

# Digestibility of plant-based and meat burgers using an *in vitro* protocol for swine

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**Objectives:** Plant-based burgers are increasingly being adopted by consumers as a substitute for meat burgers [1]. Given the importance of digestibility and the few researches that have been done on it in plant-based burgers, the objective of this research was to compare the digestibility of plant-based and meat burgers, applying an *in vitro* digestibility procedure for swine.

**Materials and Methods:** The digestibility was measured on seven types of burgers: 1 meat burger (MT), 2 commercials (CB and CE) and 4 not commercial (P1 to P4) plant-based burgers, all with pea as protein base. Ten meat burgers and six burgers for each plant-based type were analyzed in duplicate for a total of 92 samples. They were lyophilized before doing the *in vitro* digestibility analysis.

Given the similarity between the human and pig digestive systems [2], an enzymatic *in vitro* method normally utilized to test feed digestibility in swine was used [3]. Samples were digested during 3 steps: acid pepsin digestion, pancreatin digestion and Viscozyme digestion. It allowed to measure ileal (Id) total (Td) and fiber digestibility (Fd). The 3 values of digestibility were calculated as follows:

$$Id = \frac{(wbi - wai2)}{wbi} \quad Td = \frac{(wbi - wai3)}{wbi} \quad Fd = \frac{(wai2 - wai3)}{wai2}$$

Id= ileal digestibility, Td= total digestibility, Fd= fiber digestibility, wbi= weight of samples before incubation, wai2= weight of samples after 2<sup>nd</sup> step, wai3=weight of samples after 3<sup>rd</sup> step. The Daisy Incubator (Ankom Technology Corporation Fairport, NY, USA) was used to carry out the analysis. All data were analyzed with SAS software (version 9.4; SAS Institute Inc., Cary, NC).

**Results and Discussion:** Plant-based not commercial burgers and commercial burger CE had a significant higher ileal digestibility (from 64.6% to 70.6%) than meat and commercial burger CB (48.2% and 47.9%). The same significant trend was found for total digestibility (from 76.6% to 81.1% for plant-based not commercial burgers and CE; 58.7% and 57.8% for meat and CB). At contrary fiber digestibility was similar in all types of burgers (from 2% to 3.9%). The higher ileal and total digestibility of plant-based types may be due to the different protein-lipid interactions that occurs in meat

and its plant-based analogs. These bonds are stronger in meat making stomach digestion more difficult [4].

Similar results for Ileal and total digestibility were found by other authors [4], that found stomach digestibility higher in plant-based burgers then in meat, while intestinal digestibility was higher in real meat.

Moreover, we found that the use of this *in vitro* digestibility technique reduces costs, laboratory intensity and time compared to methods normally used to analyze food digestibility [3;4].

**Conclusions:** This is the first study in which enzymatic method utilized in pig digestibility studies adapted to Ankom Daisy<sup>II</sup> Instrument was used to analyze food, allowing to compare the digestibility of plant-based and meat burgers. This method has proven to be advantageous in terms of time and laboriousness.

The results obtained were very promising, and plant-based burgers showed higher digestibility than meat burgers.

Further studies are needed to confirm and extend these results in view of a more sustainable consumption of protein foods.

## V. References:

1. Kyriakopoulou K., Dekkers B., and van der Goot A.J. (2019). Plant-based meat analogues. In Sustainable Meat Production and Processing pp. 103-126. Academic Press.
2. Roura E., Koopmans S.J., Lallès J.P., Le Huerou-Luron I., de Jager N., Schuurman T., and Val-Laillet D. (2016). Critical review evaluating the pig as a model for human nutritional physiology. Nutrition Research Reviews 29(1): 60-90.
3. Tassone S., Fortina R., and Peiretti P.G. (2020). In Vitro techniques using the Daisy<sup>II</sup> incubator for the assessment of digestibility: A review. Animals 10(5): 775.
4. Zhou H., Hu Y., Tan Y., Zhang Z., and McClements D.J. (2021). Digestibility and gastrointestinal fate of meat versus plant-based meat analogs: An *in vitro* comparison. Food Chemistry 364: 130439.

**Key words:** Plant-based burgers, Meat burgers, In vitro digestibility, Pig enzymes, Ankom DaisyII instrument