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Feasibility of Meat Loss and Waste Estimates Based on Meat Consumption and Availability

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Abstract: Meat loss and waste are estimated at each stage along the food chain, but the methods used are complex, and the data needed are often fragmented. We, therefore, evaluated the feasibility of estimating meat loss and waste using a simpler method comparing meat availability and consumption, using Swiss meat consumption according to a national nutrition survey and Swiss meat availability according to food balance sheets. As availability is reported at the fresh meat level and consumption as consumed, items of the latter were converted to fresh meat equivalents before comparing consumption with availability. Consumed unprocessed meat was directly converted to fresh meat equivalents and consumed meat products after having identified their meat ingredients. Meat availability and meat consumption as consumed and as fresh meat equivalent were 138.4 g/d, 105.5 g/d, and 112.1 g/d, respectively. The resulting total meat loss and waste was 19% and varied from −36% to 38% for the different meat types. Estimating meat loss and waste based on meat availability and consumption derived from a national nutrition survey yielded results varying to such an extent that the evaluated method to estimate meat loss and waste cannot be recommended.

Keywords: meat; poultry; processed meat; fresh meat equivalent; national nutrition survey; food availability

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1. Introduction

Interest in meat consumption is growing due to its commonly reported negative health effects and negative environmental impact [1]. As food loss and waste are considered major factors greatly influencing the impact of food production on the environment [2], there is a need to assess not only consumption but also concomitant loss and waste. Food loss and food waste are defined by the Food and Agriculture Organization. 'Food loss' refers to a decrease in the quantity or quality of food occurring at the supplier stage from harvest, slaughter, or catch up to, but not including, the retail stage, and 'food waste' is a decrease in the quantity or quality of food occurring at the retail, food service provider, or consumer level [3]. However, available estimates often do not distinguish between food loss and waste, such as, for example, the most recent global estimates on the greenhouse gas emissions attributable to food loss and waste or estimates of food loss and waste in the meat sector in the European Union [2,4].

Food loss and waste in the meat sector were estimated at 23% in the European Union, but it was concluded that the underlying data were very limited and not up-to-date and that the methods used to generate the data could be improved [4]. In Switzerland, for example, beef and pork loss and waste estimates were based on assumptions calculated for the food chain in France [5]. Food loss and waste are usually estimated for each of the different stages of the food chain such as primary agricultural production, handling and transport, processing, retail, or households [3]. This estimation is highly complex and based on many assumptions, which raises questions about the accuracy and comparability of the resulting estimates of food loss and waste.

The different methodologies used to quantify food loss and waste were reviewed recently [6,7]. The four main methods were surveys; waste audits; kitchen diaries, representing direct quantification methods; and estimates based on secondary data, representing an indirect quantification based on existing food waste and loss data to estimate new waste and loss estimates. Additionally, mixtures of these four methods were used to quantify food loss and waste. All methods have advantages and disadvantages, and no one can be generally identified as "the best" method. In any case, there exists no standard methodology to quantify food loss and waste yet, and, as a consequence, all the methods are used in Europe and globally, making it difficult to compare the results [6,7].

An alternative and easier approach to estimating food loss and waste could be to relate national food availability to corresponding food consumption assessed with a national nutrition survey. As availability and consumption represent the starting and end points of the assessment of food loss and waste, the difference between availability and consumption should equal loss and waste. An advantage of this approach would be that one does not have to estimate the diverse losses and wastes along the many stages of the food chain, thereby reducing the number of potential uncertainties introduced in the estimate. The shortcoming of this approach, on the other hand, is that it is ideally based on the average consumption of the entire population, but national nutrition surveys often target specific age groups, such as children or adults of a certain age range [8]. If consumption differs by age groups, the average consumption assessed with one age group does not represent the consumption of the entire population. Nevertheless, as estimation of food loss and waste relying only on national availability and consumption data is a tempting and simpler approach compared to estimating food loss and waste at the diverse stages of the food chain, we investigated its feasibility with Switzerland as a use case.

2. Materials and Methods

The prerequisite of estimating meat loss and waste as a difference between meat availability and consumption is a direct link between consumption and availability data, and this requires a breakdown of the consumed meat products, such as sausages or salami, into their ingredients, particularly the meat types used. The reason for this is that meat availability data are collated at the level of the meat type (e.g., pork, beef, or chicken) and not at the level of the meat products as consumed. To link meat availability and meat consumption, one needs to perform several steps, and most of them are related to the analysis of the national nutrition survey: (1) determine all unprocessed meat and meat products consumed in the national survey; (2) break down all meat products at the recipe level to identify their ingredients, in particular the meat type used in their manufacturing; (3) apply yield factors to all unprocessed meat and ingredients of meat products; (4) calculate the overall meat consumption by meat type; and (5) calculate meat loss and waste as the difference between consumption at the fresh meat level and meat type availability.

2.1. Definition of Unprocessed Meat and Meat Products

Definitions for unprocessed versus processed meat, such as those of FoodEx2 by the European Food Safety Authority or the EuroFIR Food Classification [9,10], vary according to the food classification system. However, as unprocessed meat and meat products might additionally be defined at a national level, one needs to specify a priori what type of definition shall be used. In Switzerland, unprocessed meat is usually defined as meat that was conserved only by chilling, freezing, or quick-freezing, where the characteristic fibre structure of the muscle is still recognizable, and processed meat as meat having lost the original characteristics of fresh meat as a consequence of processing [11]. The Swiss ordonnance on animal foods lists a third category, namely, meat preparations (e.g., meat that was processed, but the original structure of the fresh meat is still recognizable, such as with minced meat or sausages) [11]. But, as most of these meat preparations are counted among meat products in the Swiss food-based dietary guideline ('Meat products include

sausages, cold cuts, cured meats such as dried meat and ham, or smoked meats' [12]), they are usually listed together with the meat products in Swiss dietary assessments. An exception is minced meat, which is categorized as unprocessed meat. Accordingly, the meat preparations in the present study were counted among meat products, except for minced meat, which was attributed to unprocessed meat. Thus, unprocessed meat was defined as all meat whose original structure of fresh meat was still recognizable and consisted of all meat from mammals, including its offal and minced varieties consisting of only raw meat with no additives, and processed meat was defined as meat that did not fulfil the criteria for unprocessed meat (see Table 1).

Table 1. Categories and subcategories of meat and meat products with their corresponding meat types.

Category	**Subcategory**	**Meat Type**
Unprocessed meat	Poultry	Chicken, turkey, duck, goose, or other poultry
	Mammalian meat	Beef, pork, veal, lamb, sheep, mutton, goat, rabbit, or horse
	Offal	From duck, goose, veal, rabbit, beef, pork, or other meat type
	Unspecified meat	All items identified as meat but without sufficient information to attribute it to a specific meat type
Category	**Subcategory**	**Examples**
Meat products	Bacon	Pancetta and speck
	Ham	Raw ham, cured ham, and cooked ham
	Salami	Salami, Salsiz, and Landjäger
	Sausages	Bratwurst, Cervelat, Cipollata, Chorizo, Lyoner, and Schüblig
	Dried meat	Bresaola and Bündnerfleisch
	Other meat products	Brät, Brätkügelchen, and Fleischkäse

2.2. Swiss National Nutrition Survey

The Swiss national nutrition survey called menuCH was conducted between 27 January 2014 and 31 January 2015. Its methodology is described elsewhere [13,14]. Briefly, menuCH was carried out as a cross-sectional, nationwide survey with a random sample of 2057 adults aged between 18 and 75 years, representing about half of the Swiss population. Diet was assessed with two non-consecutive 24 h recalls, the first one in a study centre and the second one as computer-aided telephone interview. Both recalls were completed with the Swiss version of the dietary assessment software GloboDiet ® (formerly EPIC-Soft®, version CH-2016.4.10, International Agency for Research on Cancer, Lyon, France). Foods and drinks were recorded at the consumption level (e.g., grilled meat and not raw meat) and classified into 19 main food groups, which were aligned with the Swiss food based dietary guidelines displayed as the Swiss food pyramid [12]. The methods and procedures of menuCH were approved by regional ethics committees under the lead of the ethics committee in Lausanne, Switzerland, and the survey was registered with the ISRCTN registry (ISRCTN16778734). The dataset used for the current analysis of menuCH (version 5.0 of the research use dataset, July 2022) was provided by the Swiss Federal Food Safety and Veterinary Office (Bern, Switzerland), the funding agency of the survey.

2.3. Identification of Unprocessed Meat and Meat Product Consumption

The menuCH dataset included detailed information on the food or dish consumption moment (e.g., items consumed at breakfast, lunch, dinner or as snacks) and all these items were classified 'on the fly' during the survey into food groups as described above. Using only the food group 'Meat, meat products, and meat alternatives' to identify unprocessed meat and meat product consumption would have led to underestimation of the corresponding consumption. For example, one would have missed dishes containing unprocessed meat or meat products such as *tortelloni* with meat filling and croissants filled with ham, which were classified in the food groups 'Cereals, cereal dishes, seeds' and 'Salty snacks', respectively.

The consumption of unprocessed meat and meat products was, therefore, identified with the following systematic two-step approach, which can be applied to any national nutrition survey. First, all the food groups were classified as groups that potentially included consumed items being or containing unprocessed meat or meat products. For example, the food group 'Alcoholic beverages' was classified as 'contains no unprocessed meat or meat product' and the food group 'Potatoes and other starchy root tubers' as 'can contain unprocessed meat or meat products' (because a classical Swiss item of the latter food group is *rösti*, i.e., boiled potatoes that are shredded, roasted, and sometimes refined with ham or bacon). Second, all consumed foods, recipes, or ingredients that were attributed to one of the food groups classified as potentially containing unprocessed meat or meat products were systematically screened for items being or containing unprocessed meat or meat products. This screening consisted again of two steps: first, a manual check of the dataset for each item listed in the food group until one item was identified as being or containing unprocessed meat or meat products, and then, second, an automated search for more entries of that specific item in the entire dataset. The manual search was conducted on the name of the consumed items (e.g., *rösti*) but also on the descriptors of each consumed item (e.g., 'Beef' or 'Meat, unspecified').

2.4. Breakdown of Meat Products to Ingredients and Linking Ingredients to Meat Types

The meat types used in the manufacturing of the meat products were identified using corresponding recipes. The selection of these recipes followed the general guideline of EuroFIR for standard recipe calculation in the context of the compilation and management of food composition databases [15]. In essence, the idea is to obtain the traditional or most often used recipe in the region of interest, which is Switzerland in the case of menuCH. Thus, recipes were obtained from the recipe collections of the trade organization of the Swiss meat industry (Proviande, Bern, Switzerland) and the training centre of the Swiss meat industry (ABZ, Spiez, Switzerland). If a recipe was not part of one of these two collections, the recipe was searched for in the collection of the traditional and largest recipe provider for the general population in Switzerland (Betty Bossi, Zurich, Switzerland), the collection of the Swiss Culinary Heritage (Verein Kulinarisches Erbe der Schweiz, Lausanne, Switzerland), and, as a last option, based on the ingredient list of corresponding commercial meat products sold by the two main Swiss retailers (Coop, Basel, Switzerland and Migros, Zurich, Switzerland).

The identified recipe delivered information about the meat type and quantity used in the manufacturing of the meat product. If the recipe did not include a weight yield factor representing any weight change occurring during the manufacturing of the meat product (e.g., a weight loss because of dehydration during drying of meat), the yield factor was obtained from the collection of yield factors of the trade organization of the Swiss meat industry Proviande (Berne, Switzerland). Finally, the meat ingredients were linked to the meat type categories as defined for the consumption of unprocessed meats.

2.5. Calculation of Fresh Meat Equivalents and Overall Meat Consumption

Next to calculating meat consumption at the consumption level, as is usually performed in nutrition surveys, overall meat consumption was calculated with corresponding fresh meat equivalents. Fresh meat corresponds to the status of unprocessed meat before any cooking is applied, and, therefore, the weight of fresh meat often does not correspond to the weight of unprocessed meat at the consumption level (i.e., after a cooking method is applied). The conversion to fresh meat equivalent is a necessary step, as meat availability is given at the fresh meat level. To obtain the fresh meat equivalents, the unprocessed meat and meat products were multiplied with their corresponding yield factors. For example, 180 g of consumed beef steak (i.e., cooked) was converted with a yield factor of 1.2125, corresponding to 218.25 g of raw or fresh beef steak. Unspecified meat consumption was converted to fresh meat type equivalents by using generic recipes, as defined by Proviande

(Berne, Switzerland). For example, an unspecified roast was defined as 50% pork, 30% beef, and 20% veal.

2.6. Estimating Meat Loss and Waste

Meat loss and waste were estimated as the difference between Swiss meat availability and meat consumption, as assessed with the Swiss national nutrition survey. As the survey was conducted during a 12 months period from 27 January 2014 to 31 January 2015, the Swiss meat availability of the years 2014 and 2015 was obtained from the Swiss food balance sheets, which considered meat import and export, and weighed accordingly (i.e., 11/12 for the year 2014, and 1/12 for the year 2015 [16]). Meat loss and waste were calculated for all meat types separately (e.g., pork, beef, and poultry).

2.7. Statistical Analysis

The calculation of fresh meat equivalents, meat consumption, and meat availability are described above. Meat consumption and availability were described as mean consumption in grams per capita per day, and all descriptive analysis was conducted with the PivotTable of MS 365 Excel (Version 2036).

3. Results

3.1. Meat Consumption According to Swiss National Nutrition Survey menuCH 2014/2015

Overall meat consumption at the consumption level was 105.5 g/d. The corresponding contribution of meat products, unprocessed meat from mammals, including their offal, and poultry, including their offal, were 36%, 36%, and 25%, respectively (the remaining 3% of meat consumption was unspecified) (Table 2). Beef and pork were the most consumed mammalian meat types at 15.9 g/d and 11.7 g/d, respectively, constituting 42% and 31% of all mammalian meat.

Table 2. Meat consumption of adults in Switzerland according to the National Nutrition survey menuCH without and with conversion to fresh meat equivalents (g/d).

	menuCH	FME UPM	UPMI	FME MP	FME Total
Unprocessed meat—Mammal	**37.8**	**46.0**	**30.4**	**33.3**	**79.3**
Beef	15.9	19.9	3.7	4.6	24.5
Pork	11.7	13.9	24.2	26.7	40.6
Veal	3.4	5.1	2.3	1.8	6.9
Lamb, sheep, and mutton	2.7	3.2	-	-	3.2
Horse	1.6	1.8	-	-	1.8
Game	1.3	1.3	0.2	0.3	1.6
Offal, veal	0.6	-	-	-	-
Rabbit	0.3	0.4	-	-	0.4
Goat	0.2	0.2	-	-	0.2
Offal, beef	0.2	-	-	-	-
Unprocessed meat—Poultry	**26.8**	**32.0**	**1.1**	**0.8**	**32.8**
Chicken	23.8	27.8	0.7	0.4	28.2
Turkey	2.1	2.4	0.4	0.4	2.8
Duck	0.5	0.8	-	-	0.8
Offal, duck, and goose	0.2	-	-	-	-
Mixed, other, and non-specified poultry	0.2	0.9	-	-	0.9
Meat products	**38.0**	**-**	**-**	**-**	**-**
Sausages	15.1	-	-	-	-
Ham	9.1	-	-	-	-
Others	7.3	-	-	-	-
Salami	3.2	-	-	-	-
Bacon	2.1	-	-	-	-
Dried meat	1.3	-	-	-	-

Table 2. *Cont.*

	menuCH	FME UPM	UPMI	FME MP	FME Total
Unspecified, mixed unprocessed and products	2.9	-	-	-	-
TOTAL	**105.5**	**-**	**31.5**	**-**	**112.1**

menuCH: consumption at the consumption level as assessed with the Swiss National Nutrition Survey for 2014/2015; FME: fresh meat equivalent; UPM: unprocessed meat; UPMI: unprocessed meat used as ingredient for meat products; MP: meat products.

All in all, 150 types of unprocessed meat and 79 types of meat products were converted to their fresh meat equivalents. As an example, to convert the unprocessed meat 'chicken breast' at the consumption level, 100 g of cooked chicken breast plus 3 g of non-meat (spices and cooking oil) were multiplied with a conversion factor of 1.2125, reflecting the weight loss occurring during the cooking process. This resulted in 117.7 g of chicken breast raw, i.e., at the fresh meat equivalence level (100 g 'chicken breast' consumed × (100/103) × 1.2125 = 117.7 g raw chicken breast). After converting the consumption to fresh meat equivalents, the overall meat consumption increased by about 6% to 112.1 g/d (Table 2).

3.2. Meat Types Used as Ingredients for Meat Products

Meat products consisted of 90% unprocessed meat at the fresh meat equivalent level, the remainder 10% being mostly water added during production. Pork meat at the fresh meat equivalent level contributed to 70% of all meat products (consumption level), beef at the fresh equivalent level contributed to 12% of all meat products (consumption level), and all the other meat types each contributed to less than 5% of all meat products.

3.3. Meat Loss and Waste

Estimated total meat loss and waste for the weighted years 2014/2015, corresponding to the period of the dietary assessment of the National Nutrition Survey menuCH, was 19% (Table 3). The corresponding loss and waste for the different meat types varied from −36% for horse meat to 38% for pork meat.

Table 3. Meat consumption at fresh meat level with Swiss adults (g/d) and meat loss and waste for the weighed years 2014/2015.

	FME menuCH	Availability 2014/2015	Loss and Waste
Unprocessed meat—Mammal	**79.3**	**109.9**	**28%**
Beef	24.5	30.4	19%
Pork	40.6	65.9	38%
Veal	6.9	6.8	−1%
Lamb, sheep, and mutton	3.2	3.0	−6%
Horse	1.8	1.3	−36%
Game	1.6	1.4	−16%
Rabbit	0.4	0.5	25%
Goat	0.2	0.3	10%
Unspecified	-	0.3	-
Unprocessed meat—Poultry	**32.8**	**28.5**	**−15%**
Chicken	28.2	NA	-
Turkey	2.8	NA	-
Duck	0.8	NA	-
Unspecified, mixed, and other poultry	**0.9**	**NA**	**-**
TOTAL	**112.1**	**138.4**	**19%**

FME: consumption at fresh meat equivalent level; menuCH: Swiss National Nutrition Survey 2014/2015.

4. Discussion

Food loss and waste cause large, unnecessary impacts on the environment [2,3]. Reliable knowledge of food loss and waste is crucial for developing strategies to mitigate both loss and waste, but the methods used to estimate corresponding data are varied, complex, and, at least for the meat sector, fragmented in the different stages of the food chain [4]. Therefore, we have assessed meat loss and waste with a simpler method by directly comparing meat availability and consumption at the national level using Swiss data. The resulting overall meat loss and waste of 19% is only slightly lower than the meat loss and waste of 23% that was estimated for Europe, but which originated from estimates addressing loss and waste at the different stages of the food chain [4]. However, meat loss and waste according to meat type varied from −36% to 38%.

4.1. Meat Consumption at the Consumption Level

The overall meat intake of 105.5 g/d at the consumption level by adults in Switzerland is the lowest total meat consumption level compared with the most recent National Nutrition Surveys of 25 countries in Europe, in which consumption ranged from 108 g/d in Germany (2007) to 197 g/d in Croatia (2011) [17]. The Swiss meat intake was also lower than the meat intake in the USA with 111 g/d (according to the NHANES 2015–2016) [18], and the meat intake in Australia with 155 g/d in 2011–2012 [19], but higher than the meat consumption in China with 71 g/d in 2019 [20]. The identified 105.5 g/d is also about 5% lower than the consumption obtained by an analysis of the founding agency of the Swiss national nutrition survey, the Swiss Federal Food Safety and Veterinary Office (111 g/d) [21]. Scientific papers have reported corresponding consumption of 103.9 g/d [22] and 108.9 g/d [23,24]. The former consumption of 103.9 g/d was likely a slight underestimation as, for the analysis of meat consumption, the authors considered only the food group 'Meat and meat products'. Our analysis of the food group 'Meat and meat products' only resulted in the identical consumption of 103.9 g/d as well, but we identified an additional 1.6 g/d of meat consumption because we considered other food groups. The latter consumption of 108.9 g/d was derived from the food group 'Meat and meat products' with the addition of one item from the food subgroup 'Savory sauces' (i.e., sauce bolognaise). However, the authors considered all the sauce as meat, and so they slightly overestimated meat consumption. In our analysis, we found a consumption of sauce bolognaise of 5 g/d (result not shown), but we considered this consumption as about 18% minced meat only, according to the traditional Swiss recipe for sauce bolognaise [25].

4.2. Meat Consumption at Fresh Meat Equivalent Level

Overall meat consumption at the fresh meat level was 112.1 g/d and only slightly higher than overall consumption at the intake level. The breakdown of the meat products consumed and the calculation of the fresh meat quantity for both meat products and unprocessed meats were, nonetheless, relevant steps to identifying the amount of meat types consumed. As most of the meat used in the production of meat products was pork meat, the consumption of pork meat of about 12 g/d (without considering pork used as an ingredient for meat products) increased to about 41 g/d. Beef consumption increased from about 16 g/d to 25 g/d, whereas poultry meat consumption, in contrast, increased only slightly from 27 g/d to 33 g/d. In any case, the breakdown of meat product consumption helps in quickly identifying the amount of meat consumed by type and thus simplifies evaluation of the environmental impact of meat, which generally differs according to meat type [26]. Calculation of consumption at the fresh meat equivalent level also allows for a better comparison of consumption with dietary recommendations, as these are usually given at the fresh meat level, whereas consumption is generally assessed after cooking at the consumption level.

4.3. Estimate of Meat Loss and Waste

The estimated overall meat loss and waste of 19% is slightly lower than the meat loss and waste of 23% reported for Europe [4] but considerably lower than the meat loss reported in the USA of about 50% [27]. However, in view of the large range of estimated meat loss and waste for the different meat types, we conclude that assessing meat loss and waste relying on a national nutrition survey that represents only the population aged 18 to 75 years, representative of half of the Swiss population, is not a valid approach. It seems that the surveyed part of the population consumed certain meat types at a much higher rate than the non-surveyed part, as their consumption was higher than the available amount of meat (e.g., poultry meat consumption of 33 g/d vs. poultry meat availability of 29 g/d). This is backed by an analysis of meat type consumption according to age range in Switzerland that demonstrated that poultry consumption gradually decreased from 38 g/d among adults aged 18 to 29 years to 16 g/d among those aged 60 to 75 years [23]. It remains to be seen if meat consumption representing the entire population would still be a feasible data basis to estimate meat loss and waste.

4.4. Estimate of Recent Meat Consumption Based on Meat Availability

Even if the difference between meat consumption and availability does not seem suitable for estimation of meat loss and waste, it still could be an option for estimating the most recent meat consumption in the part of the population surveyed in the national nutrition survey. This is particularly true if the most recent national nutrition survey was conducted long ago, as is the case with many countries, including Switzerland [8]. The most recent meat availability data, in contrast, are usually only one or two years old, as food balance sheets are aggregated regularly. The meat availability in Switzerland of 138.4 g/d in 2014/2015, the years of the national nutrition survey, declined, for example, to 129.6 g/d in the year 2020 (the year with the most recent consolidated availability data) [28]. Applying the meat loss and waste of 19% at the total meat availability level would, thus, result in a reduction in the total meat consumption at the fresh meat equivalent level from 112 g/d to 105 g/d (corresponding to 99 g/d of total meat at the consumption level). This estimate assumes, however, that meat loss and waste did not change in the years between the national nutrition survey and the most recent food availability data.

5. Conclusions

The attempt to estimate meat loss and waste based on national meat availability and national meat consumption, but only that of adults aged 18 to 75 years (representing half of the population), yielded results that varied to such an extent that estimating meat loss and waste with this method cannot be recommended. As no standard methodology exists to quantify food/meat loss and waste, there is still a need to develop standard procedures that will enable a better assessment of food/meat loss and waste.

Nonetheless, an integral step of our estimate based on meat availability and consumption, namely, the calculation of fresh meat equivalent consumption, allows for an improved evaluation of meat consumption and could be considered whenever an in-depth analysis of meat consumption according to its type is needed. Furthermore, this method could be used to estimate the most recent meat consumption in a country.

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Institutional Review Board Statement: The methods and procedures of menuCH were approved by regional ethics committees under the lead of the ethics committee in Lausanne, Switzerland, and the survey was registered with the ISRCTN registry (ISRCTN16778734).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The dataset used for the current analysis of menuCH (Version 5.0 of the research use dataset, July 2022) was provided by the Swiss Federal Food Safety and Veterinary Office (FSVO, Bern, Switzerland), the funding agency of the survey. The dataset is available for research purpose only upon request at the FSVO.

Conflicts of Interest: P.C.C. is employee of Consulting Colombani GmbH and in this position consults and receives fees from governmental and non-governmental institutions working in the field of nutrition and health, as well as from the food industry and food associations, including the sponsor of the present study Proviande (the organization of the Swiss meat industry). P.C.C. holds shares of the Anti-Inflammaging Ltd., is co-founder, editor, and writer of the competence centre "Notabene Nutrition", and serves as an expert/science writer for different media in Switzerland. T.A.B. has no conflicts of interest to declare. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results; and they did not see the manuscript before submission.

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