



ESTIMATION OF REAL PER CAPITA CONSUMPTION OF MEAT IN ITALY

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ABSTRACT

Food consumption refers to the amount of food available for human consumption. The knowledge of food consumption is crucial to set production and food supply policies, to compare eating habits with other countries, to assess the nutritional status of a population and to study the relationship between diet and health. In the last years all these aspects have taken an increasingly important interest because epidemiological studies have indicated a possible association between high consumption of meat and an risk of several forms of cancer as well as metabolic and cardiovascular diseases.

Unfortunately meat consumption is often estimated by methods that are inappropriate for this use because they do not represent the actual amount of meat consumed or, better, eaten by the consumers. The actual food consumption may be lower than the quantity shown as food availability depending on the magnitude of wastage and losses of food during the slaughtering, in the household, e.g. during storage, in preparation and cooking, as plate-waste or quantities fed to domestic animals and pets, thrown or given away

The consumption estimated by FAO and by statistical offices of the various countries through the national food balance sheets does not indicate the amount of meat, ie the weight of the skeletal

muscles of animals with included or adherent tissues, but the amount of the weighted carcass at the slaughterhouse, including bones, tendons, connective tissues and fat.

This paper discusses a method of estimating the real *per capita* consumption of meat in Italy with accuracy comparable to that of individual consumption, developed by the Study Commission of Animal Science and Production Association (ASPA). This action responds to the need of producing statistical indicator related to health food, as recommended by many international organizations (FAO, Eurostat).

Keywords: Consumption, Meat, Estimation

1. Introduction

There are different methods for estimating the *per capita* consumption of meat, highlighting the importance, purposes, advantages, disadvantages and uncertainty. They may be grouped into three categories: Food Balance Sheet, Household Budget Surveys, Individual Dietary Surveys.

1) Food Balance Sheets

Food Balance Sheets (FBSs) are annually published by FAO (2015b). They show for each food item i.e. meat for human consumption which corresponds to the sources of supply and its utilization. The total quantity of meat produced in a country added to the total quantity imported and adjusted to any change in stocks that may have occurred since the beginning of the reference period gives the supply available during that period. On the utilization side a distinction is made between the quantities exported, fed to livestock + used for seed, losses during storage and transportation, and food supplies available for human consumption. The *per capita* supply of each such food item available for human consumption is then obtained by dividing the respective quantity by the related data on the population actually partaking in it. Data on *per capita* food supplies are expressed in terms of quantity and by applying appropriate food composition factors for all primary and processed products in terms of dietary energy value, protein and fat content. It is an apparent consumption because it includes non-edible parts, such as tendons, cartilages and all the waste.

The estimated consumption of foods based on availability is the most popular method because it allows to derive the annual *per capita* consumption without difficulty and almost inexpensively. Another strong point if compared with other methods as detailed hereafter, is the ability to estimate the availability of food for the population in all the points of consumption: home, restaurants, canteens, community hospitals, prisons, barracks, etc. Moreover, the consumption can be estimated regardless of how foods are consumed: raw or cooked, fresh or processed.

At the same time FBSs present some weak points. The method leads to a significant overestimation of the consumption compared to the amount actually eaten due also to the difficulty or impossibility of separating the product for human consumption from the amount of product given to animals. Another critical issue of FBSs regards the population participating in available consumption for human use. The apparent meat consumption is helpful to know the total amount of meat available in a country for human consumption.

2) Household Budget Surveys

Household Budget Surveys (HBSs) are national surveys mainly focusing on consumption expenditure. They measure the household expenditure to buy food and other goods and services, and in some cases also the quantity.

HBSs are used to compare expenditure and indices of consumer prices for different foods among states, regions or different socio-economic groups, to monitor the consumption of various foods over time and eventually to take decisions in social, agricultural and food policies. The consumption data measured by HBSs are also used to study the relationship between consumption of a particular food or group of foods and human diseases. But this use requires precautionary measures because the estimated consumption does not express what a person really eat but simply what a person buy. Meat consumption measured by a HBS is a less coarse index compared to that obtained with the FBSs because the meat bought at retail is already deprived of most of the bones, tendons and the separable fat and do not include waste.

However, HBSs do not provide the real consumption of meat, but the available amount for consumption; furthermore, the method is more complex and expensive. Another point of weakness of this method is represented by eating meals outside home. In addition, Household Budget Surveys do not take into account guests in the family, food purchased but not consumed during the survey period or those purchased before the reference period.

3) Individual Dietary Surveys

Individual Dietary Surveys (IDSs) are carried out by research institutes on a sample of individuals representative of the population. Individual surveys provide data on the amount of foods or food categories consumed by the selected individual over the period covered by the survey. The survey may also retrieve some information, such as the daily episodes when specified foods have been consumed, whether they were home-produced or bought and, in such cases, also the commercial label, the way in which foods were cooked, the place where they were consumed, whether there was any edible wastage and so on. Tables of food composition are used to calculate the energy and nutrient content of the consumed foods.

Basically, the methods for assessing individual dietary intakes can be classified into two main categories: the retrospective reporting of intake from the recent or remote past and the prospective recording of consumption. Some methods only measure consumed foods and the frequency of consumption, others also measure the weight scale or the standard weight portions. Food can be weighted raw or cooked. The costs are high and the diversity of methods makes no fully comparable data from different surveys. Data from these surveys are more appropriate than those obtained with FBSs or HBSs to describe the eating habits and to study the relationship between food intake and human health. The limitations and uncertainties concern the weight check, the study of domestic waste in the kitchen and on the plate, the conversion from raw to cooked food, the conversion of processed products into meat, the separation of meat in compound feed. They are very expensive and therefore they are occasionally carried out or with a multiannual periodicity and not in all countries.

Definitively, all methods overestimate the real meat consumption because they include non-edible parts, processing losses and waste. In IDSs the overestimation is minimum, but in FBSs it can reach values higher more than twice the actual food consumption. It is necessary to take into account the limitations and uncertainties that each method presents, to know the objectives and reasons for which they were designed and to interpret and use the data on consumption correctly.

To overcome this situation, the Scientific Association for Science and Animal Production (ASPA) has set up a committee of professors and researchers belonging to some Faculties of Agriculture and Veterinary Medicine, experts in the meat of different animal species, plus an ISTAT expert on animal production to develop an economic, fast and reliable estimative method to assess the real *per capita* consumption of meat and fish. In this paper we reported the results on the meat.

2. Method

To achieve the aim, the committee used the Food Balance Sheets (FBSs) method, the same with which in Italy is estimated the apparent consumption. The method is even used in Italy to estimate the apparent consumption. This The actual *per capita* consumption of meat has been is calculated subtracting from the availability in kilograms of carcass weight the processing losses as well as the parts that are not edible (bones, cartilages, connective tissue, etc) and excess fat, which is normally not eaten and is not currently classified on the nutritional and dietary plan as meat but it is considered as fat. In other words, the definition of the level of meat consumption was changed from equivalent carcass to fresh meat by conversion coefficients specifically determined. First of all it is necessary to have a wide knowledge of national availabilities. This was taken from surveys on the slaughter and records of imports and exports made by ISTAT.

Then it is of fundamental importance a detailed analysis of the losses that occur between primary production and the actual consumption (Table 1). The total losses and waste were estimated using data from scientific literature on slaughtering procedure and meat yield of carcass and several joints.

Table 1 *Losses that occur in the reduction of the animal's carcass to meat*

Cold carcass
✓ Processing losses
✓ Removing most of bones, cartilages, ligaments, tendons and aponeuroses
✓ Separable fat removal
✓ Partial or total skin removal in pigs and poultry
Salable meat
✓ Retail processing losses
✓ Retail scrap material
✓ Retail wastes
Consumable meat
✓ Scrap material at consumption in the kitchen and on the plate
✓ Consumption wastes
Actually consumed meat

The estimates of losses at various levels of the supply chain are almost inexistent in Italy. Information are often inaccurate and confused: for example, no distinction is made between waste carried to a level as those carried out at previous levels, etc. In particular estimates of consumption losses both at home and outside home are scarce or non-existent.

Faced with this situation, the Committee has used a completely different approach to estimate with a good degree of approximation losses, scrap material and waste. The processing losses are liquid losses and small body parts not recoverable that occur in the sectioning of the carcass, in the preparation of the cuts and of the portioned meat. The scrap materials are parts not edible (bones, cartilage, tendons and ligaments), or diverted from human consumption (separable fat with a knife, aponeurosis, glands, nerve tissue and blood vessels). Wastes include fresh or transformed meat discarded due to impairment, presence of defects, overcoming expiration date, lack of acceptance or because purchased or cooked in excess. With this approach the total of processing losses and scrap material waste, regardless of the stage of the supply chain in which they occur, were quantified using data from the scientific literature on livestock slaughtering, consulting experts in the field and in the case of cattle performing carcass dissection trials.

For processed products the determination of conversion coefficients was more complex because it was also necessary to take into account the weight loss due to processing and seasoning and the addition of fats and other ingredients in order to transform them into fresh meat, as defined above.

3. Results

The ASPA Committee calculated the conversion factors of the carcass, quarters, cuts and all meat products imported and exported of various animal species in consumable meat. An example of these coefficients is shown in Table 2.

Table 2 Conversion coefficients of carcass in consumable meat by species

Red meat	Conversion coefficients (%)	White meat	Conversion coefficients (%)
Lambs	0,573	Broilers less than 2 kg	0,610
Lambs >15 kgs	0,536	Broilers over 2 kg	0,620
Ewes and rams	0,565	Turkeys	0,621
Piglets	0,494	Guinea Fowls	0,582
Light pigs	0,528	Ducks	0,520
Heavy pigs	0,492	Geese	0,520
Steers	0,593	Quails	0,452
Female bovine animals aged less than 15 months	0,575	Pigeons	0,501
Calves <8 months	0,524	Rabbits	0,553
Wild boars	0,707	Red deers	0,738
Fallow deers	0,722	Roe deers	0,789
Mouflons	0,632	Chamois	0,713
Horses, donkeys and mules	0,700		

The availability of consumable meat without considering retail waste was obtained multiplying the apparent availabilities by these conversion coefficients. The *per capita* availability of the retail consumable meat is achieved dividing the total availability by the population of Italy).

Table 3 shows the amount of meat consumable obtained for the different animal species in the period 2010-2014.

Obviously the *per capita* availability of consumable meat, comprising the waste to the detail is much lower than the availability in carcass equivalent calculated for example by the FAO. In fact the latest figures published by the FAO, which for Italy relate to the years 2010 and 2011, respectively report an apparent consumption of 89.51 and 86.65 Kg (FAOSTAT). However the amount of available meat thus calculated provides an index much more close to the actual consumption.

Table 3 *Estimates of consumable meat per capita in Italy without considering retail waste in the period 2010-2013 (Kg)*

Meat	2010	2011	2012	2013	Average
Bovine ¹	13,75	12,73	12,30	11,69	12,62
Pigs	20,57	19,97	19,52	19,47	19,88
Poultry	10,93	11,59	12,07	11,60	11,55
Sheep and goats	0,65	0,61	0,58	0,49	0,58
Horse	0,66	0,63	0,64	0,56	0,62
Rabbit	0,35	0,35	0,34	0,32	0,34
Wild animals ²	0,06	0,06	0,06	0,06	0,06
Total	46,97	45,94	45,51	44,19	45,65

¹ It includes buffalo meat; ² equal estimate all years

The accuracy of the estimate, which is a derived statistics, is dependent on the reliability of the statistics of supply and determination of the conversion coefficients. The data on national production, imports and exports are those collected by ISTAT. Therefore the accuracy of the estimate of the *per capita* availability of meat should be the same as that of the apparent consumption calculated by FAO, for example. As well as retail waste, the consumable meat still includes scrap material at consumption in the kitchen and on the plate and consumer waste (meat and meat products eliminated on the garbage for impairment, exceeded expiration date or because purchased or cooked in excess). In order to get the real meat consumed the waste produced at retail and the scraps and wastes at consumption level must be subtracted from the availability of consumable meat.

For retail waste some information obtained from a number of stores of a great distribution chain were taken into consideration. The retail wastes were calculated on the difference in value between the total receipts of meat put on sale and the amount of meat actually sold. Based on this information the retail wastes were estimated to be about 2% regardless all species. Taking into account these losses, it has been obtained the true consumable meat.

For consumer losses (scrap material in the kitchen and on the plate and wastes) both at home and away from home (restaurants, fast foods and services institutions,) the only information came from some researches carried out abroad. For European countries according to a study (2011) performed by FAO the meat losses at consumption amount to 11% of the quantity purchased. The same proportion of waste has been found in UK by WRAP (2009) for the group of food comprising meat

and fish, The Economic Research Service of United States Department of Agriculture estimated the losses at consumer level to 23% for meat and to 18% for poultry (USDA ERS, 2016), but in USA the losses include some inedible material, such as bones.

Based on these data, taking into account that bones have already been eliminated from the consumable meat estimate in this research, it was assumed as consumer losses a value equal to 10%. Subtracting this value to the meat consumable has been obtained the real consumption of the meat.

Table 4 shows the real meat consumption *per capita* in Italy in 2010-2013. The real consumption *per capita* obtained are almost identical to those observed in the years 2005-2006 in Italy by CRA-INRAN with the method of individual dietary survey (IDS) (Turrini et al. 2013).

Table 4 Real meat consumption per capita in Italy in the period 2010-2013 (Kg)

Meat	2010	2011	2012	2013	Average
Bovine ¹	12,12	11,23	10,85	10,31	11,13
Pig	18,14	17,61	17,22	17,17	17,53
Poultry	9,64	10,22	10,64	10,23	10,18
Mutton and goat	0,57	0,54	0,51	0,43	0,51
Horse	0,58	0,56	0,56	0,49	0,55
Rabbit	0,31	0,31	0,30	0,28	0,30
Wild Animasi ²	0,05	0,05	0,05	0,05	0,05
Total	41,41	40,52	40,13	38,96	40,25

¹ It includes buffalo meat; ² equal estimate all years

This is particularly interesting because it shows that the method proposed by us, based on FBS but changing the definition level of meat, estimates the actual consumption with the same precision of IDS on individual consumption, but without the complexity and high costs of this. Obviously the method only provides the average consumption of a country and does not allow for the breakdown of consumption by different group population differing for socio-economic, geographical, age class, sex and other demographic characteristics. Therefore our method cannot replace individual dietary survey, but can be useful for monitoring the nutritional status of the population of a country in the long range of years that usually separate the IDS.

Table 5 Apparent and actual per capita daily consumption (grams) of meat in Italy.

Meat	2010	2011	2012	2013
Bovine				
real consumption	12,12	11,23	10,85	10,31
apparent consumption	23,8	22,1	21,3	20,2
real/apparent %	50,9	50,8	50,9	51,0
Pigs				
real consumption	18,14	17,61	17,22	17,17
apparent consumption	38,4	37,3	36,9	36,7
real/apparent %	47,2	47,2	46,8	46,8

Poultry				
real consumption	9,64	10,22	10,64	10,23
apparent consumption	18,0	18,6	19,4	18,8
real/apparent %	53,6	54,9	54,8	54,4

In the four years period considered the real meat consumption *per capita* decreased by 2,45 kg, equal in relative terms to about 6%. The decrease has mainly affected the beef (1,81 kg) and pig (0,97 kg).

Table 5 shows the apparent and real daily consumption of meat of the three main species. The apparent consumption values are those calculated and published by ISMEA.

The actual consumption is compared to those apparent about 51% for beef, 47% for pork and 54% for the poultry. The method provides an estimate very close to that of the quantity of ingested meat and therefore may be a more suitable index for the studies on the relationship between meat consumption and human health.

Conclusion

The method allows to estimate the *per capita* real consumption on annual basis with the same precision of the individual dietary survey, but without the complexity and the high costs of the latter.

The developed method provides an estimate very close to that of the quantity of ingested meat and therefore may be a more suitable index for the study of the relationship between meat consumption and human health.

The method may represent a paradigmatic example to estimate real consumption of all foods, similarly to what it is done in the US by the economic statistics service of the Department of Agriculture (USDA ERS,2016).

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