

LIFE CYCLE ASSESSMENT FROM PRODUCTION OF ONE KILOGRAM OF RABBIT MEAT VERSUS CHICKEN

RAMÍREZ G. LIZET^{1*}; RAMÍREZ G. GEORGINA^{1}
AND GÜERECAL. PATRICIA²**

1.-Instituto Tecnológico y de Estudios Superiores de Monterrey Campus Ciudad de México.
Calle del Puente #222 Col. Ejidos de Huipulco, Tlalpan C.P. 14380, México D.F.

2.-Instituto de Ingeniería Universidad Nacional Autónoma de México. Circuito escolar s/n
Ciudad Universitaria, Delegación Coyoacán. México D.F. CP 04510.

*Corresponding autor: lizrubirg@gmail.com

**Corresponding autor: geowitz99@gmail.com

ABSTRACT

Both rabbit and chicken are white meat and part of the Mexican diet. Today environmental concerns of consumers encourage companies to minimize the environmental impacts of their products. ISO 14040 describes the principles and framework for Life Cycle Assessment (LCA) which is a technique to assess the environmental aspects and potential impacts associated with a product, process, or service. Therefore we decided to use this methodology in order to analyze the supply chain of both meats. The functional unit considered is one kilogram of meat rabbit or one kilogram of chicken meat in order to provide a basis for the establishment of good practices by Mexican farmers.

Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) software was used. The boundaries of the system analyzed in the process were animal feeding, meat processing, consumption and waste disposal. The methodology consisted on compiling an inventory of energy and materials evaluating the environmental impacts associated with each unit. Data measurements: faeces, urine, water and energy of machinery, were made on the rabbit farm *Los Tíos* and UNAM's chicken farm.

The life cycle impact categories analyzed were eutrophication, global warming, use of fossil fuels, water use and land use as impacts from the production of one kilogram of chicken meat and rabbit. We conclude chicken meat production requires larger amounts of energy and water. Machinery used to slaughter, freeze and clean assigned chicken meat a higher impact. Manure,



UAEM Universidad Autónoma
del Estado de México

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

especially rabbit's, causes eutrophication and land impact when penetrates soil and water ground. Use of wastewater treatment plants, rainwater, low power cleaning machines, digesters and other technologies were suggested in order to mitigate meat production environmental impacts.

Key words: Life cycle assessment, environmental impact, supply chain, rabbit farm.



426



Congreso Americano
de Cunicultura
2014



SAGARPA
SECRETARÍA DE AGRICULTURA,
GANADERÍA, DESARROLLO RURAL,
PESCA Y ALIMENTACIÓN



COMECYT
CONSEJO MEXIQUENSE DE CIENCIA Y TECNOLOGÍA

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

Introduction

Environmental concerns of consumers encourage companies to create sustainable products. In other words, producers are willing to minimize environmental impacts caused by the manufacturing process without compromising its quality. Industries today have a linear supply chain, however, there are methodologies that analyze beyond these limits and make it a cycle from obtaining raw materials to waste management. According to the Society of Environmental Toxicology and Chemistry, Life Cycle Assessment (LCA) is a process by which we evaluate as objectively as possible the environmental burdens associated to a product by quantifying the use of material and energy discharged to the environment.

Aware of the importance of the production and consumption of rabbit meat and chicken in Mexico we conducted a LCA in order to compare the production of one kilogram of New Zealand rabbit meat against Ross chicken. This publication encourages farmers in the establishment of better practices and helps mitigate its environmental impacts.

Objective

To assess the environmental impacts related to the production of one kilogram of rabbit meat compared to one kilogram of chicken meat to establish sustainable practices.

Material

Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) assisted LCA by interpreting the inventory into different impact categories. Measurements to inventory were made on *Los Tíos* farm, located in Xochimilco, for meat rabbit and in UNAM's farm, located in Tláhuac, in the case of chickens. Data for inventory were provided by these farms in order to support the sustainable production of both types of meat. Unknown data were estimated for both farms; measurements used the international system and equipment such as scales, tape measures and datasheets in the case of electricity. Electricity was turned into coal, oil, natural gas, hydro and nuclear according to the production of electricity in Mexico (BUWAL, 2000).

427



V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

Method

ISO 14040 standard for LCA states that is necessary to determine the boundaries of the system. Our system includes animal feeding, meat processing, consumption and waste disposal.

Animal feeding

Growth of animals considers food and water supply, manure and its cleaning. Food supply was considered by land impact and water consumption was 103 l/kg for chicken and 40.5 l/kg for rabbit. Measurement of feces and urine estimated that one kilogram of rabbit meat produced a total of 18.52 kg of manure, 16.2 kg of urine and 2.3 kg of feces; while the chicken meat only produced 4.9 kg of manure. Chemical analysis of the excrement in various species (Miani, 1990) was used to quantify dry matter, organic matter, total nitrogen, ammoniacal nitrogen, phosphorus pentoxide, potassium oxide, calcium oxide and magnesium oxide.

Meat processing

Slaughter in both cases is done by shocking with electric current to desensitize the animal. This is the methodology that avoids rigor mortis and keeps flesh soft. Blood is drained and viscera are deposited from the carcass. It was also considered water usage for cleaning both rabbit and chicken meats. Packages are an input to the process which produces no impact at this stage.

Consumption

In the process of use of the product was not considered any variable, since it depends on the way people prepare meat.

Waste disposal

Plastic bags and post-consumer organic waste was taken into account.

Limitations of LCA

Data collection had different obstacles; the main one was the lack of records related to the flow of materials within the farm. Water, gas and supplies necessities for animal growth weren't measured and had no inventory mostly because its production was not the same each month. Some electrical appliances had no datasheet or were too old to know the model. Also the tools to process an LCA don't have databases in Mexico; therefore the results are approximate since the impacts vary by region according to its regulations and climate.

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
 Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

Result and Discussion

TRACI displayed results classifying impacts by ecotoxicity, eutrophication, fossil fuels, global warming, human health noncancerogenic, land use, photochemical smog and water use. Rabbit meat and chicken meat were compared in each of these impacts, obtaining percentages and then changed into a scale of 0 to 10 to facilitate analysis. Figure 1 show below the final results by comparing both meats.

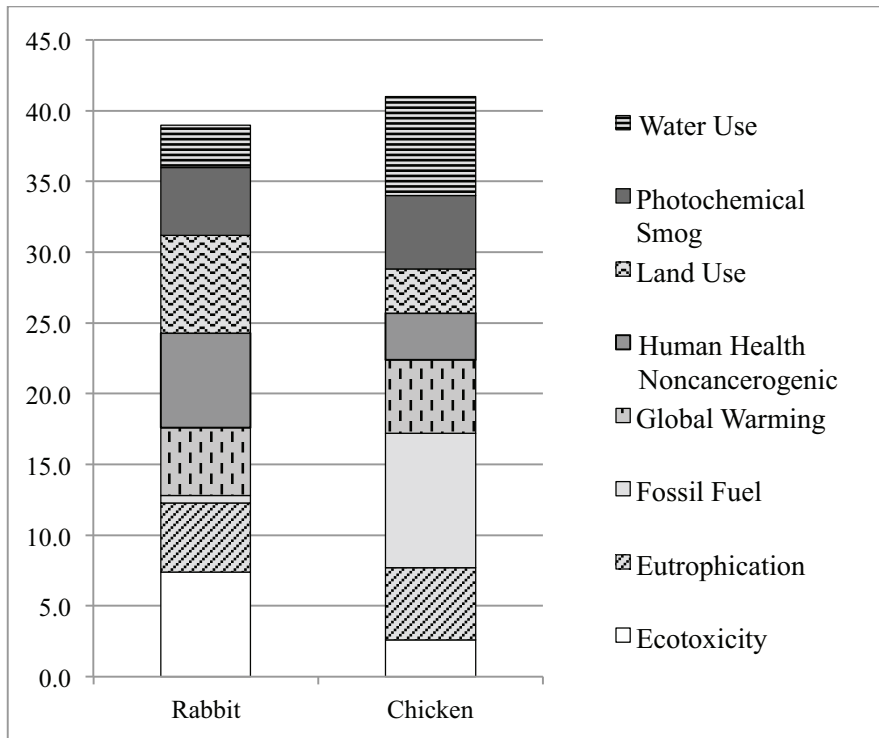


Figure 1. Comparison of impacts. Environmental impacts for production of one kilogram of rabbit and chicken meat

The biggest difference between the two productions was the use of fossil fuels with 9.5 points for chicken versus 0.5 points for rabbit, this is due to the great distances used to transport chickens from its birthplace to the area of production, unlike the rabbits that didn't require the transport as they are born within the farm. Electrical equipment for sacrifice also influences fossil fuels, not only for electrocution or plucking, but for cooling in ice tubs and long term storage in freezers.

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

Land use is greater for rabbits than chickens since the rabbit farm is not filled to capacity, therefore, rabbits have further extension to produce a kg of meat.

In the case of water use, chickens production requires considerably more water for growing and processing. Slaughter occupies larger amounts of water for cooling and de-feathering, also machinery requires deep cleaning after process. Comparative ecotoxicity value comes from using plastic bags; chicken meat distributes its weights since carries more kg per bag compared to rabbit.

Photochemical smog reflects air pollution caused by both meat productions, there's a slightly difference because of the amount of NOx emitted to the atmosphere. Human health effects vary from respiratory issues to permanent lung damage if prolonged exposure to ozone occurs.

Human Health Noncancerogenic difference is caused by the content of ammonia in both animals' manure. Rabbit manure contains 0.439 kg while chicken only 0.22 kg, in other words, chicken releases about half ammonia compared to rabbit.

Conclusions

Chicken meat production reflects a higher rate of environmental impacts; the biggest difference derives from fossil fuel required to supply energy demanded. Rabbit meat can be done manually due to the size of farm production which is reflected in low power consumption. Chicken use larger amounts of water in cleaning, drinking and processing. Correct disposal of viscera, blood and manure is imperative. Principally in rabbits, manure is important due to the high content of elements that enter ground water causing eutrophication and soil damage. Since main impacts were on energy and water some suggestions to the current agricultural production are:

- Use Wastewater Treatment Plants to mitigate their impact and promote water reuse within the same process.
- Promote the collection of rainwater for cleaning and other activities.
- Use all output as raw material and create a closed loop or industrial symbiosis to improve eco-efficiency.
- Automating only if its production is constant and wide.
- Breeding animals within the farm if possible.

430





UAEM Universidad Autónoma
del Estado de México

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

-Search alternatives to emit heat in brooders as digesters or solar cells.

It's important to remember that LCA varies according to the region and analyzed system.

However, the earlier study aims to improve current practices towards sustainable production.

References

Society of Environmental Toxicology and Chemistry. 2011. Global Guidance Principles for Life Cycle Assessment Databases. *UNEP*, 41-51.

Gabor D. 2000. Database for Energy Production. *BUWAL*

Miani A. 1990. Las deyecciones de un conejo; un fertilizante a valorar. *Cunicultura*, 199-202

