is not possible to derive the amount of meat that is actually eaten by consumers. According to an estimation of the FAO, more than 20 percent of the meat produced and more than 30 percent of the fish produced in Europe ends up in the trash or gets lost on the way to the consumers by various processes including storage and packing (FAO 2011; Hallström and Börjesson 2013; Kanerva 2013).

Kanerva (2013) compared official meat supply statistics of the FAO for eight European countries (Germany, United Kingdom, Italy, Spain, France, the Netherlands, Finland, Hungary). The author defined consumption as meat that is available for human consumption, measured in grams per inhabitant. The meat data took into account several loss factors emerging between production and consumption in households, yet did not consider loss to preparation, disposal, or storage in households (Kanerva 2013). The study showed that higher shares of people over 65 corresponded with higher meat consumption in a country. Nevertheless, one cannot conclude that this association results from a higher consumption of meat among older people, as other interacting or confounding factors might be crucial. Despite the general association between meat consumption and age composition, the consumption of beef constituted an exception. In seven out of eight examined European countries – except for Spain – beef consumption was lower at older ages. The author speculated that the underlying causes may be the conservative eating habits of older cohorts and the negative health image of beef.

Figures on the frequency of meat consumption of the European population are available through a 2012 Eurobarometer survey conducted by the European Commission. In 27 EU countries and Croatia people above age 15 were asked how often they ate meat per week. The results exhibited substantial differences in the frequency of meat consumption in the EU countries. The highest frequency of meat consumption was reported by the Danish population, with 55 percent of Danish participants reporting meat intake more than five times per week (people over 55 years: 43 percent). The Netherlands came second with a (substantially lower)

share of 34 percent who consumed meat more than five times a week (for the people over 55 years, this only amounted to 23 percent). In Italy, Malta, and Greece, over all age groups, less than five percent of the population indicated that they consumed meat more than five times a week. The highest share of people declaring no meat intake lived in Great Britain (six percent; five percent for the people over 55), followed by Finland (four percent; three percent for the people over 55). In all other EU countries, the share of those abstaining from meat was between one and three percent (European Commission 2013). As these are survey data for a total population, the number of older respondents were occasionally very low, limiting the explanatory power of the data concerning meat consumption in the older population.[1]

Data set and sample description

The fifth wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) (Börsch-Supan 2017)[2] served as a data source for the following analyses. SHARE is a multidisciplinary longitudinal survey which collects data on socio-economic and health conditions of the European population aged 50 or older (Börsch-Supan et al. 2013).

Data on individual meat consumption is available in the fifth survey wave, which was conducted in 14 European countries and Israel in 2013. The information was obtained through a self-report of the frequency of intake, whereas the amount of intake was not enquired. For the question "In a regular week, how often do you eat meat, fish or poultry?", the answer options "Every day" / "3-6 times a week" / "Twice a week" / "Once a week" / "Less than once a week" were available. If the respondents reported eating meat or fish twice a week or less frequently, they were asked in a follow-up question whether they could not "afford to eat it more often", or whether they eat meat or fish seldomly "for other reasons".[3] Consequently, we refer to the eating frequency whenever using the term meat and fish "consumption". The actual amount consumed cannot be considered.

For our analyses, we used a sample of individuals aged 50 or older with valid responses to the question concerning the frequency of meat and fish consumption. Thus, we arrived at a

[1] Another survey of the European Commission collected changes in meat consumption in Europe as well as personal assessments whether meat and fish are considered healthy or unhealthy, however, no eating frequencies were surveyed (European Commission 2006).

[2] The analyses were conducted with the data version 6.0.0.

[3] Because of a deviation in the questionnaire instrument (Stuck et al. 2017, 32), there is a slight difference in the number of respondents of the follow-up questions compared to the number of respondents having stated a rare meat and fish consumption. Some respondents were not asked the follow-up question although they had stated eating meat or fish less than twice a week.

sample of 64,812 individuals from 15 countries. The number of interviews per country ranged from 1,586 in Luxembourg to 6,560 in Spain. Figure 1 provides an overview of the sample.
We combined the results of the analyses of the SHARE data with macro-information from the particular countries. The gross domestic products (GDP) per capita (in US dollars, at current prices adjusted for purchasing power parities) in the survey year, 2013, were extracted from the OECD (2016) database. Data on price level indices for food, meat and fish were provided by Eurostat (2016).[4] Calibrated cross-sectional weights, which were provided in the SHARE data set (Stuck et al. 2017), were used for all descriptive analyses, allowing for conclusions representative of the population aged 50 and older.

Figure 1: Description of the sample.

Country	Gender		Age				Total
	Male	Female	50-59	60-69	70-79	80+	
Austria	1,831	2,443	1,076	1,499	1,196	503	4,274
Germany	2,660	2,902	2,009	1,781	1,316	456	5,562
Sweden	2,107	2,399	825	1,839	1,257	585	4,506
Netherlands	1,850	2,258	1,176	1,614	898	420	4,108
Spain	3,038	3,522	1,717	2,028	1,616	1,199	6,560
Italy	2,128	2,526	1,256	1,594	1,272	532	4,654
France	1,902	2,507	1,187	1,549	977	696	4,409
Denmark	1,884	2,161	1,431	1,389	795	430	4,045
Switzerland	1,360	1,621	877	1,054	721	329	2,981
Belgium	2,494	3,022	1,898	1,780	1,118	720	5,516
Israel	1,114	1,404	620	907	632	359	2,518
Czechia	2,297	3,223	1,338	2,259	1,385	538	5,520
Luxembourg	749	837	610	533	276	167	1,586
Slovenia	1,263	1,644	868	963	702	374	2,907
Estonia	2,248	3,418	1,349	1,811	1,718	788	5,666
Total	28,925	35,887	18,237	22,600	15,879	8,096	64,812

Data: SHARE w5 6-0-0, weighted. Own calculations.

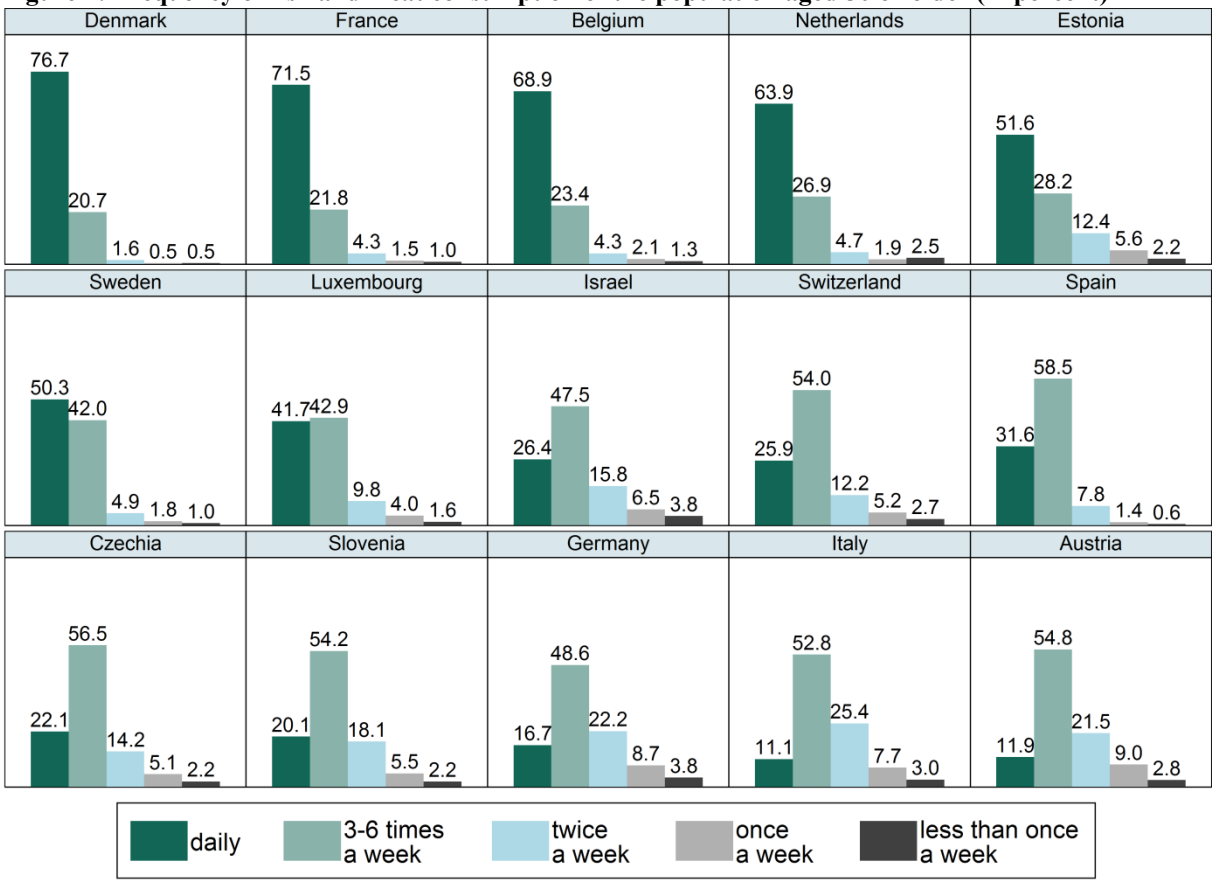
Comparison between countries regarding meat eating frequencies

Figure 2 elucidates the country-specific frequencies of meat consumption, and clearly shows that the categories “daily consumption” and “3-6 times a week” were mentioned most frequently. In all studied European countries and Israel, meat and fish seem to be consumed on a regular basis by the population over 50. In the Netherlands, France, Denmark, Belgium,

[4] There is no information available for Israel.

and Estonia, more than half of the respondents reported eating meat or fish daily. In Sweden, exactly half of the individuals aged 50 or older answered likewise. Denmark and France had the highest values of frequent meat consumption, with more than 70 percent of the respondents stating daily meat consumption. Less than five percent of the respondents in all countries reported eating meat less than once a week. Although the answer option "never" was not available, we can estimate that the percentage of vegetarians and vegans among the respondents were in the single-digit percentage range. Among the 66,000 interviews available in the SHARE data without sample restrictions, there were only four refusals, and only 30 individuals who answered with "don't know". As such, it can be assumed that vegetarians did not systematically refuse to answer this question or answer with "don't know".

Figure 2: Frequency of fish and meat consumption of the population aged 50 or older (in percent)



Data: SHARE w5 6-0-0, weighted. N=64,812. Own calculations.

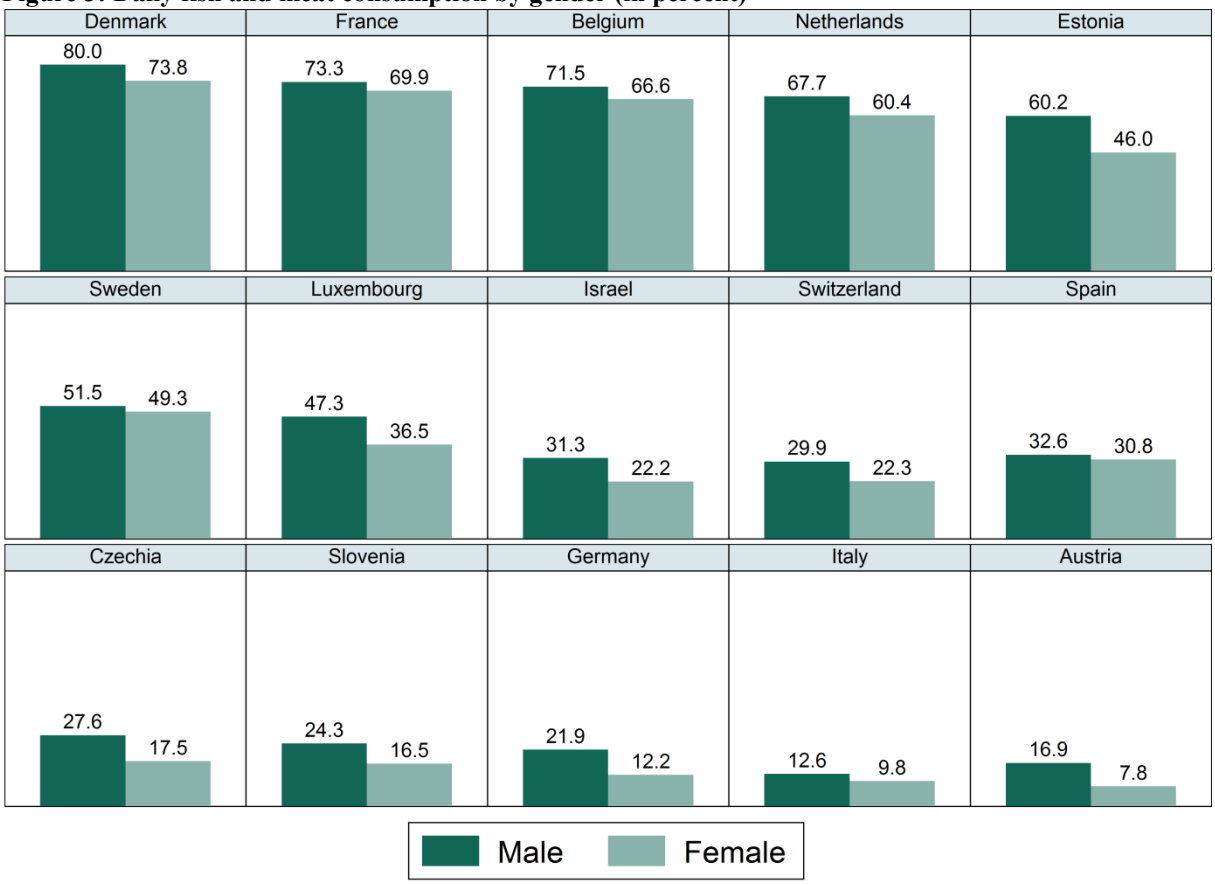
Age and gender differences of "passionate meat eaters"

In this section we exclusively consider individuals aged 50 and older who consume meat or fish daily.

At first glance, the results support known gender disparities in meat consumption (see e.g., Gossard and York 2003; Prättälä et al. 2007; Fekete et al. 2012; Schösler et al. 2015). The

higher daily meat intake among men in comparison to women is a cross-border phenomenon. However, in Italy, Sweden, and Spain, the difference between the sexes is rather small (less than 3 percentage points). In contrast, larger differences could be found in Luxembourg, Estonia, Israel, Czechia, Germany, and Austria (between 9 and 14 percentage points) (see Figure 3).

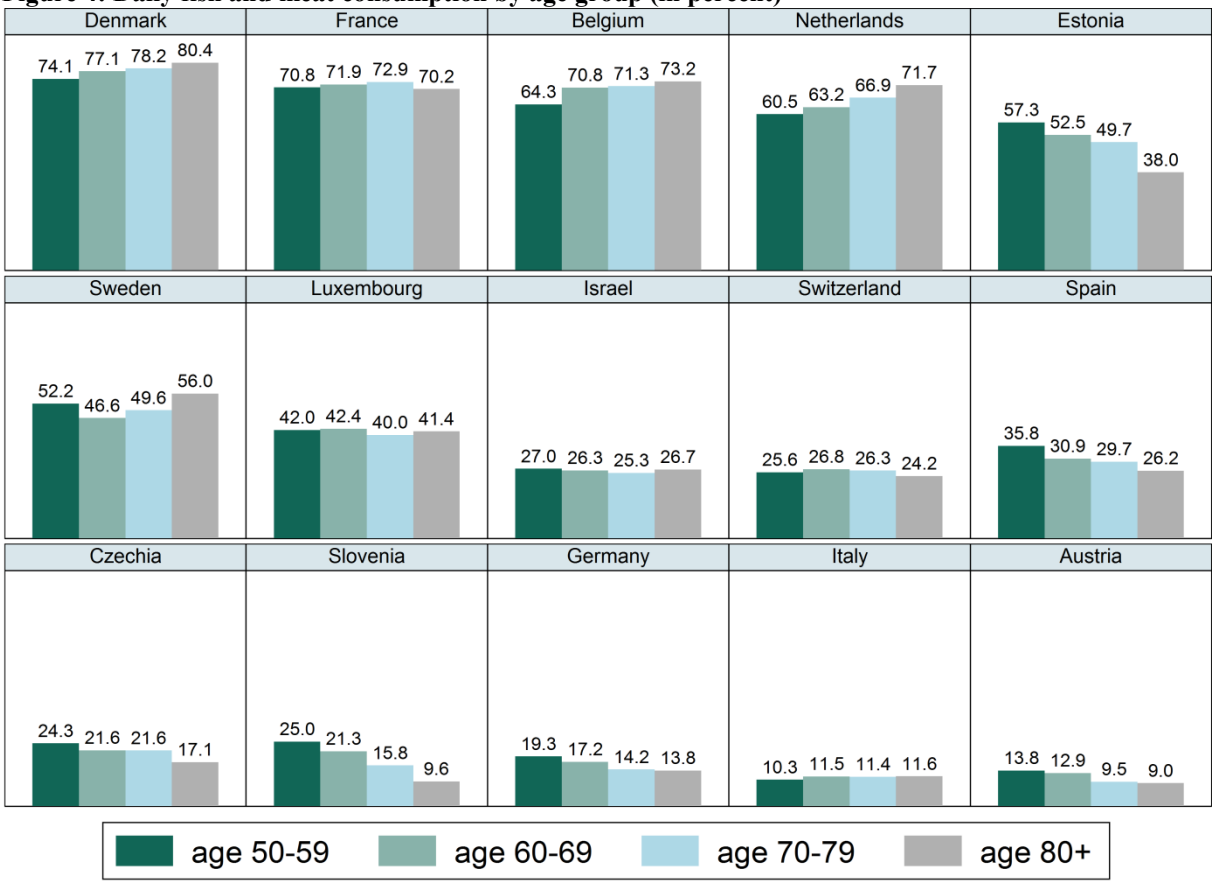
Figure 3: Daily fish and meat consumption by gender (in percent)



Data: SHARE w5 6-0-0, weighted. N=64,812. Own calculations.

Figure 4 illustrates the proportion of daily meat eaters in the various age groups. The largest difference exists between the youngest and the oldest age group in Estonia and Slovenia (19.3 and 15.4 percentage points). For most countries, the disparities between age groups are rather small. Nevertheless, some patterns in the trends between age and meat or fish consumption become apparent. In the Netherlands, Belgium, and Denmark, the share of people consuming meat or fish on a daily basis increases with age. In contrast, in Austria, Germany, Spain, Slovenia, Czechia, and Estonia, the share of daily meat eaters is lower in higher age groups. Sweden, Switzerland, Italy, France, Israel, and Luxembourg are amongst the countries without (systematic) differences between the age groups.

Figure 4: Daily fish and meat consumption by age group (in percent)



Data: SHARE w5 6-0-0, weighted. N=64,812. Own calculations.

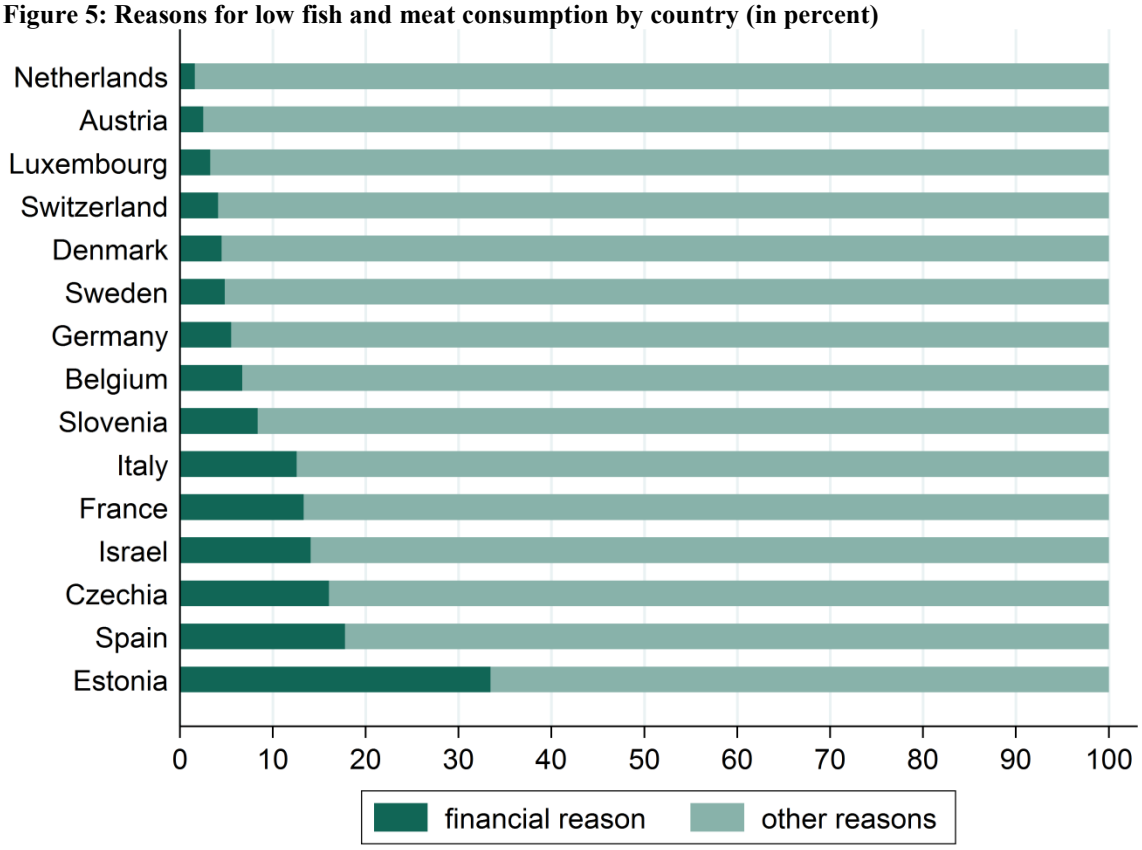
Because this study utilised cross-sectional data, it cannot be determined whether the demonstrated disparities are age or cohort effects. Cohort effects may play a role, considering that individuals of each specific age group grew up and were socialised under similar circumstances. The social and economic situation and the thereby resulting nutrition during childhood affect dietary attitudes, habits, and familiarity that persist over the life course (Winter Falk, Bisogni, and Sobal 1996; Brombach 2000). Certain birth cohorts shared, for instance, the experience of war and famine. Such similarities can permanently influence the appreciation of certain nourishment and individual food preferences. Possible age effects of changes in dietary behaviour may have health-related reasons – for example, certain illnesses require a certain diet, sense of smell and taste can change with age, and natural teeth are replaced by artificial ones (Koehler and Leonhaeuser 2008). Moreover, physical constraints in old age can impair the ability to prepare certain meals (e.g. Volkert 2005), for example, cutting and preparing meat may no longer be possible. However, it could be also the case that major intentional changes in dietary behaviour become less likely with increasing age. For instance, a study based on German population data showed that older adults are well informed

about the health consequences of overeating, but that the intention of overweight adults to change their nutritional behaviour decreased with age (Winter 2013).

Reasons for low fish and meat consumption

Next, we focus on individuals who reported eating meat rarely or never. As described above, in most of the countries only a minority of the people aged 50 or older consumed meat or fish less than three times a week. Asked for the reasons for their rare meat consumption, few of them stated financial causes (see Figure 5). In nine out of 15 countries, this minority constituted less than ten percent of the respondents. However, there were also countries where economic aspects influenced the meat and fish intake of larger population groups. With 33 percent, Estonia had the largest share of respondents who attributed their low meat consumption to financial reasons. In Spain, this was true for at least 18 percent of the survey participants with low meat consumption.

Figure 5: Reasons for low fish and meat consumption by country (in percent)



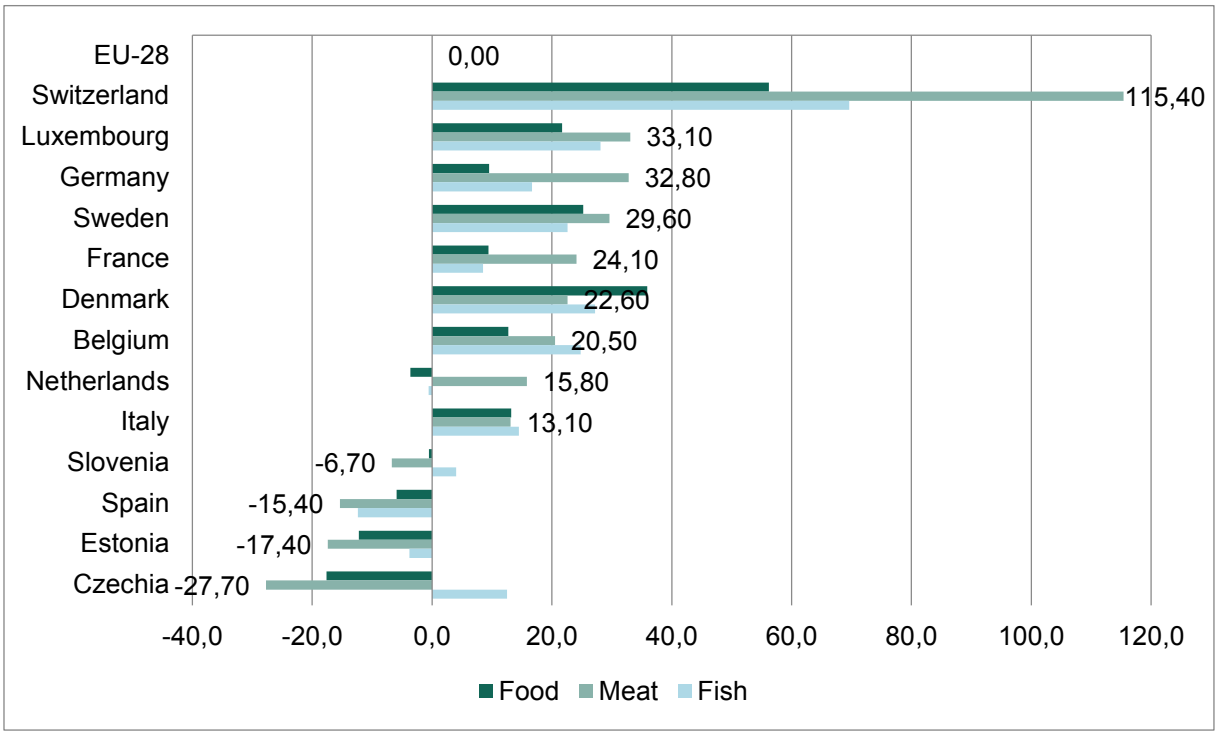
Data: SHARE w5 6-0-0, weighted. N=10,420. Own calculations.

Economic factors and nutrition

According to the reports of the surveyed Europeans, monetary reasons do not seem to play a major role in choosing a completely or almost meat-free diet. Objectively, supply and prices for meat and fish vary substantially between European countries.

When analysing the association between meat consumption and economic factors, it is worthwhile to consider the relationship of prices for food in European countries. Figure 6 depicts the prices for meat, fish and food as a whole in the particular countries compared to the EU average.[5] Unsurprisingly, prices in countries with a relatively high Gross Domestic Product (GDP) were substantially higher than the EU average, whereas prices in economically weaker countries were below the EU average. Combining prices for food with the frequencies of fish and meat consumption based on SHARE data on country level, no association could be found between the price of food and the frequency of meat or fish consumption (results not shown).

Figure 6: Price level indices for food, meat, and fish in 2013 in comparison to the EU average



Data: Eurostat (2016). Own depiction.

The impact of economic factors on nutrition has been examined in several studies at both the micro and macro level. Previous investigations from various European countries have reported unanimously that higher fish consumption was associated with higher income (Moreira and Padrão 2004; Bonaccio et al. 2012; Maguire and Monsivais 2015; Méjean et al. 2016).[6] Concerning the eating frequency of older adults, Dijkstra et al. (2014) showed that higher fish consumption is associated with higher income for this population group as well. The same European studies identified a negative association between meat consumption and

[5] This figure was created following Eyerund (2015).
[6] These studies measured fish consumption as daily intake in grams (except for Moreira and Padrão (2004), who examined eating frequency).

income (Moreira and Padrão 2004; Bonaccio et al. 2012; Maguire and Monsivais 2015; Méjean et al. 2016). This association was found to be consistent with an analysis of older adults, and was particularly apparent in men; individuals with lower incomes consumed meat more often per week (Samieri et al. 2008). Presumably, these findings are not a direct effect of income. It is more likely that income correlates strongly with other characteristics such as education, knowledge about food, and ecological attitudes (see Méjean et al. 2016).

The connection between wealth and meat consumption has been already identified in macro-analyses. Most of the studies have linked national indicators of wealth to information on meat consumption or supply. It has often been observed that the association between GDP per capita and meat consumption follows an inverted U-shaped curve (Vinnari, Vehema, and Luukkanen Jyrki 2006; Cole and McCoskey 2013; Vranken et al. 2014). In a study of Cole and McCoskey (2013), the turning point was identified at a very high income level. As a result, few countries have reached the GDP level required for a decline in meat consumption. In contrast, other studies have found a positive linear association rather than an inverted U-shaped relationship (York and Gossard 2004; Frank 2008; Sans and Combris 2015). Another study with FAO data found no association between meat consumption (in percent of the overall energy intake) and GDP, although the share of food of animal origin increases with rising GDP per capita (Mathijs 2015).[7]

In contrast to the macro-level studies mentioned above, which have generally supported an association between the wealth of a country and its level of meat consumption, our data did not confirm this association. We only detected a slight association between GDP per capita and the share of the older population consuming meat or fish daily ($r = 0.15$, see Figure 7).

[7] In these studies, meat consumption was derived from macro data of FAOSTAT on meat supply, measured in kilograms per capita per country or the share of caloric intake through animal products.

Figure 7: Share of daily meat eaters aged 50 and older w.r.t. the GDP of a country

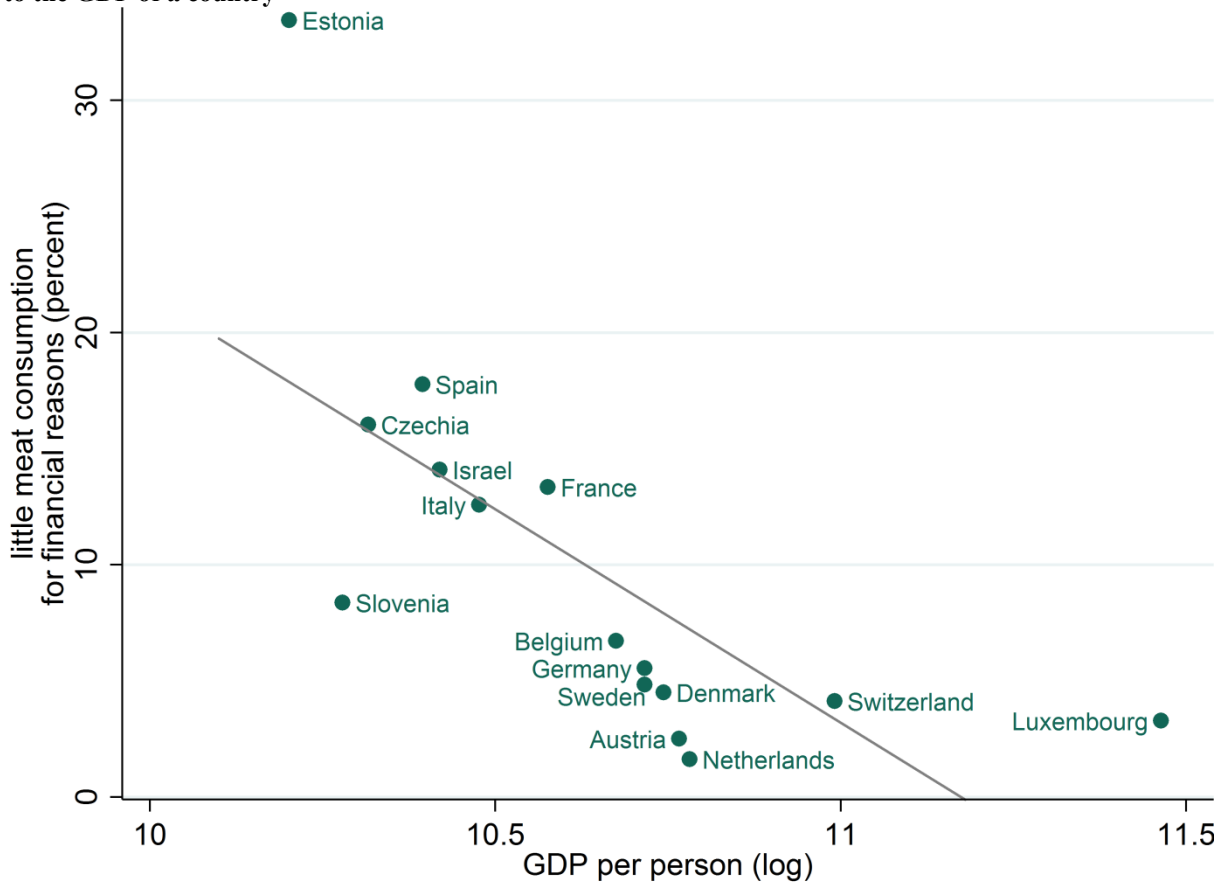
Data: SHARE w5 6-0-0, OECD (2016). r=0.15. Own calculations.

The deviation of our results from the results of previous investigations could have several explanations. In the SHARE data, the measurement of meat consumption is not based on a quantity, but on the frequency of consumption. In addition, relatively few and mainly (wealthy) European countries are considered in the cross-section, so there is less variation than in global comparisons or time series analyses. As a result, the prosperity of a country did not seem to be related to the frequency of meat and fish consumption within Europe. However, a clear association could be seen in relation to GDP and the proportion of respondents who, for financial reasons, did not eat meat more often.

In Figure 8, the two values for all the countries studied as well as the resulting regression line (linear OLS) are shown on a coordinate system, with a clear correlation to be seen (r = –0.70). The higher the GDP of a country, the smaller population proportions of individuals who for financial reasons rarely consumed meat or fish.[8]

[8] Figure 8 uses the natural logarithm of GDP. Also if the GDP is used without transformation, there is a clear correlation (r = –0.58).

Figure 8: Share of individuals aged 50 or older who eat fish and meat rarely out of financial reasons, w.r.t. to the GDP of a country



Data: SHARE w5 6-0-0, OECD (2016). r=0.70. Own calculations.

Discussion

Research on health behaviour, including eating habits, plays an important role in the context of population ageing and increased life expectancy. With the current state of research, meat cannot be classified as a healthy or unhealthy food per se, but, for some diseases, there are recommendations regarding the consumption of meat or fish. On the one hand, meat provides proteins and essential micronutrients such as iron, zinc, and vitamin B12. On the other hand, the consumption of red (especially processed) meat has been linked to an increased risk of type 2 diabetes, colorectal cancer, cardiovascular diseases, and mortality (Ekmekcioglu et al. 2016). These non-communicable diseases have become the predominant cause of death in Europe (OECD/EU 2016) and play a correspondingly large role in the second half of life. However, other evidence suggests that red unprocessed meat can serve as an important source of protein that could counteract muscular atrophy and cognitive dysfunction in old age (Kouvari, Tyrovolas, and Panagiotakos 2016). Concerning fish consumption, the state of research is similarly controversial. The intake of omega-3 fatty acids, protein and other nutrients through fish consumption is considered to be health enhancing in terms of heart

diseases, type 2 diabetes, neurological development, and mortality. However, the exposure of marine animals to environmental toxins in the form of heavy metals such as mercury or arsenic is well-known and poses a risk to public health (Miklavcic et al. 2013; Ren et al. 2016).

Data on the actual extent of meat consumption of the older population can provide an evidence base for future nutrition recommendations or health-policy considerations. For mastering the challenges of population ageing in Europe, a relevant component is the knowledge of needs and preferences of the eating behaviour of older individuals. The objective of our contribution was to describe similarities and differences in the meat consumption of the population aged 50 and older in Europe. Our analyses showed that typical gender disparities can be observed in all countries. The relation between age and the frequency of meat consumption, however, differed from country to country. There was no explicit pattern revealing whether the frequency of meat consumption increases, decreases or remains constant with age. In general, it can be stated that the examined cohorts are regular meat eaters, whereas vegetarians are rare. This data also showed that the frequency of meat consumption could not be explained by economic reasons in the studied sample. The relation is considerably more complex, and cultural, regional and many other macro-level aspects as well as individual, socio-demographic characteristics may interact (Kutsch 2000; Kanerva 2013). It would be interesting to explore information on the motives for consumption or non-consumption of meat, which are unfortunately unavailable in this data source. An already mentioned advantage of the study is the uniform method of collection and resulting comparability of the frequency of meat consumption for many countries. In contrast to studies that use data on meat supply in particular countries and relate this to the number of inhabitants, SHARE data depict the actual (self-reported) individual frequency of meat intake.

At this point, the boundaries and limitations of the data used here should also be explicitly mentioned. Firstly, it was not possible to differentiate between the consumption of meat and fish in this study. As fishing and fish consumption vary in importance in the various European countries, it would be worthwhile to analyse fish consumption separately. Secondly, the data were collected through a voluntary self-report of the eating frequency and as such can be biased by the response behaviour of the respondents. How often meat is actually eaten by the older population could differ from the reported information. For instance, due to a false assessment of what one's own consumption is in a "regular week", or cultural differences in the response behaviour. Thirdly, vegetarians and vegans are not clearly identifiable. Though they certainly contribute to the group which consumes meat once or less in the week, the

exact percentage of vegetarians and vegans could not be quantified. Nevertheless, it can certainly be noted that the proportion of older people who are potentially vegetarians was below four percent. Finally, it should be emphasised that the study deals solely with cross-sectional data. Our analysis of the meat eating habits of the different age groups of the older population contributes to the limited research landscape. However, only statements about the birth cohorts of the SHARE survey can be made. The nutrition of future generations in old age cannot be predicted from these results, and it is possible that today's younger generation will consume far less meat in old age than the current elderly population, as they are growing up under the impression of meat scandals and trends such as vegetarianism and veganism.

Acknowledgments

This paper uses data from SHARE Wave 5 (DOI:10.6103/SHARE.w5.600), see Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N°211909, SHARE-LEAP: N°227822, SHARE M4: N°261982). Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

Johanna Schütz received funding from *MaxNetAging*.

We would like to thank Nataliia Shvets, Manuel Kronenberg, Julia Blaut, and Nana-Adjoa Kwarteng for proofreading, translation support, and valuable comments.

References

Bonaccio, Marialaura, Americo E. Bonanni, Augusto Di Castelnuovo, Francesca de Lucia, Maria B. Donati, Giovanni de Gaetano, and Licia Iacoviello. 2012. "Low income is associated with poor adherence to a Mediterranean diet and a higher prevalence of obesity: cross-sectional results from the Moli-sani study." *BMJ open*, 2(6): 1–9.

Börsch-Supan, Axel. 2017. "Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 5." doi: 10.6103/SHARE.w5.600.

Börsch-Supan, Axel, Martina Brandt, Christian Hunkler, Thorsten Kneip, Julie Korbmacher, Frederic Malter, Barbara Schaan, Stephanie Stuck, and Sabrina Zuber. 2013. "Data

Resource Profile: the Survey of Health, Ageing and Retirement in Europe (SHARE)." *International journal of epidemiology*, 42(4): 992–1001.
Brombach, Christine. 2000. *Ernährungswissenschaft*, *Ernährungsverhalten im Lebensverlauf von Frauen über 65 Jahren. Eine qualitativ biographische Untersuchung*. Gießen: Köhler.
Christensen, Kaare, Gabriele Doblhammer, Roland Rau, and James W. Vaupel. 2009. "Ageing populations: the challenges ahead." *Lancet*, 374(3): 1196–208.
Cole, Jennifer R., and Suzanne McCoskey. 2013. "Does global meat consumption follow an environmental Kuznets curve?" *Sustainability: Science, Practice, & Policy*, 9(2): 26–36.
Cordts, Anette, Achim Spiller, Sina Nitzko, Harald Grethe, and Nuray Duman. 2013. "Fleischkonsum in Deutschland. Von unbekümmerten Fleischessern, Flexitariern und (Lebensabschnitts-) Vegetariern." *FleischWirtschaft*(7.2013): 59–63.
Dijkstra, S. C., J. E. Neter, I. A. Brouwer, M. Huisman, and M. Visser. 2014. "Adherence to dietary guidelines for fruit, vegetables and fish among older Dutch adults; the role of education, income and job prestige." *The journal of nutrition, health & aging*, 18(2): 115–21.
Ekmekcioglu, Cem, Peter Wallner, Michael Kundi, Ulli Weisz, Willi Haas, and Hans-Peter Hutter. 2016. "Red meat, diseases, and healthy alternatives. A critical review." *Critical reviews in food science and nutrition*: 1–15.
Elmadfa, Ibrahim. 2012. "Österreichischer Ernährungsbericht 2012."
European Commission. 2006. "Special Eurobarometer 246. Health and Food." Wave 64.3.
European Commission. 2013. "Flash Eurobarometer 367. Attitudes of Europeans towards building the single market for green products."
Eurostat. 2016. "Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates (prc_ppp_ind)."
Eyerund, Theresa. 2015. "Fleischkonsum in Deutschland und Europa. Ausgewählte Zahlen und Fakten." IW-Report.
FAO. 2011. "Global food losses and food waste – Extent, causes and prevention."
Fekete, Christine, Simone Weyers, Susanne Moebus, Nico Dragano, Karl-Heinz Jöckel, Raimund Erbel, Stefan Möhlenkamp, Natalia Wege, and Johannes Siegrist. 2012. "Age-Specific Gender Differences in Nutrition: Results from a Population-Based Study." *Health Behaviour & Public Health*, 2(1): 10–20.
Fjellström, Christina, Birgitta Sidenvall, and Margaretha Nydahl. 2001. "Food Intake and the Elderly — Social Aspects." In *Food, People and Society*, ed. Lynn J. Frewer, Einar Risvik, and Hendrik Schifferstein, 197–209. Berlin, Heidelberg: Springer Berlin Heidelberg.
Frank, Joshua. 2008. "Is there an "animal welfare Kuznets curve"?" *Ecological Economics*, 66(2-3): 478–91.
Gossard, Marcia H., and Richard York. 2003. "Social Structural Influences on Meat Consumption." *Human Ecology Review*, 10(1): 1–9.
Hallström, Elinor, and Pål Börjesson. 2013. "Meat-consumption statistics: reliability and discrepancy." *Sustainability: Science, Practice, & Policy*, 9(2): 37–47.
Irz, Xavier, Laura Fratiglioni, Nataliya Kuosmanen, Mario Mazzocchi, Lucia Modugno, Giuseppe Nocella, Behnaz Shakersain, W. B. Traill, Weili Xu, and Giacomo Zanello. 2014. "Sociodemographic determinants of diet quality of the EU elderly: a comparative analysis in four countries." *Public health nutrition*, 17(5): 1177–89.
Kanerva, Minna. 2013. "Meat consumption in Europe: Issues, trends and debates." artec-paper Nr. 187.

Koehler, Jacqueline, and Ingrid-Ute Leonhaeuser. 2008. “Changes in food preferences during aging.” *Annals of nutrition & metabolism*, 52 Suppl 1: 15–19.
Kouvari, Matina, Stefanos Tyrovolas, and Demosthenes B. Panagiotakos. 2016. “Red meat consumption and healthy ageing: A review.” *Maturitas*, 84: 17–24.
Kutsch, Thomas. 2000. “Konturen einer Ernährungssoziologie.” In *Konsum. Soziologische, ökonomische und psychologische Perspektiven*, ed. Doris Rosenkranz, and Norbert F. Schneider, 149–68. Opladen: Leske + Budrich.
Maguire, Eva R., and Pablo Monsivais. 2015. “Socio-economic dietary inequalities in UK adults: an updated picture of key food groups and nutrients from national surveillance data.” *The British journal of nutrition*, 113(1): 181–89.
Mathijs, Erik. 2015. “Exploring future patterns of meat consumption.” *Meat Science*, 109: 112–16.
Max Rubner-Institut. 2008a. “Nationale Verzehrsstudie II. Ergebnisbericht, Teil 1.”
Max Rubner-Institut. 2008b. “Nationale Verzehrsstudie II. Ergebnisbericht, Teil 2.”
Méjean, Caroline, Wendy Si Hassen, Christelle Lecossais, Benjamin Allès, Sandrine Péneau, Serge Hercberg, and Katia Castetbon. 2016. “Socio-economic indicators are independently associated with intake of animal foods in French adults.” *Public health nutrition*, 19(17): 3146–57.
Miklavcic, Ana, Anica Casetta, Janja Snoj Tratnik, Darja Mazej, Mladen Krsnik, Marika Mariuz, Katia Sofianou, Zdravko Spiric, Fabio Barbone, and Milena Horvat. 2013. “Mercury, arsenic and selenium exposure levels in relation to fish consumption in the Mediterranean area.” *Environmental research*, 120: 7–17.
Moreira, Pedro A., and Patricia D. Padrão. 2004. “Educational and economic determinants of food intake in Portuguese adults: a cross-sectional survey.” *BMC public health*, 4: 58.
OECD. 2016. “GDP per capita and productivity levels.”
OECD/EU. 2016. *Health at a Glance: Europe 2016*. Paris: OECD Publishing.
Oeppen, Jim, and James W. Vaupel. 2002. “Demography. Broken limits to life expectancy.” *Science (New York, N.Y.)*, 296(5570): 1029–31.
Prättälä, Ritva, Laura Paalanen, Daiga Grinberga, Ville Helasoja, Anu Kasmel, and Janina Petkeviciene. 2007. “Gender differences in the consumption of meat, fruit and vegetables are similar in Finland and the Baltic countries.” *European journal of public health*, 17(5): 520–25.
Public Health England. 2016. “National Diet and Nutrition Survey Results from Years 5 and 6 (combined) of the Rolling Programme (2012/2013 – 2013/2014).”
Rea, Irene M. 2017. “Towards ageing well. Use it or lose it: Exercise, epigenetics and cognition.” *Biogerontology*, 18(4): 679–91.
Ren, Z., C. Huang, H. Momma, Y. Cui, S. Sugiyama, K. Niu, and R. Nagatomi. 2016. “The consumption of fish cooked by different methods was related to the risk of hyperuricemia in Japanese adults: A 3-year follow-up study.” *Nutrition, metabolism, and cardiovascular diseases : NMCD*, 26(9): 778–85.
Samieri, Cecilia, Marthe-Aline Jutand, Catherine Feart, Lucile Capuron, Luc Letenneur, and Pascale Barberger-Gateau. 2008. “Dietary patterns derived by hybrid clustering method in older people: association with cognition, mood, and self-rated health.” *Journal of the American Dietetic Association*, 108(9): 1461–71.
Sans, P., and P. Combris. 2015. “World meat consumption patterns: An overview of the last fifty years (1961-2011).” *Meat Science*, 109: 106–11.

Schösler, Hanna, Joop de Boer, Jan J. Boersema, and Harry Aiking. 2015. “Meat and masculinity among young Chinese, Turkish and Dutch adults in the Netherlands.” *Appetite*, 89: 152–59.

Stuck, Stephanie, Sabrina Zuber, Markus Kotte, Fabio Franzese, Stefan Gruber, and Tim Birkenbach. 2017. “SHARE Releaseguide 6.0.0.” http://www.share-project.org/fileadmin/pdf_documentation/SHARELIFE_release_guide_6.0.0.pdf.

Trummer, Manuel. 2015. “Die kulturellen Schranken des Gewissens – Fleischkonsum zwischen Tradition, Lebensstil und Ernährungswissen.” In *Was der Mensch essen darf*, ed. Gunther Hirschfelder, Angelika Ploeger, Jana Rückert-John, and Gesa Schönberger, 63–79. Wiesbaden: Springer Fachmedien Wiesbaden.

Vinnari, Markus, Jarmo Vehema, and Luukkanen Jyrki. 2006. “Animal based food consumption in the EU: do we decrease our meat consumption when income levels rise?” In *Turun kauppakorkeakoulun julkaisuja, Keskustelua ja raportteja, Lifestyles and social change. Essays in economic sociology*, ed. Terhi-Anna Wilska, and Leena Haanpää, 229–52. Turku: Turun kauppakorkeakoulu.

Volkert, Dorothee. 2005. “Nutrition and lifestyle of the elderly in Europe.” *Journal of Public Health*, 13(2): 56–61.

Vranken, Liesbet, Tessa Avermaete, Dimitrios Petalios, and Erik Mathijs. 2014. “Curbing global meat consumption. Emerging evidence of a second nutrition transition.” *Environmental Science & Policy*, 39: 95–106.

Winter, Kristin. 2013. “Soziale und sozialpsychische Determinanten des Gesundheitsverhaltens. Eine theoriegeleitete Analyse am Beispiel von Überernährung und Tabakkonsum.” Inaugural-Dissertation zur Erlangung des Doktorgrades (Dr. phil.). Berlin.

Winter Falk, Laura, Carole A. Bisogni, and Jeffery Sobal. 1996. “Food Choice Processes of Older Adults. A Qualitative Investigation.” *Journal of Nutrition Education*, 28(5): 257–65.

York, Richard, and Marcia H. Gossard. 2004. “Cross-national meat and fish consumption: Exploring the effects of modernization and ecological context.” *Ecological Economics*, 48(3): 293–302.