The hidden cost of meat consumption in Italy

Environmental and health impacts

SUMMARY REPORT

#CARISSIMACARNE

LAV

This document is the summary report, prepared by LAV, of the study “Il costo nascosto del consumo di carne in Italia: impatti ambientali e sanitari” (The hidden cost of meat consumption in Italy: environmental and health impacts).

LAV, as an association, is committed to a rapid “food transition,” a profound systemic change that would see the consumption of animal proteins drastically and rapidly reduced in favour of plant proteins, thus saving the lives of several million animals. Therefore, LAV decided to carry out a unique research: an analysis of the emissions of the entire “life cycle” of meat (“from fodder to table”), with specific reference to the Italian context. This analysis is intended to measure emissions and environmental and health impacts. It will provide an economic estimate of these impacts to clarify the amount of this sector’s indirect costs. The summarised study, therefore, provides scientific, accurate, and specific data on the “hidden cost” of meat in Italy: that is, the economic translation of all the environmental damage caused by meat production and consumption. The economic value is enormous and to date has not been compensated in any way or “referred” to the cost of the various foodstuffs ‘produced’ from cattle, pigs, and poultry.
Demetra performed the research on behalf of LAV. Demetra is a consulting company operating in the field of scientific research on sustainability. A research team consisting of scholars, researchers, and academics was set up.

Research team

- Alessandro Arrigoni, Ph.D. in Materials Engineering - Environmental Engineer specialized in sustainability and life cycle analysis – Demetra
- Guido Scaccabarozzi – Sustainability Manager – Environmental Engineer specialized in methods of measuring environmental impacts and climate neutral strategies – Demetra
- Caterina Villa – LCA Expert – Master Degree in Environmental Sciences expert in LCA and methods of measuring ecosystem services – Demetra
- Francesca Allievi – PhD at the University of Turku (Finland), researcher on agri-food sustainability issues and university professor (critical review)
- Giovanni Dotelli – Ordinary Professor at the Department of Chemistry, Materials and Chemical Engineering “Giulio Natta” of the Polytechnic University of Milan (critical review)

INTRODUCTION

It is now clear, and confirmed by many international bodies, that meat consumption has a very significant impact on the environment and human health, as well as on animals reared for food.

In recent years, scientific and economic bodies have initiated important studies to detect how environmental and health impacts generate costs for society in terms of loss of well-being, lack of productivity, and environmental damage.

At the same time, the livestock sector is supported by continuous flows of subsidies from both the European Union and national funding programmes.

However, 14 years have passed since the publication of FAO’s Report “Livestock’s Long Shadow: Environmental Issues and Option”, denouncing the enormous impact of animal husbandry on the environment. These fourteen years saw fruitful developments. Reports and declarations of authoritative international bodies continue to highlight how urgent it is to reduce meat consumption and to drive a change towards plant-based protein, on environmental, health, and economic grounds. In 2019, with the Global Warming of 1.5 report, the Intergovernmental Panel on Climate Change (IPCC) stated that to reduce the expected incalculable damage, the following must be achieved: 45% reduction in global carbon dioxide emissions by 2030, compared to 2010 levels, and the elimination of net emissions by 2050, recognising the transition to food behaviours characterized by a lower percentage of animal food as a crucial phase in achieving the goal of not exceeding 1.5°C earth temperature increase as per the Paris Climate Agreement.

Increased demand for animal proteins and increasingly intensive and unsustainable animal husbandry are the first 2 of the 7 factors identified in the United Nations Environment Programme (UNEP) report “Preventing Future Zoonotic Disease” as underlying the high risk of outbreaks and spread of serious and communicable diseases.

The Workshop Report on Biodiversity and Pandemics, on the links between nature degradation and the increasing risks of pandemics recently released by IPBES (Intergovernmental Platform on Biodiversity and Ecosystem Services), rings a reliable and frightening bell, also in economic terms: scholars estimate that the costs of preventing pandemics are 100 times lower than the cost of responding to the pandemics themselves.

According to the World Resource Institute (WRI), global demand for animal-based food, which will see a 70% increase in meat and dairy consumption in 2050 compared to 2010, can trigger explosive health conditions.

The impacts of the meat ‘production’ cycle weigh on the planet, collective health, and the economy due to the substantial aid and subsidies to the livestock supply chain. Between March and May 2020 alone, for example, 14.5 million euros were disbursed to the pig, sheep and buffalo sectors in addition to the 100 million euros allocated by the “Cura Italia” Decree to the livestock and fisheries sector[1]. In another example, through the CAP, premiums for dairy cattle amounted to € 71,300,487 in 2019, for milk cows (meat husbandry) to €38,710,322, and for slaughtered cattle, to €63,566,423[2].

Moreover, we must not forget the substantial aid donated to glossy advertising campaigns for meat or other products presented as coming from animals living in unrealistically idyllic scenarios.

Meat consumption, in fact, mainly relies on animals, infinite and vulnerable clones of each other, transformed by virtue of increasingly precise genetic selections aimed at maximum yield with minimum effort. These are accompanied by continuous mechanical breeding and births, rapid and never-ending, producing “consumer goods” at incessant rates and broken down for sale. Their much-touted welfare is also, in the minimum criteria that govern it, subject primarily to the quality of the “product” intended for the table. The whole situation has solid and tangible profiles and consequences. There is no excuse to postpone a necessary, profound, and urgent systemic change to stop the destruction caused by meat consumption and performed on multiple levels and on numerous fronts throughout the planet, including Italy.

To address this problem area, first of all, we need to frame and know its dimensions. Subsequently, we, as individuals and communities, must adopt behaviours aimed at maximizing the remediation of damages and preventing them from getting worse.

To identify the problem’s extent, LAV has focused on an accurate and specifically referenced framework of the Italian context and of the environmental and health footprint of the of the most widespread meat types’ of production and consumption cycle. At the same time, the aim was to translate these impacts to an economic scale to clearly measure the uncompensated damage resulting from animal husbandry. The report summarised here provides an overview of meat consumption in Italy. Next, it explains the methodology adopted for estimating hidden costs due to meat consumption, to follow with the main study outcomes, interpreted by comparison with those available in the scientific literature, which are discussed with the conclusions emerging from the work performed.

1 - https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/15734
2 - http://www.pianetapsr.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1367

MEAT IN ITALY

To frame the situation, the study first reports **statistics on meat production, trade and consumption in Italy and per capita consumption for the different types of meat**.[3] Almost 600 million animals are slaughtered in Italy every year (see table 2)

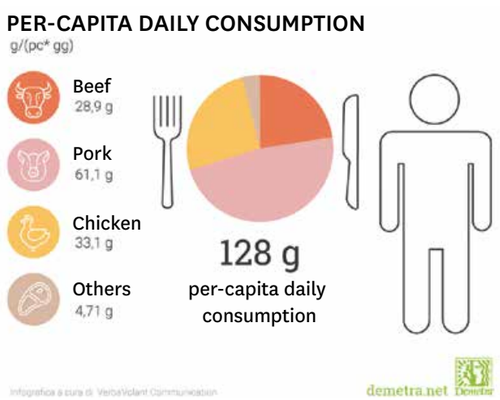
The most extensively reared animals in Italy are chickens (73% of all live animals at the time of the survey), followed by turkeys (12%) and pigs (4%). To have an idea of the number of chickens farmed**, there are approximately 2.5 live chickens for each resident in Italy.**

Almost a million and a half tons of meat were obtained in Italy in 2018 (40% of the total), from the slaughter **of more than 11 million pigs.** Next up are chickens and turkeys, approx. 562,000,000; cattle, approx. 2,770,000, and 15,900,000 rabbits. (Table 2)

The study focused on the most widespread meat consumed in our country, but we should not forget the other millions of animals, such as rabbits, horses, sheep and goats that are reared and killed every year and that are an unwilling part of the gargantuan meat 'production cycle.' Together, they reach 3.1% of the annual quantity (Table 2). The percentage is also reflected, in principle, in the breakdown of the per-capita daily consumption, (Table 8) with an amount, for the omnivorous population in Italy, equal **to 128 g.** This represents the functional unit used in this study to calculate the annual impacts of meat consumption in Italy.

Meat		Consumption		
		Kt/y	g/(pc*gg)	%
Beef	Fresh	563	27,6	21,6
	Processed	28,9	1,25	0,98
Pork	Fresh	219	16,2	12,7
	Processed	1.034	44,9	35,1
Chicken	Fresh	680	33,1	25,9
Others		97	4,37	3,68
Total		**2.620**	**128**	**100**

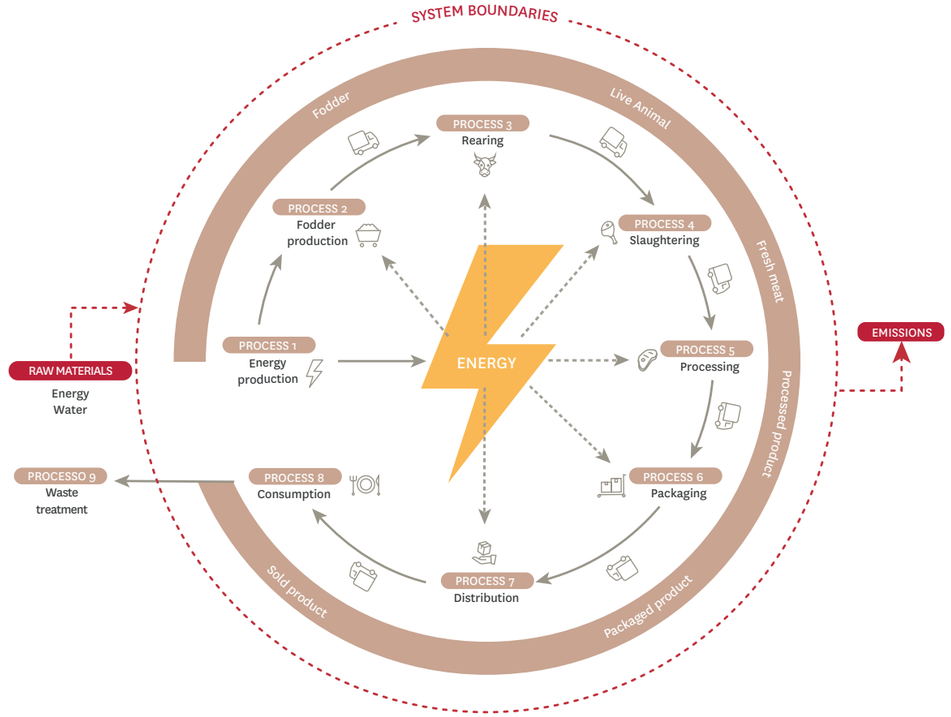
Table 8. Distribution of daily meat consumption by the omnivorous population in Italy. Actual daily consumption represents the functional unit used to estimate the annual impacts of meat consumption in Italy.



Family	Species	Slaughtered animal	Produced meat		Yield
		thousands	kt	%	kg/head
Cattle	Buffaloes	109	22,3	0,6	204
	Bulls and cows	2.660	787	21	296
	Total	2.770	809	22	NA
Galliformes	Chickens	534.000	973	27	1,82
	Turkeys	27.800	300	8,2	10,8
	Total	562.000	1.270	35	NA
Pigs	Pigs	11.300	1.470	40	130
Others	Goats	128	1,67	0,1	13,1
	Horses	20,5	5,62	0,2	274
	Rabbits	15.900	43,1	1,2	2,72
	Sheep	2.750	33,9	0,9	12,3
	Others	ND	30,4	0,8	NA
	Total	18.800	115	3,1	NA
Total		595.000	3.670	100	NA

Table 2. Animals slaughtered and meat produced in Italy in 2018. Source: FAOSTAT

3 - The reference year for the entire study is 2018.



ESTIMATE OF ENVIRONMENTAL IMPACTS: THE METHOD

In this study, the emissions generated at all stages of four types of meat, i.e. rearing, slaughtering, processing, packaging, distribution, consumption and waste treatment, have been converted into economic costs for society through **a lifecycle assessment** (*LCA*). This is a structured and internationally standardised method that allows quantifying the potential environmental impacts associated with a good or service, starting from the consumption of resources and emissions.

The analysis was divided into 'production' and consumption of **beef, pork, processed pork and chicken**, i.e., the four most common types of meat in Italy [4].

Eleven environmental impact categories are considered: climate change; ozone layer reduction; land acidification; eutrophication (divided into freshwater and marine); human toxicity; photochemical smog formation; particulate formation; eco-toxicity (divided between terrestrial, freshwater, and marine); ionizing radiation; land occupation; and water consumption.[5]

In particular, the costs for society related to the most relevant environmental impact categories for our case study are illustrated in the ENVIRONMENTAL FOCUS SECTION. [6]

ESTIMATE OF HEALTH IMPACTS: THE METHOD

From the analysis of several cohort studies and scientific literature, we can derive a measurement of health damage associated with meat consumption, compared to different classes of diseases. This figure, compared to consumption levels and population, tells us how many years of life and "healthy" life are lost annually in Italy, out of the total population, due to meat consumption. Therefore, this research uses the DALY[7] (*Disability-Adjusted Life Year*) as unit of measurement which expresses the number of years lost because of a disease, due to disability or premature death. In line with epidemiological studies, the relationship between consumption of red or processed meat and the risk of contracting **colorectal cancer, type 2 diabetes, stroke, and cardiovascular diseases** has been considered. [8]

4 -In the first part of the study, where the environmental and health impacts of the different types of meat are compared, the functional unit is 100 g of meat consumed. In the final part of the study, however, the functional unit is the average daily meat consumption of the omnivorous population in Italy, equal to 128 g of meat.

5 - These categories are the same as those suggested by the European Commission for LCA studies, with scientific models confirmed by peer review, which correlate some emission with the impact on the environment and/or humans.

6 - The costs related to environmental impacts due to Italian meat consumption occurring outside national borders, (for example, the impacts of deforestation in South America to grow soybeans consumed in Italian farms), have been ascribed to the Italian society, considering the EU's "polluter pays" principle. According to this principle, Italy has a debt with the countries in which the environmental impact occurs. In addition, environmental damage occurring abroad also indirectly affects the well-being of Italians. For example, biodiversity loss and greenhouse gas emissions due to deforestation in South America cause a loss of well-being for the whole world.

7 - Originally developed in 1990 by Harvard University for the World Bank - the World Health Organization (WHO) adopted it since 2000 - the DALY is an increasingly common measure in public health and disease health impact assessment. It extends the notion of potential years of life lost due to early death to include "healthy" life years lost due to ill health or disability.

8 -Risk factors for the various diseases related to meat consumption and the years of life lost in Italy due to disease have been found in epidemiological studies published in internationally recognized scientific journals.

11 ENVIRONMENTAL IMPACT CATEGORIES

1 Climate Change
2 Ozone layer depletion
3 Land acidification
4 Freshwater and marine eutrophication
5 Human toxicity
6 Photochemical smog formation
7 Particulate formation
8 Land, freshwater, marine eco-toxicity
9 Ionizing radiation
10 Agricultural land occupation
11 Water consumption

MAIN STUDY OUTCOMES

HIDDEN ENVIRONMENTAL COSTS [9]

- **The life cycle of 1 kg of fresh beef generates an environmental impact that can be summarised in a cost to society of €13.5, while 1 kg of pork, depending on the processing, varies between €4.9 and €5.1 while the chicken weighs on the community for €4.7 per kg.** [10]
  In other words, it can be said that a 100g beef burger[11] causes an environmental cost of €1.35, while 300g of beef would cost €4.05. A 100-gram pork sausage will impact with a cost of between €49 and 51 cents, while a chicken breast of the same weight will be equivalent to €47 cents.

HIDDEN HEALTH COSTS

- **Approximately 350,000 years of life are lost each year due to meat consumption in Italy** [12] **(corrected for disability).**[13]
- This result, distributed among the population, is equivalent to saying that **every year, the healthy life expectancy of a meat eater is reduced by about 2.3 days** and the cost of these lost years of life falls on the whole community, in terms of health costs and lack of productivity.
- Considering an average European value **of 55,000 euros for a year of life lost in health and dividing the expenditure among the quantities of meat consumed in Italy**, **the consumption of 1 kg of red meat costs the community €5.4 and the consumption of 1 kg of cured meats costs €14.**[14]
  In other words, the consumption of 100 grams of ham costs the community, in health terms, €1.4.

HIDDEN ENVIRONMENTAL COSTS + HIDDEN HEALTH COSTS

- Adding up the environmental and health damage, the consumption of 1k g of meat is equivalent to costs for the community of about €5 for chicken meat, €10 for pork, €19 for cured meats (processed pork) and €19 for beef.
- By comparison, the production of 1 kg of legumes costs about €50 cents.
  In other words, applying the same criterion, the consumption of each 100g beef burger costs the community €1,9, the same amount as 100 grams of ham.

ANNUAL HIDDEN COSTS (ENVIRONMENTAL + HEALTH)

- If the cost of one kg of meat is extended to **annual meat consumption in Italy,** the price paid by society due **to environmental and health impacts** stands at around **€36.6 billion (in a range between €19.1 and €92.3 billion)**[15]**.**
- Divided by the Italian population**, the damage generated by meat consumption per capita is, therefore, in a conservative and balanced estimate, around €605 per year (with a range between the minimum and maximum values, ranging between €316 and €1,530 euros per person).** The average cost is almost equally divided between **environmental costs (48%)** and **health costs (52%).**[16]
- The highest costs in the community **are generated by cured meats**, given the high consumption in Italy (39%) and the high health costs compared to other types of meat. **Fresh meat** also creates a powerful burden on society, mainly **due to the emissions that its life cycle generates**[17].

9 -The environmental impacts have been converted into costs for the community through estimates of the damage they generate on the well-being of the population. These estimates are the same as those used by the European Commission for the evaluation of external costs.
10 - Emissions of particulates, which damage human health; emissions of acidifying gases, which reduce the productivity of land; greenhouse gas emissions, with all the damage that a warmer planet causes; the diffusion of nutrients and pesticides in nature with indirect costs for man due to damage to ecosystems.
11 - Food simplification is presented here as an example by LAV and is not an integral part of the research in 'Il costo nascosto del consumo di carne in Italia' (The hidden cost of meat consumption in Italy). For any scientific detail, please refer to the main report.
12 - The disability-adjusted life year (DALY) is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability, or early death. It was developed in the '90s as a way to compare the overall health and life expectancy of different countries.
13 - Excluding uncertain factors, such as the effect that meat consumption generates on cardiovascular diseases.
14 - As can be seen from this difference, the main cost is generated by the high consumption of processed meat (46 g per day on average), which increases the risk of contracting type 2 diabetes by 30%, stroke by 16%, and colorectal cancer by 14%.
15 - Depending on the value ascribed to environmental and health impacts and considering the uncertainty in health risk estimates due to meat consumption.
16 -Given the numerous conservative inputs made in the study, (such as the exclusion of some categories of environmental impact and diseases related to meat consumption such as antibiotic resistance, obesity, spread of viruses), the calculated hidden cost is probably an underestimate of the real cost, values close to the lower end of the cost range associated with environmental and health impacts were used. In case the highest values of the confidence interval were considered, the hidden cost of meat consumption in Italy could exceed €1,500 per person per year.
17 - In addition to greenhouse gas emissions, generated mainly by the bowel fermentation of cattle and the management of animal manure, emissions of particulates and acidifying gases in stables and emissions of nitrates and pesticides into the soil to grow fodder also generate costs of billions of euros on society each year. These emissions generate a direct cost to human health; for example, bronchial diseases caused by particulate emissions, and an indirect cost generated by damage to ecosystems: for example, agricultural losses due to acid soils or lack of pollinators due to pesticides.

1: FOCUS ON HIDDEN COSTS ENVIRONMENTAL

- Considering the extreme values of the external cost estimates, the total cost in the community caused by the life cycle of meat consumed in Italy varies between **a minimum of €6.3 billion (equal to €105 per inhabitant per year) to a maximum of €43.2 billion (equal to €714 per inhabitant per year).**
- **1 kg of chicken or pork generates 8 times more costs for society than the** same amount of legumes, 1 **kg of beef generates costs multiplied by 23 times**.
- If we consider the proteins produced instead of the weight/mass, the gap in costs between meat and legumes increases further. The average cost of obtaining protein from legumes varies between 97% and 92% less than the cost generated by meat.
- For **1 kg of harvest**, pea production generates the lowest environmental cost for society, equal to €40.2 cents.

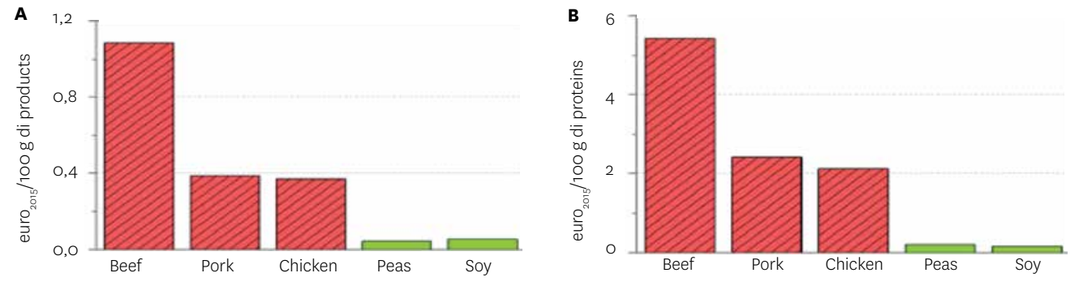


Figure 20. Comparison of the cost to society (euro2015) of meat and legumes due to the environmental impacts generated throughout their entire life cycle: a) comparison on 100 g of product; b) comparison on 100 g of protein.

In-depth study of some environmental impact categories

Below are the impacts and **costs for society related to the most relevant environmental impact categories for our case study**.

As already stated, the survey performed considers **100 g of meat consumed**, compares the different meats with each other and **with both peas and soy**, making the same comparison also on **100 g of protein consumed**.

Climate change

Anthropogenic emissions of greenhouse gases, notably carbon dioxide (CO_2), methane (CH_4) and nitrous oxide ($_{N2O}$), into the atmosphere trap outgoing heat. The resulting global warming changes the climate and weather conditions and increases the occurrence of extreme events. Costs to society attributable to climate change include rising sea levels and consequent migrations of coastal populations, increased health costs, loss of years of life due to the spread of diseases, reduced availability of water and food in some areas, loss of biodiversity, and altered ecosystems.

Comparing Results

Per 100 g products

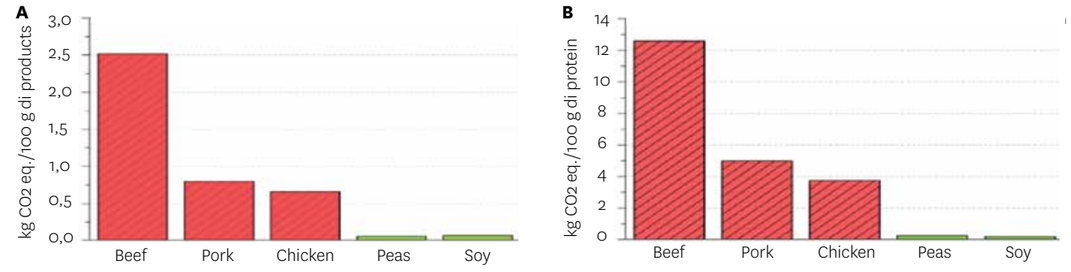


Figure 3. Comparison of the global warming potential (kg CO_2 eq.) of the production phase of meat with European legumes (peas and soy): a) comparison on 100 g of product; b) comparison on 100 g of protein.

In the **comparison by weight (100 g),** meat has a **global warming potential between 10 and 50 times higher than that of legumes.** For 100 g of products, peas show a slightly lower impact than soy. The gap between meat and legumes increases when the comparison considers proteins produced, given the high protein content of legumes. By comparison to legumes**, per 100 g of protein,** beef generates **55 times the impact of peas and 75 times that of soy**.

Per 100 g consumed

Regarding greenhouse gas emissions, the rearing phase is the most relevant phase for all types of meat with a **minimum contribution of 66% for processed pork and a maximum of 77% for beef.**

By processing

100 g of **cooked ham**-type processed meat generate **65 g of CO_2 eq**, while **cured ham processing generates emissions that are five times more than** that **(330 g CO_2 eq /100).**

Example: Climate change impact of some foods[18]

Beef (Hamburger) 100 g =	3.26 kg CO_2 eq.
Beef (Steak) 300 g =	9.78 kg CO_2 eq.
Pork (Sausage) 100 g =	1.19 kg CO_2 eq.
Chicken (Breast) 100 g =	0.94 kg CO_2 eq.

THE FIGURE*: in one year, the emissions associated with the life cycle of beef consumed in Italy alone amount to 18, 341,46 kilotons of CO_2 eq. (over 18 million tons), for a hidden annual cost of over €1 billion. This is equivalent to the amount of greenhouse gases emitted by the largest and most polluting coal-fired power stations in Europe. In total, CO_2 eq. emissions associated with meat amount to about 40 million tonnes per year.

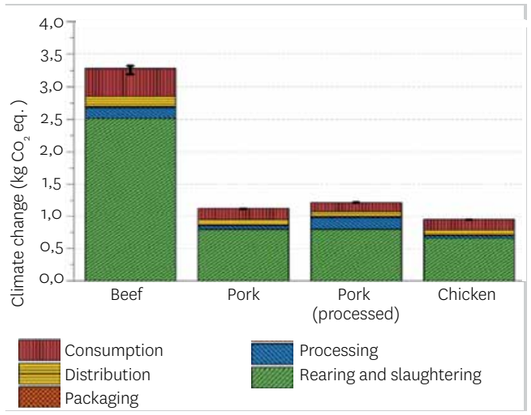


Figure 4. Comparison of the global warming potential for the four types of meat considered, divided by lifecycle stages (kg CO2 eq. per 100 g of meat consumed). The error bar indicates the standard deviation of the result, calculated using a Monte Carlo analysis (10,000 iterations).

Land acidification

Emissions into the atmosphere are converted into sulphuric acid and nitric acid and deposited on land or vegetation, also in the form of **acid rain**, which contribute to lowering the soil pH, resulting in damage to crops, growth of plants with diseases, and corrosion of buildings.

Comparing Results

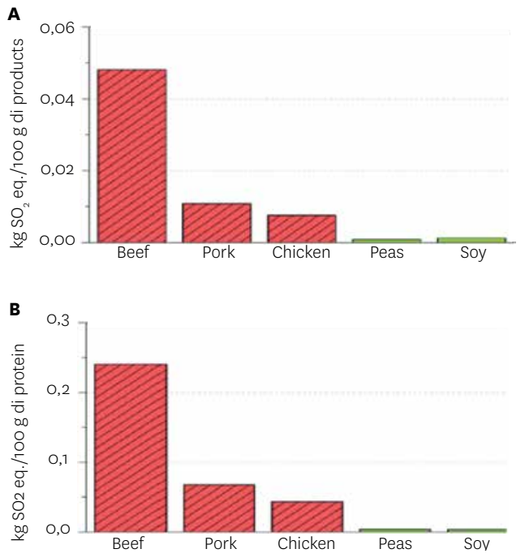


Figure 7. Comparison of the land acidification potential of the production phase of meat with European legumes (peas and soy): a) comparison on 100 g of product; b) comparison on 100 g of protein.

The most impactful phase for this environmental damage is rearing, which contributes **between 75% and 80% more than the other** production cycle **phases.** The main cause is **ammonia** emitted by the management (shelter and storage) of animal manure and used in the fertilisation of fields intended to produce animal feed.

This is not surprising, **given that 60% of the total ammonia emissions in Italy are due to the management of animal manure** and, in line with this statistic, **almost 60% of the emissions of the entire life cycle of cattle derive from manure** (directly in the rearing phase, and indirectly from waste in **the subsequent phases) and 33% from field fertilisation.**

The contribution of **legumes to acidification is minimal compared to that of meat**, both in terms of quantity and protein content.

For **100 g of protein produced, peas and soy** have a potential impact on land acidification ranging from **a minimum of 1% compared to beef to a maximum of 8% compared to chicken meat.**

18 - Food simplification is presented here by way of example by LAV and are not an integral part of the research 'Il costo nascosto del consumo di carne in Italia' (The hidden cost of meat consumption in Italy). For any scientific detail, please refer to the main report.
* Data processing by LAV.

The hidden cost associated with these impacts is estimated at just under €3 billion a year.

Marine eutrophication

Excessive nutrient enrichment (nitrogen, phosphorus and potassium) of soil, water, and air disrupts natural ecological processes. Different nutrient concentrations lead to **variations in the presence of particular species** present in the ecosystem (e.g., algal proliferations) which can lead **to ecologically dead zones due to lack of oxygen**[19]**.** Most emissions do not occur in livestock farming per se, but **in the production of food that serves as animal feed.** Indirectly, however, these emissions are always caused by livestock farming**: about 95% of the emissions derive from the use of manure as fertiliser**. Almost all of these emissions derive from nitrate emissions into water.

Comparing Results

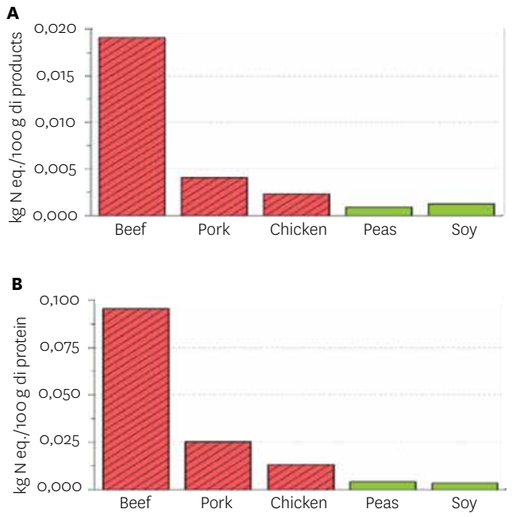


Figure 9. Comparison of the marine eutrophication potential of the production phase of meat with European legumes (peas and soy): a) comparison on 100 g of product; b) comparison on 100 g of protein.

Comparing **100 g of protein produced**, beef causes **25 times the average impact caused by legumes,** pork **7 times**, and chicken meat **3.5.**

The hidden cost associated with these impacts is estimated at just under €700 million a year.

Particulate formation

The **mix of particles**, solid or liquid, of various sizes, **emitted as a result of anthropogenic activities, is called particulates.** The smaller the particle size, the greater the depth to which **they can access the human body**, including into the lung alveoli. Secondary particulates, smaller than 2.5 microns ($PM_{2.5}$), are more harmful to human health than PM_{10}. The agri-food sector contributes to the formation of **secondary particulates** mainly through **ammonia emissions from manure storage and spreading**.

Diseases caused or aggravated by particulate matter **include asthma, chronic obstructive pulmonary disease, cardiovascular diseases caused by inflammation and arteriosclerosis, arrhythmias, and cardiac arrest**. In addition, toxicological studies have shown that particulate matter can also cause genetic alterations and allergic reactions. Reduced particulate concentrations have been associated with a reduction in premature deaths.

In the meat production cycle, the main cause of particulate formation is **the emission of ammonia into the atmosphere (75% for cattle, for example),** which occurs both in the **management of manure** and in the **fertilization** of fields for animal feed.

The trend confirms data from other impact categories reviewed: **peas and soy cause an impact between 1% and 8% of that generated by meat.**

Comparing Results

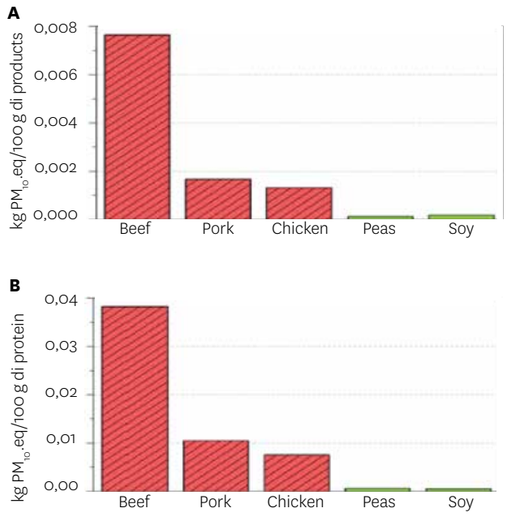


Figure 11. Comparison of potential particulate formation of the production phase of meat with European legumes (peas and soy): a) comparison on 100 g of product; b) comparison on 100 g of protein.

PRACTICAL EXAMPLE OF IMPACT[20]

Beef (Hamburger) 100 g	0.008 kg PM_{10}
Beef (Steak) 300 g	0.024 kg PM_{10}
Pork (Sausage) 100 g	0.02 kg PM_{10}
Chicken (Breast) 100 g	0.001 kg PM_{10}
Soy IT 100 g	0.0002 kg PM_{10}
Peas 100 g	0.0001 kg PM_{10}

19-In this case, the damage estimate refers exclusively to the impact on ecosystems, expressed as a fraction of the species present in a square meter, that are potentially damaged by the emission (PDF: potentially disappeared fraction) in one year
20 - Food simplification is presented here as an example by LAV and is not an integral part of the research of 'Il costo nascosto del consumo di carne in Italia' (The hidden cost of meat consumption in Italy). For any scientific detail, please refer to the main report.

THE FIGURE*: in one year, the emissions associated with the life cycle of fresh beef consumed in Italy alone amount to 54.22 kilotons of PM_{10} eq, for a hidden annual cost of over €2.1 billion. A total of more than 98 thousand tons of PM_{10} eq can be attributed to the meat supply chain, for economic damage amounting to over €3.8 billion.

Land ecotoxicity

The **main impact agents are pesticides used in agriculture**, created specifically to kill organisms that pose a threat to the field or farmed animals. As these substances disperse into the environment with use; their impact extends well beyond the place where they are applied, and toxins can also accumulate in food animals, creating possible damage to human health as well.

Chicken meat is the most impactful, followed by pork; beef, for once, is the least impactful. The reason for this trend is that the impact is directly proportional to the use of **soy flour from South America and palm oil** from South-East Asia in the feeding of farmed animals.[21]

Comparing Results

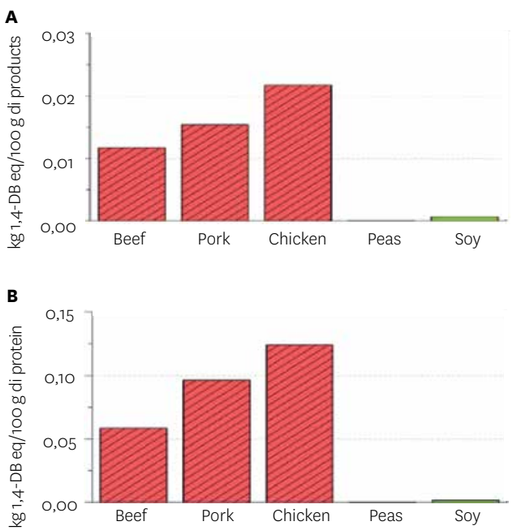


Figure 13. Comparison of the potential land eco-toxicity of the production phase of meat with European legumes (peas and soy): a) comparison on 100 g of product; b) comparison on 100 g of protein.

The impact of legumes is much lower than that of meat, both in terms of mass and protein[22]. In protein terms**, meat impacts 30 to almost 500 times more (in the case of chicken).**

THE FIGURE*: in one year, the economic damage associated with the life cycle of the various types of meat, in terms of terrestrial ecotoxicity, is more than €4.4 billion.

Agricultural land occupation

This category includes all land removed from nature to make room for crops or livestock needed for meat production.[23]

Comparing Results

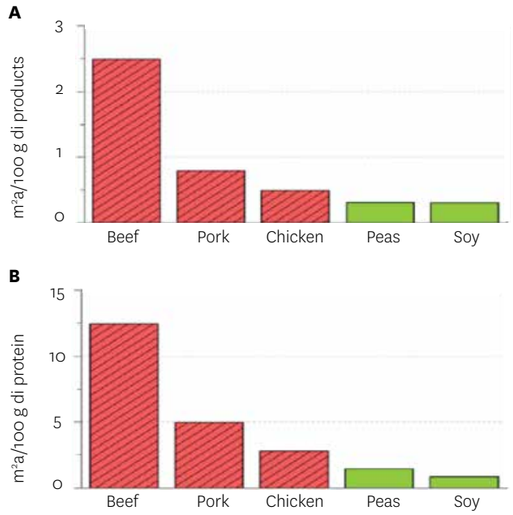


Figure 15. Comparison of agricultural land occupation of the production phase of meat with European legumes (peas and soy): a) comparison on 100 g of product; b) comparison on 100 g of protein.

Meat uses on average between **3 and 12 times the agricultural land used to grow legumes**. Again, soy is the most sustainable source of protein: **0.8 m² of soil is consumed per 100 g of protein produced**, compared, for example to the **12.5 m² necessary to produce 100 g of protein from beef.**

21 - Almost 100% of the impact of chicken is in fact due to these two crops: 70% soy from Argentina and 27% palm oil from Indonesia and Malaysia.

22 -The category indicator is 1.4-dichlorobenzene dispersed in the marine environment. This substance scarcely degrades and therefore accumulates in the environment, with impacts mainly on aquatic life. The impact of other chemicals dispersed in nature is therefore assessed in relation to the impact of 1.4-dichlorobenzene. The price to the community used in the study is estimated at the economic value given to biodiversity. The costs of the toxicity categories present greatest uncertainty. The estimated cost for the fraction of species (PDF); that is, highly likely to disappear in a region due to unfavorable environmental conditions (in this case the presence of pesticides) is €0.083/(PDF*m2*year) with an estimated range of €0.024 to €0.649.

23 - In this study, the category "land occupation" refers to occupation for agricultural purposes, given the relevance to the subject matter of the investigation. The ReCiPe model was used to calculate the impact, considering 18 different characterization factors for different land uses. The conversion of land use into an economic cost is particularly problematic given the difficulty in giving monetary value to nature's ecosystem services, such as food and water supply, climate regulation, water purification or pollination. The economic value used in this study is estimated at the value attributed to biodiversity loss, already presented for the ecotoxicity category.

PRACTICAL EXAMPLE OF IMPACT[24]

Beef (Hamburger) 100 g	2.49 m²
Beef (Steak) 300 g	2.49 m² x3 (7,47)
Pork (Sausage) 100 g	0.79 m²
Chicken (Breast) 100 g	0.49 m²
Peas 100 g	0.31 m²

Water consumption

Beef consumes between **6 and 8 times** the amount of water needed to produce chicken and pork, respectively.

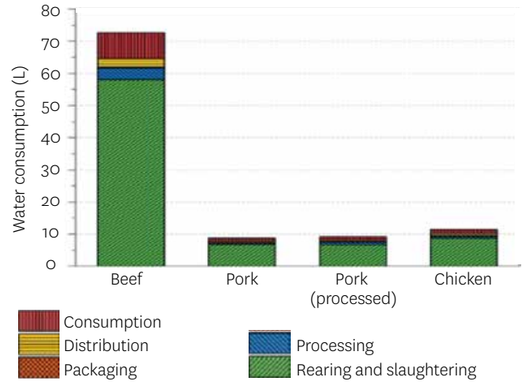


Figure 16. Potential water consumption (L) per 100 g of meat consumed divided by lifecycle stages

The difference in consumption among meat types depends mainly on the quantities and type of food consumed by animals. The bulk of consumption, for all types of meat, is the fodder production phase. In particular, the irrigation of fields for maize and wheat production is the main contribution for all types of meat.

Water used to drink and wash animals in corrals also plays an important role in total consumption, a burden of more than 30% in the case of pigs and about 10% for cattle and chickens.

Of the 730 litres collected to obtain 1 kg of beef, 92 are consumed in the corral by the bovine.

Pigs and chickens drink less**: pigs consume 2.9 litres per 100 g of meat, and chickens 1.1 litres.**

Note: The water consumption calculated here is much lower than the values reported in the literature with reference to the water footprint of meat (e.g., 1,500 litres per 100 g of beef[25]). This difference is due to this study's exclusion of the contributions of green and grey water related to consumption.[26]

Comparing Results

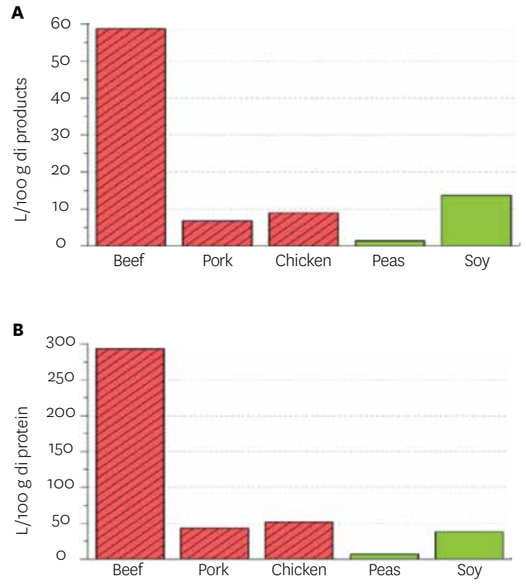


Figure 17. Comparison of water consumption (L) of the production phase of meat with European legumes (peas and soy): a) comparison on 100 g of product; b) comparison on 100 g of protein.

Water consumption for meat production was compared with water consumption for pea and soy production.

For **100 g of protein produced, soy requires less water (38 L) than all meat (from 43 L for pork to 290 L for beef).**

In protein terms, **pea production is the process that requires the lowest water consumption (6.6 L/100 g protein).**

PRACTICAL EXAMPLE OF IMPACT[27]

Beef (Hamburger) 100 g	58,63 Litres
Beef (Steak) 300 g	175,89 Litres
Pork (Sausage) 100 g	6,83 Litres
Chicken (Breast) 100 g	9,00 Litres
Peas 100 g	1,42 Litres

24 Food simplification is presented here as an example by LAV and is not an integral part of the research 'Il costo nascosto del consumo di carne in Italia' (The hidden cost of meat consumption in Italy). For any scientific detail, please refer to the main report.

25 - A.Y. Hoekstra, M.M. Mekonnen, The water footprint of humanity, Proc. Natl. Acad. Sci. U. S. A. 109 (2012) 3232–3237. doi: qw2ase0.1073/pnas.1109936109.

26 - In the case of the 'traditional' water footprint, in fact, the following are also calculated: green water, i.e. the volume of rainwater that does not contribute to surface runoff and refers mainly to water that passes from the ground into the air in the steam state due to the combined effect of perspiration, through plants, and evaporation, directly from the ground; grey water, which represents the volume of polluted water, quantified as the volume of water necessary to dilute pollutants to the point that the water quality returns above quality standards. https://www.minambiente.it/pagina/cose-la-water-footprint

27 - Food simplification is presented here as an example by LAV and is not an integral part of the research of 'Il costo nascosto del consumo di carne in Italia' (The hidden cost of meat consumption in Italy). For any scientific detail, please refer to the main report.

UNDER THE MAGNIFIER: THE ENVIRONMENTAL COSTS OF ALL CATEGORIES

Analysing Table 14, considering the environmental costs deriving from the consumption of 100 grams of beef, processed pork, and chicken, it is noted that in the case of beef, the environmental impact that generates the greatest cost on society is the **formation of particulates,** responsible for 28% of the total cost. It is followed **by acidification (22%), soil consumption (19%), and climate change (14%). Particulate matter generation** is also one of the main causes of the social costs of producing other meats: 18% and 15% of the total for pork and chicken, respectively. For both, however, the higher social cost is due to **land ecotoxicity**, which generates a cost to society of €17 cents per 100 g of pork (34% of the total) and €24 cents per 100 g of chicken meat (50% of the total). **Agricultural land occupation, land acidification, and climate change** also play a leading role in the cost to society generated by pork and chicken production, with percentages ranging between 10% and 18%. un ruolo di primo piano anche nel costo per la società generato dalla produzione di carne di maiale e pollo, con percentuali che variano tra il 10% e il 18%.

Impact Category	Beef			Processed Pork			Chicken		
	Aver.	Min.	Max	Aver.	Min.	Max	Aver.	Min.	Max
Climate change	0,184	0,071	0,308	0,067	0,026	0,112	0,053	0,021	0,089
Ozone layer depletion	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Land acidification	0,300	0,032	0,341	0,071	0,008	0,081	0,049	0,005	0,055
Freshwater eutrophication	0,001	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000
Marine eutrophication	0,074	0,074	0,074	0,016	0,016	0,016	0,009	0,009	0,009
Human toxicity	0,010	0,007	0,015	0,005	0,004	0,008	0,003	0,002	0,005
Photochemical smog formation	0,014	0,010	0,022	0,002	0,002	0,004	0,001	0,001	0,002
Particulate formation	0,378	0,270	0,582	0,092	0,066	0,142	0,069	0,049	0,107
Land eco-toxicity	0,128	0,017	0,145	0,167	0,022	0,189	0,235	0,032	0,266
Freshwater eco-toxicity	0,001	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000
Marine eco-toxicity	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Ionizing radiation	0,003	0,002	0,003	0,001	0,001	0,001	0,001	0,000	0,001
Agricultural land occupation	0,261	0,079	2,12	0,083	0,025	0,677	0,052	0,016	0,418
Total	**1,35**	**0,56**	**3,61**	**0,51**	**0,17**	**1,23**	**0,47**	**0,14**	**0,95**

Table 14. Sensitivity analysis of environmental costs deriving from the consumption of 100 g of beef, processed pork and chicken.

2: FOCUS ON HIDDEN HEALTH COSTS

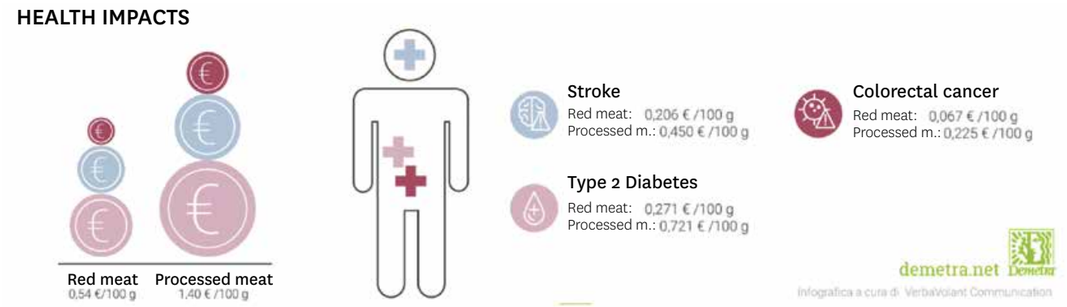
- At the national level, the cost to society, excluding cardiovascular diseases, is between **€12.7 and €24.5 billion per year**, with an **average value of €19.1 billion (equal to €315 per person).**
- If the total cost to the community is divided equally on the meat consumed annually in Italy (**1,060 kilotons/year of processed meat and 782 kilotons/year of red meat**), it is possible to **estimate the cost generated to the community due to the consumption of 100 g of meat** (as shown in the infographic below).[28]
- For **processed meat**, the main contributions are due to costs in terms of DALY loss for **type 2 diabetes and cardiovascular diseases** (35% and 33%, respectively).

Comparison with plant alternatives

In the studies used as a source for calculating the health impact of meat consumption, dose-response curves are reported in terms of the relative risk of contracting a certain disease, also for legumes.

- For all diseases considered in this report, **a consumption of 50 or 100 grams per day of legumes does not increase the risk of contracting them. On the contrary, the risk of getting sick is reduced as the daily consumption of legumes increases**.
- For example, for 100 g of legumes consumed per day, the risk of contracting cardiovascular disease **is reduced by more than 10%**.

28 -It is worth noting that the cost does not refer to the health cost to be incurred by an omnivore who eats 100 g of meat once, but reflects the annual health cost for Italy (in terms of loss of life years and healthy life years) due to the total consumption of meat (assuming the daily consumption reported above) divided into individual portions (100 g).



3: FOCUS ON TOTAL HIDDEN COSTS (ENVIRONMENTAL + HEALTH)

Meat Type	Environmental costs 1 kg · Euro 2015	Health Costs 1kg · Euro 2015
Beef	13,5	5,4
Pork	4,9	5,4
Pork (processed)	5,1	14,0
Chicken	4,7	0

Total economic costs to society due to meat consumption (**1 kg consumed**)

Based on this analysis, the total hidden cost borne by society for 1 kg of beef or cured meat purchased is equal to €17 (considering that 110 grams of that purchased kilo will be wasted and therefore not consumed)[29].

For processed pork, **the health share represents the most significant contribution of the total cost, the opposite is true for beef: 71% of the cost to society is due to the environmental impacts generated during its life cycle.**

Meat Type	Environmental costs/euro 2015	Health Costs/euro 2015
Beef	1,35	0,54
Pork	0,49	0,54
Pork processed	0,51	1,40
Chicken	0,47	0

Table 17. Total economic costs (environmental and health costs) to society due to meat consumption (100 g consumed)

The contributions of the environmental and health shares are equivalent in the case of **fresh pork. Its consumption costs the community about €10 per kg consumed**.

Finally, the environmental impacts generated by the life cycle **of chicken meat** on society amount to **about €5 per kg, entirely attributed to its environmental damage. Even meat generally considered to have a lower "impact," therefore, produces enormous damage and externalities: €5 of environmental damage per kg produced is twice the average cost of wholesale chicken. For every kg of wholesale traded chicken, there is a double economic value, made up of environmental costs compensated by neither the producer nor the consumer.**

Comparison with plant alternatives

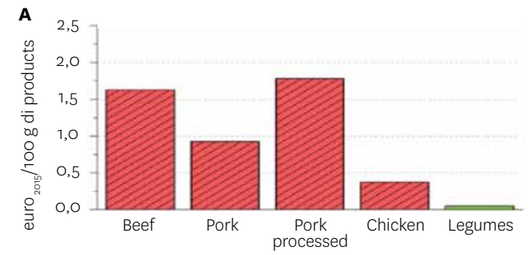


Fig 24. Comparison of total (environmental and health) hidden costs due to meat and legumes consumption (euro 2015): a) comparison on 100 g of product; b) comparison on 100 g of protein.

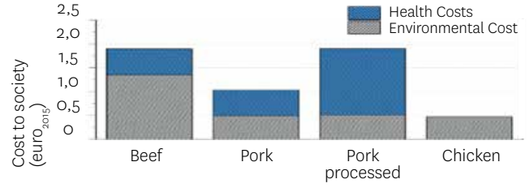


Figure 23. Total economic costs to society due to meat consumption (100 g consumed)

29 - For every €17 per kg of meat per beef and cured meat purchased, if we subtract 110g of waste, we have 890g left, which multiplied in one case (beef) by €18.9/kg result in €16.8, while in the other case (processed pork) by €19.1/kg result in €16.99. So, we can approximate to €17 in both cases.

The **environmental and health cost** due to the **consumption of 1 kg of legumes is equal to €50 cents**, lower than the cost generated by all types of meat considered in the study.

Even excluding the health benefits of a legume-based diet, **the hidden cost of meat is between 8 and 37 times higher than that of legumes (€0.30 to €1.70 more).** [30]

The comparison is even more favourable for legumes when protein is compared: **100 g of protein from legumes costs the community €17 cents (excluding health benefits), while 100 g meat proteins cost between €2 and €11**. In this comparison, pork further worsens its performance given its lower protein content than other meats.

4: FOCUS ON TOTAL ANNUAL HIDDEN COSTS

Meat consumption in Italy generates a collective hidden cost estimated at **€36.6 billion per year, equal to €605 for each individual resident**. **To provide a term of comparison for the value mentioned, it is equivalent, as an order of magnitude, to the sum of three taxes active in our country: that on electricity and system charges (€14.4 billion in 2017), the regional additional income tax (Irpef) (€11.8 billion), and the tobacco tax (€10.5 billion**).

The main contribution (54%) **is made by the consumption of processed meat**, given the high consumption and high health costs.

Consumption **of beef follows (31%). This cost also includes the** cost related to the consumption of processed beef (2% of the total cost).[31]

Overall, **beef has a hidden cost to society of around €11.5 billion**, mainly due **to the environmental impact caused by animal husbandry.**

Chicken meat weighs on society for a total annual cost of about **€3.2 billion, equal to €53 per person**.

Fresh pork (about 17% of the total pork consumed in Italy) costs society **about €37.5 per inhabitant each year**, at a total cost **of €2.3 billion.**

- A legume-based diet, in addition to **having an environmental impact of 95% lower** on average than meat, could create a collective benefit given the reduction of the risk of contracting **several diseases.**
- As we have already said, given the **numerous conservative hypotheses** made in the study, such as the exclusion of some categories of environmental impact and diseases related to meat consumption (e.g. antibiotic resistance, obesity, spread of viruses**), the calculated hidden cost is probably an underestimation of the real cost. In addition, values close to the lower end of the cost confidence interval associated with environmental and health impacts were used**.
- The maximum value associated with health damage (calculated in[32] DALY) and environmental damage is equal to €92.3 billion. Divided by the Italian population, this value corresponds to a cost per capita of €1,530 per year.
- At the other extreme, if lower economic values are attributed to DALYS and environmental impacts, and if the minimum risk of contracting diseases is considered, the per capita cost would be €316, equal to an annual cost for the community of €19.1 billion (see Table 19).

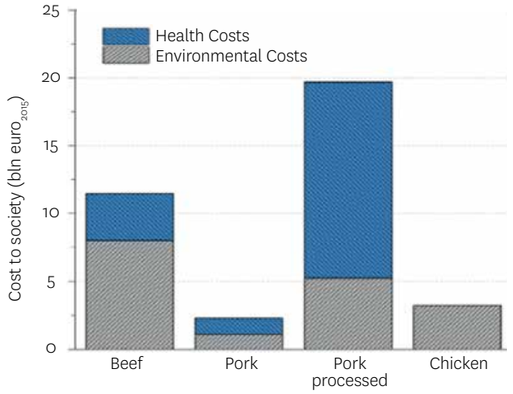
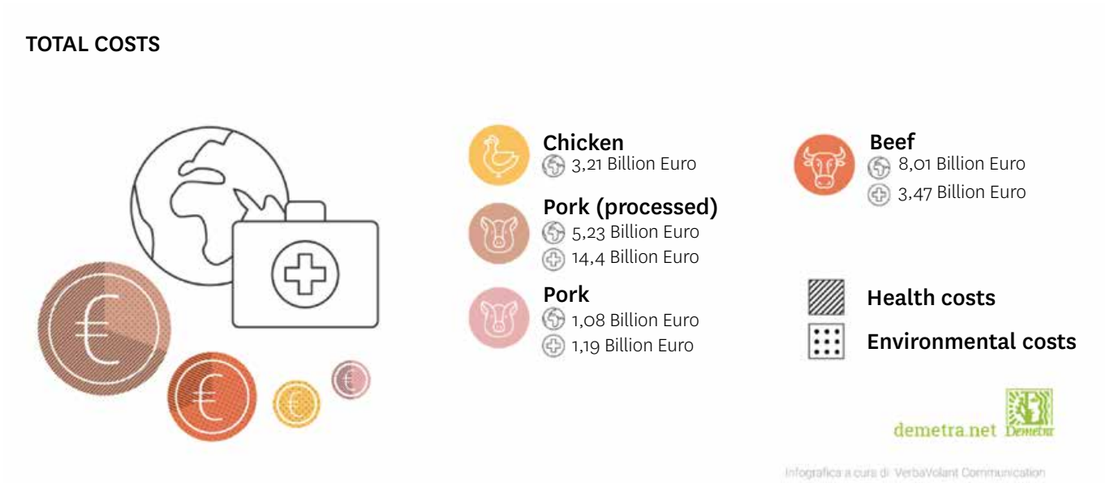


Figure 25. Comparison of total environmental and health hidden costs for the Italian society due to annual meat consumption (billion euro2015).



Meat Type	Environmental costs			Health Costs			Total Costs		
	Aver.	Min.	Max	Aver.	Min.	Max	Aver.	Min.	Max
Beef	8,01	3,33	21,4	3,47	1,40	10,7	11,5	4,73	32,0
Pork	1,08	0,36	2,65	1,19	0,43	3,77	2,27	0,78	6,42
Pork (processed)	5,23	1,75	12,7	14,4	10,9	34,8	19,7	12,7	47,5
Chicken	3,21	0,92	6,47	0	0	0	,3,21	0,92	6,47
Total	**17,5**	**6,35**	**43,2**	**19,1**	**12,7**	**49,1**	**36,6**	**19,1**	**92,3**
Per capita (EUR)	**290**	**105**	**714**	**315**	**211**	**811**	**605**	**316**	**1.526**

Table 19. Variability of total hidden costs to Italian society (environmental and health costs) due to annual meat consumption (billion euros 2015)

30 - We should remember that these numbers do not consider the costs for society due to the processing, distribution, and consumption of meat and legumes.
31 - Based on the assumption that the processing of bresaola generates the same environmental impacts as the processing of cured ham, while the same impacts as the processing of ham were assumed for the processing of canned beef. With reference to health impacts, the same impacts as processed pork was considered for processed beef.

32 -As already explained, the disability-adjusted life year (DALY) is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability, or early death. It was developed in the '90s as a way to compare the overall health and life expectancy of different countries.

RECOMMENDATIONS

The current food choices, with the impacts and costs detected by the study presented here, strongly influence the future of everyone and the planet. We can act on the climate and life of the planet, including animals, with simple variations of our behaviour at the table, making it an aware and sustainable one. Meat impact data and population growth require a dietary transition from animal proteins to plant proteins that are more environmentally sustainable and healthy for humans.

Prompt action is needed to avoid ever more serious environmental, health, and economic damage that - as in the case of the Covid-19 pandemic - would spare almost no one.

The path to follow must lead to a systemic change that involves a decisive reset of food systems and the transition towards a clear affirmation of the consumption of proteins of plant origin to the detriment of those from animals.

Individual conduct must be facilitated and guaranteed by the institutions, which are called upon to adopt active policies, in this sense, commensurate with the epochal crises we are facing.

TO LOCAL INSTITUTIONS

Local authorities play an important role in achieving the 2030 Agenda objectives, and an ambitious local *food policy* is now essential in this regard. In this context, LAV promotes policies and measures that facilitate the adoption of sustainable individual and collective behaviours oriented towards a 100% vegetable diet.

To this end, LAV recommends:

- The planning of food policies that include elements to raise awareness and educate citizens about the centrality of food choice in terms of improving environmental sustainability, individual health, and respect for animals,
- Local food transition plans for public catering, which provide for a progressive and decisive use of plant proteins instead of animal proteins, thus ensuring the achievement of objectives to reduce greenhouse gas emissions and other pollutants, protect public health and prevent economic damage to the community.

AT NATIONAL AND COMMUNITY POLITICAL LEVEL

LAV believes that at national and European Union level, policies need to be implemented that maximize the spread of proteins of plant origin. To move consistently in this direction, the numerous subsidies that support the livestock supply chain, in many meat "production" phases, must be eliminated soon. The externalities highlighted in this study are largely brought back to the cost of meat; specific tax levers must be activated to discourage the consumption of animal proteins and promote that of vegetable proteins. The challenge of preserving the climate, as discussed over the years and also foreseen in many specific plans, from the current proposal for a National Recovery and Resilience Plan (PNRR), to the previous Integrated National Energy and Climate Plan (PNIEC), completely ignores the contribution of livestock to emissions. Similarly, many of the issues addressed in the PNRR (from air quality to ecosystem integrity, from land consumption to population health) inevitably refer to the food issue, but, incredibly, no mention is made.

The country must conceive a Food Transition Plan, a roadmap that aligns the food issue with the themes of development, sustainability, climate, social justice, and health.

To this end, LAV recommends:

- The progressive and rapid reduction to zero of the "Environmentally Harmful Subsidies" (SAD) catalogued by the Ministry of the Environment with reference to livestock farming and the extension of the catalogue with the inclusion of livestock categories not currently included.
- Promoting the consumption of vegetable proteins by lowering VAT from 22% to 4%, as is already the case for animal milk, for 'milk'-type vegetable drinks.
- The progressive and then definitive blocking of public funding for animal husbandry and transparency in the criteria and numbers relating to them.
- The adoption of a law that protects vegetarian and vegan food choices and the subjects who adopt them, in all environments and social spheres, promoting their dissemination and correct information about them.
- The revision of the Community Agricultural Policy (CAP) increasingly in the direction of protecting the environment, biodiversity, and public health, with the rapid, progressive, and therefore definitive reduction of subsidies to the livestock supply chain, and a framework of financing and measures to promote the cultivation of plant proteins specifically intended for human consumption (thus excluding those for animal feed intended for income).
- The halt to publicly funded animal product marketing campaigns and their transformation into campaigns on the correct substitution and adoption of plant proteins.

The numbering of the Tables and Figures in this summary corresponds to the numbering in the research "The hidden cost of meat consumption in Italy: environmental and health impacts" carried out by DEMETRA, and has been maintained to facilitate consultation of the two documents.

- The shift of public livestock farming subsidies from production aid to aid for the conversion of the supply chain to crop production.
- Achieving the *Farm to Fork* strategy objective, which states that "*a correct diet based on plant foods reduces the risk of disease and greatly reduces the impact of our food system on the environment*," to be performed through a decisive enhancement of 100% plant protein foods.
- The adoption and extension of food labelling that will cover the nutritional, climatic, environmental, and social aspects of products. This is already included among the *Farm to Fork* strategy objectives and must be extended to also contain clear elements regarding the animal's quality of life (rearing, transport).
- The activation of tax levers, also by applying a 'meat tax' or similar measures, capable of reducing consumer prices of meat to the real environmental and health costs generated throughout the supply chain.
- This was followed by a major change in farming practices as part of the planned revision of COUNCIL DIRECTIVE 98/58/EC of 20 July 1998 on the protection of animals kept for farming purposes and measures to phase out intensive farming.

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A VACCINE FOR THE PLANET

LET'S NOT COME BACK AS BEFORE

Animal exploitation caused the pandemic. Let's make this pandemic the last one.

1 / MORE VEGETABLE FOODS

Because meat, milk and eggs cut down forests, pollute, cause suffering, and spread new viruses.

2 / A TRULY GREEN ECONOMY

Companies, starting with food and clothing firms, must be converted to true sustainability, by giving them access to the 'Recovery Fund-Next Generation EU'.

3 / STOP THE TRADE OF EXOTIC ANIMALS

Let's stop import, trade and keeping of wild and exotic animals. who can be vehicles for the spread of new viruses.

4 / NO MORE PUBLIC MONEY FOR ANIMAL AGRICOLTURE

Factory farms are time bombs for the spread of new viruses. Let's shift public funding from animal agriculture to plant-based food production.

5 / MORE RESEARCH WITHOUT ANIMALS

Let's invest in a science that uses alternative methods, which are more effective for patients than animal testing. Let's free animals from laboratories.

6 / HELP FOR FAMILIES WITH PETS

The health and economic crisis have affected many families with pets. Let's help them by providing access to veterinary medicines, reduced VAT on food and care and incentives for pet adopters.

LAV

#NONCOMEPRIMA

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