

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, pancreatic digestion and Viscoszyme 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 2nd step, wai3=weight of samples after 3rd 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 than 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^{II} 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:

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Key words: Plant-based burgers, Meat burgers, *In vitro* digestibility, Pig enzymes, Ankom Daisy^{II} instrument