Red and Processed Meat Consumption in Italian Households: the role of environmental sensibility on individual propensity

1 Topics

Food-consumption habits are central in the environmental and health-related discourse. In particular, meat production and consumption have become major concerns because of the impact of livestock on global warming and environmental degradation. The Food and Agriculture Organization (FAO) reported that livestock farming accounts for a significant proportion of anthropogenic greenhouse gas emissions (FAO 2020), raising awareness on the importance of shifting the diet to limit gas emissions. The importance of diets is also advocated by the Intergovernmental Panel on Climate Change who recognizes positive effects of diets which are high in coarse grains, pulses, fruits and vegetables, nuts and seeds, and low in energy-intensive animal-sourced foods. In this way consumption of meat analogues such as imitation meat (from plant products), cultured meat, and insects is evoked as helping in the transition to more healthy and sustainable diets, although their carbon footprints and acceptability are still uncertain (ICPP Special report, 2019, chapter 5).

In the 2030 Agenda for Sustainable Development the type of food consumption is not directly monitored, even if the progress made towards limiting global temperature increase would significantly ease the path to many SDGs, such as those related to poverty, hunger, access to water, and terrestrial and marine ecosystems (UN, 2023).

Regarding country specific monitoring, in Italy, the Italian Statistical Institute monitors individuals' nutrition by measuring the proportion of those who eat at least 4 portions of fruit and vegetables a day as part of the set of indicators related to risk or health protection factors caused by lifestyles (Istat, 2023). Moreover, the Italian Osservatorio Senior has recently considered the topic of food consumption as a characteristic feature of 'silver ecology' (https://osservatoriosenior.it/2021/11/silver-ecology/), intended as the contribution of seniors to sustainable development. For all these reasons the topic of meat consumption could be more relevant in population studies too.

2 Review of the Literature

While resources are limited, the population keeps growing along with the necessity of natural resources, energy and space. The link between population, emissions and global temperature has received a lot of attention with recent probabilistic forecasts of gas emissions and temperature that heavily rely on population projections (Raftery et al., 2017). In 2018 the Intergovernmental Panel on Climate Change (IPCC) highlighted the interconnection between earth and its resources, as well as climate and society, suggesting the importance of modifying dietary habits by lowering red meat consumption in favor of a diet rich in vegetables and fruits (Livi Bacci, 2019).

High production of meat and processed meat is a function of its high consumption in many developed countries, which is itself highly dependent on the population size and its age composition. Relations between demographic change and emissions of the major greenhouse gas carbon dioxide have been studied from different perspectives, however only limited literature has investigated how the population's characteristics relate to meat consumption and how meat-consumption habits have changed throughout time. More in general, until now little attention has been devoted to dietary habits of large populations, with studies that consider individual, household and contextual explanatory factors. Among relevant literature, we mention Mori and Clason (2004) who projected the consumption of fish and

meat by the Japanese population. The authors projected household heads' consumption, for the years 2010 and 2020, synthesizing age and cohort effects. The authors assumed a decline in fish consumption due to the rapid aging of the Japanese population and the lower consumption of this food among the young. However, their results indicated that the decline would be much smaller - only about 3.5% by 2020. They also predicted that consumption of fresh meat would remain unchanged over the same period.

More recent literature includes Di Novi and Marenzi (2022) that used Italian survey data from 1997 to 2012 to explore patterns of meat consumption across generations, cohorts and household types. They used an approach that involves age, period, and cohort effects to disentangle the effect of generations in adherence to Mediterranean diet. Nevertheless, "since they rely on a pseudo-panel, they cannot take explicit account of individual-specific heterogeneity in red and processed meat consumption" (p. 1329, Di Novi and Marenzi, 2022). Using a 2017 Finnish study, Sares-Jaske et al., (2022) investigated how sociodemographic and economic characteristics are associated with red and processed meat consumption. They found important differences with regards to demographic characteristics (sex, age), type of household (single, with children, etc), whether people lived in rural areas and educational level.

In this context, we expand on the existing literature and we contribute by using more recent Italian data, by measuring the change in red meat consumption in the last 10 years and by exploring individual and household factors connected with such consumption. Among the individual variables we also test the effect of environmental sensibility.

3 Data and Methods

We use data collected annually since 1993 by the Istituto Nazionale di Statistica (Istat) in a household survey, "Aspects of Daily Life", which is part of the Multipurpose Survey system. Every year nearly 20.000 households for a total amount of around 50.000 individuals are interviewed. Since food consumption habits change slowly, we consider two well-spaced time points, namely 2012 and 2021. The survey contains several question items on food habits. We build a binary indicator taking value 1 if an individual answered that he/she eats at least "some time a week" red or processed meat (RPM from here onwards), and 0 otherwise. We will refer to this indicator as "RPM Consumption" and it will be the variable of interest that we use to evaluate RPM Consumption levels in the sample. We consider only mononuclear households and - inside them - only components aged 18 ys. or more.

The comparison of the two years under consideration (Table 1) shows that there are different distributions in terms of age structure and propensity (consumption rate) to consume RPM. To determine the size of the effect of changes in propensities and that of changes in age structure on the otal variation in RPM consumption, we apply the Kitagawa decomposition (1955). This methodology enables us to differentiate between the "structural effect", the "propensity effect", and the "interaction effect". Secondly, we move to exploring demographic and non-demographic factors associated with RPM consumption by means of logistic models.

4 Preliminary results

In the last ten years the RPM consumption has reduced by 4.3 p.p. (Table 1). The trend is slightly decreasing by age in both the two time points, but people aged between 45-54 ys. and 60-64 ys. show a higher reduction. People in the last age class seem not to change their RPM consumption: they still continue to consume less than other younger people. Furthermore, significant disparities in the age structure, due to the aging of the population can be observed over the decade.

This first result led us to explore whether the identified differences in RPM consumption could be attributed to the different compositions in terms of age structure. As stated earlier, we performed Kitagawa's (1955) decomposition for this purpose. The results (Table 2) show that the total variation in RPM consumption between the two years (-4.3%) is almost entirely attributable to the propensity, which would drop by 3.88 p.p. with the same age structure.

The lower propensity in meat consumption opens the floor to questions related to factors associated with food habits. To this end, we focus on 2021 since it is the year with the lowest

Age Classes	Population (%)		RPM consumption rates (%)	
	2012	2021	2012	2021
18-24	8.4	7.7	90.3	85.9
25-34	13.1	9.9	87.5	83.9
35-44	18.3	12.9	87.4	83.1
45-54	18.5	19.1	86.6	81.3
55-59	8.0	9.9	83.3	78.7
60-64	7.8	8.8	83.2	78.1
65-74	13.4	16.4	83.2	79.2
75 and more	12.5	15.2	78.3	78.6
Total	100.0	100.0	85.2	80.9

Table 1: Composition of the population aged 18+ and incidence of RPM consumption by age group Italy, 2012 and 2021.

Total variation (%)	Structural effect (%)	Propensity effect (%)	Interaction effect (%)
-4.30	-0.52	-3.88	0.09

Table 2: Kitagawa decomposition of the overall variation (2012-2021) in RPM consumption rates.

observed meat consumption, and we run a preliminary logistic model with covariates that refer to demographic characteristics, such as age, sex and household type, role within a family (parent or kid), geographical area of residence, and a variable representing environmental sensibility. The latter is built by using an item in the questionnaire which asks to list the most important environmental problems. Since meat production is associated with higher gas emissions and climate change, we built a binary indicator attaining value "Yes" when at least one of these two problems was listed and "No" otherwise.

While in these preliminary results the model doesn't show highly significant results for the environment variable, it highlights differences between age groups and sex, with older people eating less red meat, especially in ages 45 through 75 configuring a u-shaped association, and women eating significantly less meat than men. Moreover, it seems that couples with kids tend to eat more red meat than couples without kids. Considering couples without kids as the baseline, singles tend to eat less meat, while single parents who live with their kids tend to have a meat consumption similar to that of couples without kids. It therefore seems that household composition is a relevant predictor of food habits and may be used to explain the observed decrease throughout time. Potentially in contrast with this result is the coefficient estimated for an individual's role in the family whose value shows that kids tend to eat less meat than their parents. Last, by looking at the coefficients for the geographical areas, we notice that in the Islands and in the South, people seem to eat more red meat as compared to the North-West, while in the North-East people tend to eat less of it.

Each macro-area contains 2 to 5 regions (NUTS 2-level) and in other results, not shown here for the sake of brevity, we found that not all regions behave in the same way in such macro-areas. Therefore, we plan to disentangle the effect of the geographical area and further investigate this result by using multi-level logistic random models with regions as second level of hierarchy. Moreover, while these initial results do not provide large evidence to support the effect of environmental sensibility on meat consumption habits, we acknowledge that indicators more suitable for describing environmental sensibility may be available and we plan to expand our analysis with a more thorough inclusion of indicators that indicate environmentally friendly behaviors.

Table 3: Estimates and standard errors of regression coefficients.

	Estimate	**Std. Error**	**t-value**	**Pr(>—t—)**
Intercept	**0.889113**	**0.013320**	**66.753**	<2e-16 ***
Environmental sensibility (Yes)	0.009206	0.004500	2.046	0.040784 *
Age class				
18-24 (baseline)				
25-34	-0.022909	0.010543	-2.173	0.029794 *
35-44	-0.041722	0.011859	-3.518	0.000435 ***
45-54	-0.062529	0.011852	-5.276	1.33e-07 ***
55-59	-0.082616	0.012984	-6.363	2.00e-10 ***
60-64	-0.083026	0.013314	-6.236	4.54e-10 ***
65-74	-0.065085	0.012638	-5.150	2.62e-07 ***
75 and more	-0.050494	0.012820	-3.939	8.21e-05 ***
Sex (Female)	-0.079904	0.004256	-18.774	<2e-16 ***
Family type				
Couple (baseline)				
Couple with kids	0.036358	0.006144	5.918	3.29e-09 ***
Single	-0.051088	0.006621	-7.716	1.24e-14 ***
Single with kids	0.015400	0.008630	1.784	0.074366
Role in the family (Kid)	-0.036705	0.008998	-4.079	4.53e-05 ***
Geographical area				
North West (baseline)				
North East	-0.034177	0.006423	-5.321	1.04e-07 ***
Centre	0.009327	0.006566	1.421	0.155438
South	0.020403	0.005972	3.416	0.000636 ***
Islands	0.041268	0.007774	5.308	1.11e-07 ***

Our contribution is an exploration of potential factors associated with RPM, but we aim to produce a broader impact by drawing attention to meat consumption as an important determinant of gas emissions and identifying relevant demographic covariates that can improve research in forecasting of gas emissions and climate change.

References

Di Novi and Marenzi (2022), Improving health and sustainability: Patterns of red and processed meat consumption across generations, Health policy 126 (2022) 1324-1330.

Food and Agriculture Organization of the United Nations Statistics Division http://www.fao.org/faostat/en/data/CL/visualize (accessed October 30, 2020).

IPCC (2019), Food Security. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial https://doi.org/10.1017/9781009157988.007.

Istat (2023), Rapporto Bes 2022: il benessere equo e sostenibile in Italia, Roma.

Kitagawa, E. M. (1955). Components of a difference between two rates. Journal of the American statistical association, 50(272), 1168-1194.

Livi Bacci M. (2019), Clima, spazio, popolazione, Neodemos, 1/10/2019.

Mori, H., & Clason, D. L. (2004). A cohort approach for predicting future eating habits: the case of at-home consumption of fresh fish and meat in an aging Japanese society. International Food and Agribusiness Management Review, 7(1), 22-41.

Raftery, A. E., Zimmer, A., Frierson, D. M., Startz, R., & Liu, P. (2017). Less than 2 C warming by 2100 unlikely. Nature climate change, 7(9), 637-641.

Sares-Jaske, L., Valsta, L., Haario, P., & Martelin, T. (2022). Population group differences in subjective importance of meat in diet and red and processed meat consumption. Appetite, 169, 105836.

UN (2023), Synergy Solutions for a World in Crisis: Tackling Climate and SDG Action Together (Website: sdgs.un.org/climate-sdgs-synergies).