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Is eating meat the new smoking? Exploring the dynamics between meat consumption and education in Switzerland

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Abstract

Purpose – This study aims to test Singer's suggestion that 'over the next 20 years meat could follow smoking into disrepute" using the findings of the recent literature on meat consumption, education and smoking and data from consumers in Switzerland in 1990–2017.

Design/methodology/approach – We hypothesise that meat consumption in developed countries has increasingly shifted to people with less education, as has been observed for smoking in previous studies. Using trend analysis by regressions, we describe the consumption dynamics of nine sorts of meat in Switzerland and estimate meat consumption trends for populations with and without university education separately.

Findings – Our results partly confirm the hypothesis. Less educated households consume more non-fish meat per person than households with at least one member educating or having finished education at university. For most categories of meat, the relative decline in consumption has been significantly higher for households in which at least one person holds a university education.

Originality/value – Our study contributes to the studies on sociology of meat eating and suggests paying more attention to risks related to meat consumption and to awareness of the population about these risks.

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Keywords Meat, Switzerland, Education, Trend analysis

Paper type Research paper

1. Introduction

Meat eating is strongly connected with health risks (particularly red meat: Forouzanfar *et al.*, 2015; Steinbach *et al.*, 2020; Iqbal *et al.*, 2021), criticised as unethical to animals (Mann, 2020; Heidemann *et al.*, 2020), overuses the environment and contributes to climate change (Gossard and York, 2003; Stoll-Kleemann and Schmidt, 2016; Poore and Nemecek, 2018; IPCC, 2019). In developed countries, higher meat consumption is associated with lower education and (often) lower income (CEDAR, 2014; Zeng *et al.*, 2019; Kirbiš *et al.*, 2021; Miller *et al.*, 2022), and Switzerland is no exception (Schneid Schuh *et al.*, 2018; Eichholzer and Bisig, 2000). The literature about reducing meat consumption has grown tremendously over recent years (e.g.

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Link and Jacobson, 2008; Cramer *et al.*, 2017; Milford *et al.*, 2019; Wozniak *et al.*, 2020; Jakobsen *et al.*, 2021; Resare Sahlin and Trewern, 2022; Kwasny *et al.*, 2022). Many critics argue for diets with "less but better meat", and regular efforts are made, at different levels, to achieve such diets (Garnett *et al.*, 2015; Sorensen *et al.*, 2005; Cripps and Thiagarajah, 2018; Resare Sahlin and Trewern, 2022). These efforts are mainly educative, aiming to shape human generations to become more aware of the disadvantages of meat eating and manage their protein intake with less meat and perhaps with meat substitutes.

In 1998, the ethicist Peter Singer suggested that "over the next 20 years meat could follow smoking into disrepute" (Singer, 1998). While Singer's timeline was clearly too optimistic, his suggestion was based on the fact that both smoking and eating meat increase the risk of disease, which, for a number of later scholars, has been enough to build parallels between these consumption categories (Morabia *et al.*, 1999; van Put, 2016; Feinberg *et al.*, 2019) and relate them to similar socioeconomic characteristics of consumers (e.g. Hiscock *et al.*, 2011; Wang *et al.*, 2018). However, the considerable reduction in smoking happened even without being motivated by any ethical and environmental concerns, while the average meat-eater remains conservative in terms of nutrition style. Opposite to developed countries, eating meat in developing countries is associated with higher social status and income (Delgado, 2003), which weakens income as a driver for lower meat consumption. Average meat-eaters stimulate meat production and revenues (FAOSTAT, 2022a, 2022b) and can still argue for tradition and the under-investigation of alternatives; however, they struggle to defend excessive meat-eating from health, ethical, environmental, cultural and even sexual perspectives (e.g. Lockie *et al.*, 2002; Garnett *et al.*, 2015; Eker *et al.*, 2019). Compared to the connection between education and smoking dynamics (e.g. Schaap *et al.*, 2009; Legleye *et al.*, 2011; Corsi *et al.*, 2013; Pampel *et al.*, 2015) the dynamics of meat eating across education levels has been less studied. For the Swiss canton of Geneva, however, such a study exists (Schneid Schuh *et al.*, 2018), and it shows that a university degree contributes to shaping diets in compliance with the Swiss meat and fish dietary guidelines of 1998 and 2011 (Swiss nutrition society, 2017; Federal Office for Food Safety and Veterinary Affairs, 2017). Moreover, Arnaudova *et al.* (2022) have shown that nutritional transition happens among students in Switzerland.

The novelty of this study is that we test the association between average meat eating and level of education over many years and in all regions of Switzerland, for nine sorts of meat, using a large disaggregated dataset on household consumption over a long period of time. We want to find if Singer's suggestion has become at least traceable in the way that, like for smoking, meat consumption has been focusing increasingly on lowly educated socioeconomic groups. We hypothesize, first, to see lower personal consumption of meat among more highly educated households, as has been shown in other developed countries (Section 2.2), and, second, that trends in meat consumption in Switzerland for the university-educated population are more negative than those for households with a lower educational level.

2. Theoretical framework

2.1 Smoking and education

Given this paper's focus on the connection between the dynamics of smoking in the last decades and the level of education among smokers, two questions need to be answered. One concerns the stability of the finding that less educated people are more likely to be smokers than highly educated people, and the other concerns the reason for this phenomenon.

The contemporary international literature clearly answers the first question in the affirmative. What Legleye *et al.* (2011) have called "widening inequalities in smoking initiation and cessation patterns" has been confirmed for a large number of countries and

cultures over the last twenty years (Mackenbach, 2011; Corsi *et al.*, 2013; Pampel *et al.*, 2015). Smoking is on its way to becoming a habit that signals a low degree of education. The question about the underlying reason for this phenomenon is less easy to answer. However, medical research may contribute to an understanding of the growing disparity. In such research, it is often reported that less educated people comply less with preventive measures (Kaur *et al.*, 2021), health promotion interventions (van Berkel *et al.*, 2013) and their own treatment regimens (Kaur *et al.*, 2021; Jensen, 2020). Taken together, the underlying mechanisms seem to indicate that self-management, in general, seems to align with education level (O'Connell, 2004).

If we follow the proposition of Verreault and Fortier (2011) that a partial purpose of education is to teach compliance with societal norms, these findings are not surprising and can relatively easily be transferred to the case of smoking. Most societies have come to the conclusion that the overall effects of smoking are negative, both for the individual and on the societal level. This relatively new norm has rather quickly trickled down to those groups of society that are used to complying with such norms. For persons with a lower educational background anti-smoking campaigns have had relatively smaller effect as compared to higher educated (and higher income) groups (Durkin *et al.*, 2009).

2.2 Meat consumption and education

As in the case of smoking, the question about meat consumption and education can be split into a factual and an argumentative element. What do we know already about the connection between meat consumption and education, and what, beyond that, can we hypothesise? Table 1 approaches the first question for the Swiss case and mostly displays the results of medical studies; research carried out in other countries is summarised in Appendix 1. The brief result of all the studies is that higher-quality diets (including lower meat consumption) are, in general, consumed by better educated persons.

Author (Year)	Key information Method (period)	Result (territory)
Baur *et al.* (2022)	Swiss-specific Nutritional Index (Aug. 2018–Sep. 2018)	Education formed intentions and lead to healthier eating (Switzerland)*
Steinbach *et al.* (2020)	Logistic regression (Jan. 2014–Feb. 2015)	Women and highly educated individuals were less likely to be high meat eaters (Switzerland)*
Wozniak *et al.* (2020)	Food frequency questionnaire and logistic regression (2005–2017)	Compared with omnivores, vegetarians were more likely to be young, with a higher education and a low income; pescatarians and flexitarians were more likely to be women and flexitarians were also more likely to have a lower income (Geneva)**
Schneid Schuh *et al.* (2018)	Logistic regression (between 1993 and 2016)	Compliance with Swiss dietary guidelines for meat increased among participants with a university degree (Geneva)**
Galobardes *et al.* (2001)	Multiple linear regression (1993–1998)	Consumers with a lower education and/or occupational level consumed less fish (Geneva)***
Eichholzer and Bisig (2000)	Bivariate analyses and multivariate logistic regressions (1992/1993)	Participants with a low level of education were found to consume daily meat or meat products more frequently (Switzerland)****

Note(s): Education level: * primary school or no degree, secondary, tertiary; ** university degree and otherwise; *** low (≤8 years of schooling), medium (9–12 years of schooling) and high (≥13 years and Swiss baccalaureate); **** high, middle, low
Source(s): Authors own creation

Table 1.
Literature on meat consumption and education in Switzerland

The negative association between education and meat consumption has been stable in quantitative research over the long period that our study covers as well as for different territories. In addition, there is research on motivations and constraints for meat consumption reduction on the individual level, which shows that health, ecological, and ethical motivations alone are hardly capable of explaining meat reduction (Lea and Worsley, 2003; Schenk *et al.*, 2018; Einhorn, 2020). However, none of the many studies we reviewed compared the trends in meat consumption between groups by education. For the second, argumentative, part of the question, it should suffice to refer to the growing unease about high meat consumption levels faced by developed societies, which is fuelled by health, environmental and ethical concerns. New norms of what an appropriate diet is are emerging, and it is likely that people with a strong educational background adapt more easily to such norms than people without. Therefore, we hypothesise that meat consumption has decreased more rapidly in well-educated segments of the Swiss population than in others.

3. Materials and methods

3.1 Data

We used data from the Swiss Federal Statistics Office, which has been conducting a survey on the consumption of Swiss households, including food consumption, since 1990. During each survey, members of randomly chosen households are required to provide personal characteristics and the amounts of foods consumed in the household. Therefore, we did not observe the same households over time, and we did not observe the individual consumption of each participant. Instead, we observed the education and population of randomised households each available year (see more about the food data by Swiss Federal Statistics Office in Mann and Loginova, 2023), as well as their yearly-averaged monthly consumption of eight sorts of meat (beef, poultry, pork, veal, wild and rabbit meat, sausages, ham and bacon, other meat) and a sole fish category separately.

Our dataset contained information about respondents' school, professional and university education. In this study we distinguish between the households with (in) university education (or expenditures on it) and without. The survey was not held for the period from 1991 to 1999, and the information on the highest level of education achieved and whether a household member was currently in obtaining the university education was only recorded until 2005. After 2006, information on education was not collected for households; however, households recorded their expenditure on high (university) education. This information was used to define those households that had at least one person currently in education at university or another type of higher education. Therefore, we considered the level of a household's education as the highest level of education declared among its members.

Households that declared zero consumption of any particular sort of meat were kept in the data. Households that did not declare any value for a particular sort of meat were not considered in the estimations for a corresponding sort of meat. For education variables, the households that did not declare finished or current university education before 2006, as well as those that did not declare expenditure on education after 2006, were excluded from the data. Households that declared zero expenditure on university (or other higher) education were considered households where no person was currently in higher education. We also calculated the consumption per person in each household and excluded the 0.5% of the households with the highest and lowest meat consumption per person in the groups by meat sort and year. The households excluded by the highest bound reported extreme values of consumption that a human would struggle to consume. Therefore, these values were likely reporting errors. The lower bound of observations mirrored the higher one, and this small part of zero observations were excluded for consistency, with the aim of reducing the probability of zero reporting under positive consumption and balancing the reduction of the highest values.

After the mentioned reductions and considerations, we had 362,871 observations for 40,722 households observed in one of the several available years, namely 1990, 2000–2017. Our data is slightly more optimistic than official statistics. While Swiss higher education institutions officially enrolled about 86 and 275 thousand students in 1990/91 and 2022/23, respectively (Federal Statistical Office, 2023), which is about 1–3% of total population in the years of measurement, our data suggests that this number stood at the level of 3–5%. With regard to people with finished high education, the situation is less clear as official sources count mainly people aged 25–34. Among these people, the share of high-educated persons was about 38–51% in 2008–2018, respectively (OECD, 2019). Our data covers all age groups, albeit at the household level, and show that the share of highly educated households remained around 30% in the studied period from 1990 to 2017. We had nine datasets in total (one for each sort of meat); 40,330 households declared to be in higher education or not; 27582 households declared to be with higher education or not. The descriptive statistics of the data is presented in Appendix 2.

3.2 Method

To visualise the patterns and trends in personal meat consumption among more and less educated households, we calculated and presented the average personal consumptions in these households by year of observation. While estimating trends in meat consumption for two educational levels, we employed linear models ("lfe" R-package) with robust estimates for each studied meat, using the observations for each available household (see, e.g. Mann and Loginova, 2023). In both visualisations and estimations, we expected to see lower meat consumption per person in more educated households. With regard to the speed of change, our expectations were less clear because no evidence was found in the previous literature and, therefore, these estimations became the particular area of interest of this study.

Formally, for each sort of meat

$$i = \{\text{"}Beef\text{"}, \text{"Poultry"}, \text{"Pork"}, \text{"Veal"}, \text{"Wild And Rabbit Meat"}, \text{"Sausages"}, \text{"}Ham\ And\ Bacon\text{"}, \text{"}Other\ Meat\text{"}, \text{"}Fish\text{"}, \text{"}Total\ Meat\text{"}\}$$

and level of education j at time t, we observed consumption in households h. We denoted the consumption in grams per person as $c_{i,j,t,h}$ and calculated the consumption $\widetilde{c}_{i,j,t,h}$ in percentages to the average consumption level of the group in 1990 (this level is denoted as $c_{i,j,1990}$) as follows:

$$\widetilde{c}_{i,j,t,h} = c_{i,j,t,h} / c_{i,j,1990} * 100 \tag{1}$$

While $c_{i,j,t,h}$ shows the level of consumption per person, $\widetilde{c}_{i,j,t,h}$ measures this level in percentages to the level of consumption per person in 1990, thus allows for the comparability of consumption levels in the educational groups, across foods and over time (see, e.g. Loginova and Mann, 2022). Further, we used $c_{i,j,t,h}$ and $\widetilde{c}_{i,j,t,h}$ to estimate the levels and the slopes of consumption trends. For $c_{i,j,t,h}$ and $\widetilde{c}_{i,j,t,h}$, respectively, we denoted the slopes of the consumption trends with $\beta_{i,j}$ and $\widetilde{\beta}_{i,j}$ and the levels of the consumption trends with $\alpha_{i,j}$ and $\widetilde{\alpha}_{i,j}$. We obtained robust estimates of trends in consumption per person by education groups ($\widehat{\beta}_{i,j=1}$, $\widehat{\beta}_{i,j=0}$, $\widehat{\widetilde{\beta}}_{i,j=0}$ and $\widehat{\widetilde{\beta}}_{i,j=1}$), using the following regressions:

$$c_{i,j,t,h} = \alpha_{i,j} + \beta_{i,j} t + \varepsilon_{i,j,t,h}, \tag{2}$$

$$\widetilde{c}_{i,j,t,h} = \widetilde{\alpha}_{i,j} + \widetilde{\beta}_{i,j}t + \widetilde{\varepsilon}_{i,j,t,h}, \quad (3)$$

where $\varepsilon_{i,j,t,h}$ and $\widetilde{\varepsilon}_{i,j,t,h}$ are the error terms. The robust estimates for $\beta_{i,j}$ and $\widetilde{\beta}_{i,j}$ (i.e., $\widehat{\beta}_{i,j=1}$, $\widehat{\beta}_{i,j=0}$, $\widehat{\widetilde{\beta}}_{i,j=0}$ and $\widehat{\widetilde{\beta}}_{i,j=1}$) and their significance for different sorts of meat and fish were the first area of interest of the present study. A zero or insignificant $\widehat{\beta}_{i,j}$ and $\widehat{\widetilde{\beta}}_{i,j}$ would mean that we had no evidence that the consumption changed over time.

We checked the significance of the difference between the estimated trends for $j = 1$ (for highly educated households) and $j = 0$ (otherwise) using the interaction terms, that is, a three-step procedure for comparing regression slopes, in which we:

(1) bound the datasets for both types of households ($j = 1$ and $j = 0$) together,

(2) calculated the interaction term $t*j$, and

(3) ran the following regressions:

$$\boldsymbol{c_{i,t,h}} = \boldsymbol{\alpha_i} + \boldsymbol{\beta_i t} + \boldsymbol{\gamma_i j} + \varphi_i(\boldsymbol{t*j}) + \boldsymbol{\varepsilon_{i,t,h}} \quad (4)$$

$$\widetilde{c}_{i,t,h} = \alpha_i + \widetilde{\beta}_i t + \widetilde{\gamma}_i j + \widetilde{\varphi}_i(t*j) + \widetilde{\varepsilon}_{i,t,h} \quad (5)$$

where γ_i and $\widetilde{\gamma}$ are coefficients for educational dummy, and the φ_i and $\widetilde{\varphi}_i$ are the coefficients for the interaction term $t*j$. After estimating (4) and (5), $\widehat{\varphi}_i$ and $\widehat{\widetilde{\varphi}}_i$ are the estimations of the differences in the trends $\widehat{\beta}_{i,j=1}$ versus $\widehat{\beta}_{i,j=0}$ and $\widehat{\widetilde{\beta}}_{i,j=0}$ versus $\widehat{\widetilde{\beta}}_{i,j=1}$, respectively, and were the second area of interest of the study. The significance of $\widehat{\varphi}_i$ and $\widehat{\widetilde{\varphi}}_i$ is the significance of difference between the studied trends.

Since we had two different types of data on education, we conducted the estimations for the population during different periods in which the data were comparable. Therefore, we studied meat consumption for households:

(1) involved (or not) in university education in the years 1990 and 2000–2017;

(2) with and without university education in the years 1990 and 2000–2005.

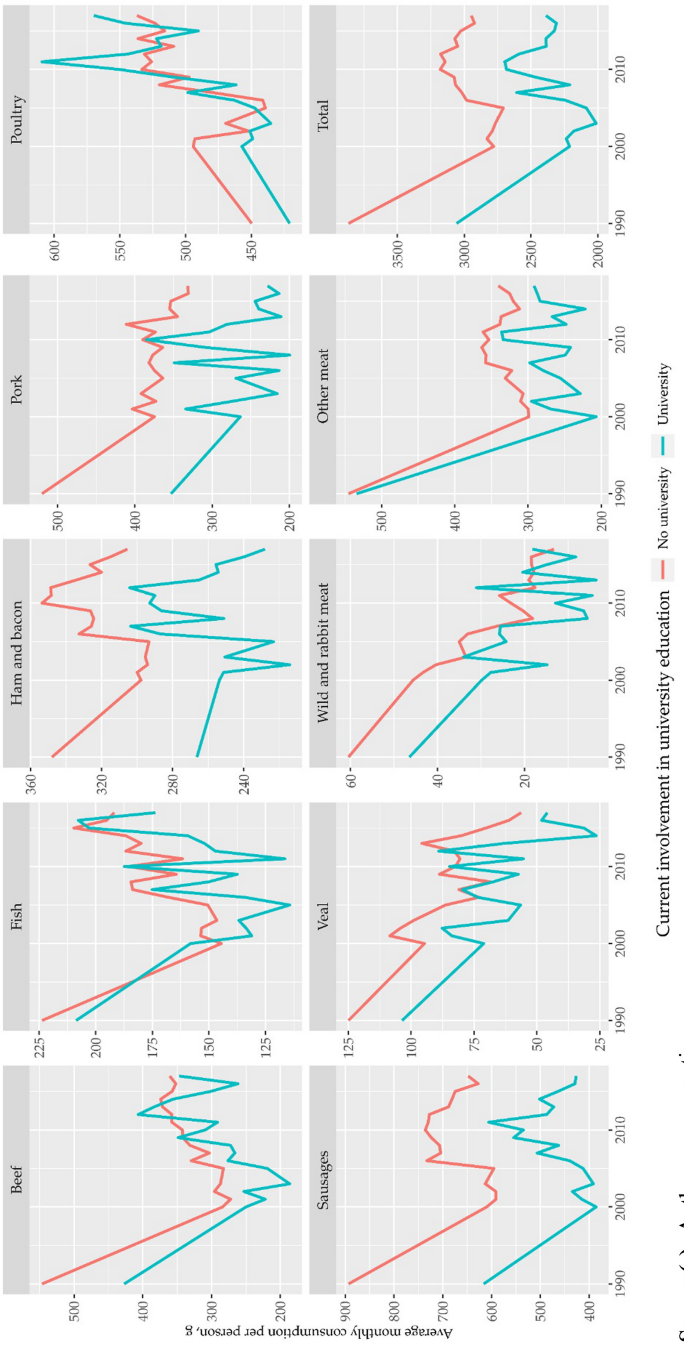
4. Results

Figures 1 and 2 already provide some illustrative evidence about the patterns of less- and better-educated consumers. Particularly pork and processed products are consumed mostly by households unrelated to university. For fish, rather the opposite is true.

4.1 Current involvement in education and meat consumption

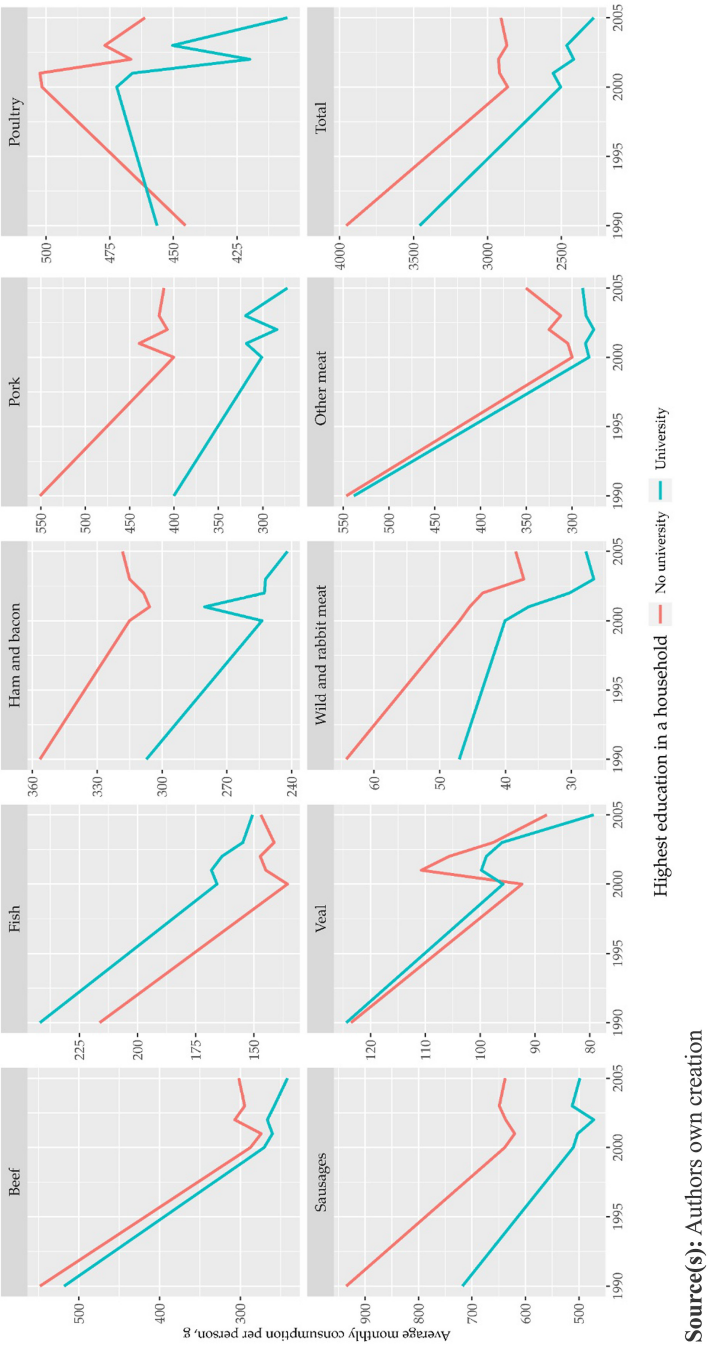
The level of meat consumption can be associated with current involvement in education. Figure 1 visualises this association for the years 1990–2017. Households with at least one person at university or in another form of higher education (around 3–5% of all households) consumed less meat of all types per person. The fact that less educated consumers (who usually also earn less) consume more meat than better educated confirms, in a way, the small role of income, as meat in Switzerland is among the most expensive food items. The exceptions for the gap between the two groups were fish, beef in 2013, poultry after 2005 and veal in 2009–2011, where the difference in consumption for the compared households was not critical, but differed from observations on fish by Galobardes *et al.* (2001).

The lower level of consumption may be a reason for the less sharp trends in meat consumption for households with members in education compared to others (Table 2). The



Source(s): Authors own creation

Figure 1.
The dynamics of meat consumption for people in and beyond university education



Source(s): Authors own creation

Figure 2.
The dynamics of meat consumption for people with and without university education

Food (i)	At least one person $\widehat{\beta}_{i,j=1}$	$\widehat{\widehat{\beta}}_{i,j=1}$	Nobody $\widehat{\beta}_{i,j=0}$	$\widehat{\widehat{\beta}}_{i,j=0}$	Difference $\widehat{\varphi}_i$	$\widehat{\widehat{\varphi}}_i$
Beef	−3(1) *	−1(0)*	−6(0)***	−1(0)***	3(1.1)**	0.4(0.2)†
Poultry	5(1)***	1(0)***	3(0)***	1(0)***	1.8(1.3)	0.5(0.3)
Pork	−4(1)***	−1(0)***	−6(0)***	−1(0)***	2.1(1.1)*	0 (0.3)
Veal	−2(0)***	−2(0)***	−2(0)***	−2(0)***	−0.1(0.4)	−0.4(0.4)
Wild and rabbit meat	−1(0)***	−3(1)***	−2(0)***	−3(0)***	0.5(0.3)	0.1(0.6)
Sausages	−4(1)**	−1(0)**	−6(0)***	−1(0)***	2.1(1.2)†	0(0.2)
Ham and bacon	0(1)	0(0)	0(0)†	0(0)†	0.2(0.6)	0.1(0.2)
Other meat	−9(1) ***	−2(0)***	−7(0) ***	−1(0)***	−1.7(1.1)	−0.4(0.2)†
Fish	−1(1)	0(0)	−1(0)***	0(0)***	−0.1(0.8)	−0.1(0.4)
Total	−20(4) ***	−1(0) ***	−25(1)***	−1(0) ***	5.5(4.3)	0(0.1)

Note(s): Significance codes: "***" = $p \leq 0.001$; "**" = $p \leq 0.01$; "*" = $p \leq 0.05$; "†" = $p \leq 0.1$. Values in brackets are standard errors. Number of households are 1990 ± 5 (in education) and 38330 ± 5 (otherwise). Robustness checks are provided in Appendix C, Table C1 (available from the authors)
Source(s): Authors own creation

Table 2.
Meat consumption trends for households involved (or not) in university education

decrease in meat consumption is 1–3 grams a year faster for people in university education. Both groups, however, increased poultry consumption, and this increase was more rapid for households containing students. The minor differences between the trends in the groups by education did not reach statistical significance of $\widehat{\varphi}_i$, except pork (+2.1 grams), sausages (+2.1 grams) and beef (+3 grams). All these estimates were positive; that is, households paying for education decreased their consumption of these items more slowly in absolute values, but there was no single significant difference $\widehat{\widehat{\varphi}}_i$ (at p-value = 0.05) for trends measured for consumption in percentages and for differences in trends of total meat consumption.

4.2 University education in a household and meat consumption

Households may have nobody studying at university, because this level of education may already have been achieved. Our data did not contain the finished education level in households after 2005. We could only use the data for the years 1990 and 2000–2005 to illustrate the association between meat consumption and the university education in a household (Figure 2). Veal, before 2000, and fish were more consumed by highly educated households (30% of all households), although in 2005 the consumption in highly educated and lower educated households of these two foods was almost equal. The other sorts of meat were less consumed by more educated households, the same refers to total meat consumption.

Figure 2 allows to see the year in which more educated households performed the same as less educated ones in the last year of measurement. Educated households were ahead in meat-non-eating competition by 10–15 years for pork, sausages, ham and bacon. For other sorts of meat, educated households were ahead by 5–10 years, with the exception of veal, for which consumption was almost the same in most of the years studied. If the same exercise is undertaken for Figure 1, where a member of the households is in education, the results differ only for sausages. In regard to reduction of sausage consumption, the consumption patterns of highly educated households were more than 25 years ahead. For the other sorts of meat, this figure stands at 5–10 years. When thinking about the role of education in the lives of people, these figures seem to be important: households with more informed/updated members are, on average, 10 years ahead when a change is proved necessary.

Table 3 indicates negative consumption trends for all sorts of meat for both types of households except for the fact that less educated households increased their consumption of

Food	At least one person		Nobody		Difference	
	$\widehat{\beta}_{i,j=1}$	$\widehat{\widehat{\beta}}_{i,j=1}$	$\widehat{\beta}_{i,j=0}$	$\widehat{\widehat{\beta}}_{i,j=0}$	$\widehat{\varphi}_i$	$\widehat{\widehat{\varphi}}_i$
Beef	−20(1)***	−3(0)***	−20(1)***	−1(0)***	−0.2(1.2)	−1.6(0.2)***
Poultry	−2(1)†	0(0)***	3(1)***	1(0)***	−4.4(1.2)***	−0.6(0.2)**
Pork	−8(1)***	−2(0)***	−11(1)***	−2(0)***	2.7(1.3)*	−0.3(0.2)
Veal	−3(0)***	−2(0)***	−2(0)***	−2(0)***	−0.6(0.5)	−0.5(0.3)
Wild and rabbit meat	−1(0)***	−3(0)***	−2(0)***	−3(0)***	0.5(0.4)	0(0.5)
Sausages	−17(1)***	−2(0)***	−24(1)***	−1(0)***	6.7(1.4)***	−0.9(0.1)***
Ham and bacon	−4(1)***	−1(0)***	−3(0)***	0(0)***	−0.7 (0.7)	−0.8(0.2)***
Other meat	−20(1)***	−3(0)***	−18(1)***	−2(0)***	−1.8(1.1)	−1.4 (0.2)***
Fish	−6(1)***	−2 (0)***	−6(0)***	0(0)***	−0.8 (0.7)	−1.5(0.2)***
Total	−81(4)***	−2(0)***	−84(3)***	−2(0)***	2.7(4.8)	−0.2(0.1)†

Table 3.
Meat consumption trends for households with (or without) university education

Note(s): Significance codes: "***" = $p \leq 0.001$; "**" = $p \leq 0.01$; "*" = $p \leq 0.05$; "†" = $p \leq 0.1$. Values in brackets are standard errors. Number of households are 8520 ± 15 (high-educated) and 19030 ± 17 (otherwise). Robustness checks are provided in Appendix C, Table C2 (available from the authors)
Source(s): Authors own creation

poultry after 1990. We found statistically significant differences in trends for absolute values of poultry (−4.4 grams), pork (+2.7 grams) and sausages (+6.7 grams) consumption in highly educated households compared to other households. For percentage changes, the differences in trends were significantly negative for six and insignificantly negative for three of the nine meat types studied, with educated households reducing their meat consumption faster. For total meat consumption, the difference in trends was negative and weakly significant.

5. Discussion and conclusion

At almost the same time that Singer (1998) suggested that eating meat would become the new smoking, Morabia *et al.* (1999) was able to show that the diet of Swiss (Genevan) smokers appeared less healthy than that of people who had never smoked. Our study hypothesised that this association is likely to have a stable common background, which is education.

Our results in regard to levels of consumption principally match those of previous studies of developed countries: educated households consume less red and processed meat, probably substituting them with fish and poultry, which are more consumed by educated households. Unlike other studies, we further attempted to illustrate this association from the "speed of change" perspective.

We found the opposite of what we expected for consumption in levels and many examples that prove our hypothesis for consumption in percentages. Households where someone is undertaking education tend to reduce meat consumption more slowly than other households or do not differ from them (the joint category of "other meat" is an exception), while there are significant differences between highly educated households and others. The significant differences in trends in consumption levels exist (1) for beef, pork and sausages, when comparing trends for households where someone is in higher education and other households; and (2) for poultry, pork and sausages, when comparing trends in consumption of highly educated households and other households. The significant differences in trends for consumption in percentages exist (1) for beef and the joint category of "other meat", when comparing households where someone is in high education and other households; (2) for beef, poultry, sausages, ham and bacon, fish and the joint category of "other meat" when comparing the trends in consumption of highly educated households and other households. The last mentioned of these results align with our expectations in regard to a faster decrease in meat consumption among educated households and therefore support our hypothesis for many meat products.

The main limitation of our study is that university education may not cover the range of educational levels that is relevant for consumption behaviour, so that our study only explores a part of the relation between education and meat consumption. However, the disparity in meat consumption between differently educated groups in Switzerland exists and is widening – if not in absolute terms, then in relative ones. While our results have shown a weak trend only, the disparity could well grow if one takes into account the intensifying debate on the detrimental effects of meat consumption. In addition, measuring education by expenditures of the household may weaken a small portion of our results. Despite our analysis is done on a household level, the differences in personal consumption are observable and meaning that even one educated person in a household is enough to change the average personal consumption of a household.

How would the trends look in other countries characterized by different level of meat consumption is a good question for further studies. Especially in developing countries, where the concerns about meat are stronger, meat is cheaper and education does not promote healthy diets, it makes sense to conduct the studies that help to prevent health risks of excessive meat eating.

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Appendix 1

Author (Year)	Source Method (period)	Result (territory)	Education variable
Groth *et al.* (2001)	Multivariate regression analysis (1995)	Education was significantly associated with fat in the diet (Denmark)	Levels Basic school, Upper secondary school, Vocational education, Short higher education, Medium higher education, Long higher education
Gossard and York (2003)	Ordinary least squares (1996)	Negative significant association between meat (or beef) consumption and education (United States)	In years >12
Sorensen *et al.* (2005)	Randomised controlled trial (1999–2003)	The intervention is at least as effective in changing targeted health behaviours among the less-educated as among more educated persons (United States)	Levels ≤4 years of college >4 years of college
Lallukka *et al.* (2006)	Sequential logistic regression models (2000–2002)	'Associations of own education with healthy food habits" that are also consistent with previous literature (Finland, Helsinki)	Levels Basic Intermediate Higher
Zeng *et al.* (2019)	Trends in mean intake assessed by treating the 2-year survey cycle in survey-weighted linear regression models (1999–2016)	Energy-adjusted mean consumption did not change for processed meat and fish, declined for unprocessed red meat and increased for poultry (United States)	None
Kirbiš *et al.* (2021)	Ordinal regression model (2019)	Participants with higher education consume meat less frequently but fish more frequently; Educational status is linked to tolerance of vegans (Slovenia)	1 = primary school or less; 2 = some secondary education; 3 = some higher education
Miller *et al.* (2022)	Bayesian models (1990–2018)	Animal-source foods intakes (servings per week) were higher among more-educated versus less-educated adults (264 population strata across 185 countries)	Levels ≤6 years of education, >6 years to <12 years, or ≥12 years

Source(s): Authors own creation

Table A1. Meat consumption and education in selected countries

Appendix 2

Table A2. Descriptive statistics of households (in grams per person)

	With university education				In university education			
	At least one person		Nobody		At least one person		Nobody	
Food (i)	Max	Mean	Max	Mean	Max	Mean	Max	Mean
Beef	5,000	339	5,067	392	5,018	307	6,144	361
Poultry	3,800	447	3,810	468	4,938	483	5,849	492
Pork	5,400	331	7,050	468	4,495	281	7,050	393
Veal	2,325	103	2,400	109	2,106	69	3,931	90
Wild and rabbit meat	1,780	37	1,920	51	1,500	24	1,920	32
Sausages	4,380	567	4,550	753	3,920	486	4,948	702
Ham and bacon	2,310	272	2,330	330	2,243	260	3,137	324
Other meat	4,025	362	4,333	407	4,080	314	4,333	363
Fish	2,300	186	2,357	172	2,991	164	3,802	181
Total	16,678	2,759	16,390	3,310	15,437	2,454	20,208	3,104

Source(s): Authors own creation

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