Texture profile analysis on raw homogenized meat and plant-based burgers

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Objectives: The investigations to obtain the textural and sensory quality of plant-based burgers as close as meat burger's quality are increasing, and several studies are emphasizing the correlation between instrumental and sensory texture parameters.

In the present study we evaluated some parameters measured by the instrumental texture profile analysis (TPA) on raw homogenized meat and plant-based burgers (PBB) rather than in its original structure. This was because laboratory experience had shown objective perceivable variability during handling.

Materials and Methods: Two commercial PPBs (CB, CE, pea protein based) and one meat (MT) burgers, for a total of 66 samples, were analyzed for: total moisture content (TMC), fluid to the consumer's mouth (FTM) and meat cooking shrinkage (MCS) [1]. These parameters are related to the juiciness (the last two were measured on the cooked product) and could define and affect the texture of the sample.

Raw samples were homogenized (600 rpm for 20s), poured into a plastic container of 18 mL then, using a texture profile analyzer (Instron 5543), a double compression cycle test was performed with a cylinder probe of 11.2mm diameter. This method was used by Siraj [2] for liquid samples that cannot hold the shape.

The parameters obtained from uniaxial compression were gumminess (GM), chewiness (CH), adhesiveness (AD), springiness (SP, also called elasticity) cohesion force resilience (CF, the peak force observed at the second compression divided by the peak force of the first compression) and cohesion energy resilience or cohesiveness (CEN, the area of work during the second compression divided by the area of work during the first compression).

SAS 9.4 was used for statistical analysis using GLM and correlation procedures. Significance was evaluated by Pearson and Tukey tests.

Results and Discussion: Results of the TPA showed that the gumminess was significantly different: lowest for the CB (1.089N), the double for MT (2.120N) and highest for CE (7.842N).

The chewiness of CB (1.027N, TMC=60.1%) was significantly lower than the MT (1.904N, TMC=60.8%), whereas CE (6.472N, TMC=55.2%) was significantly chewier and this result was expected because CE is a pre-cooked burger, which means that it contains less water and needs more chews to stimulate the saliva. Both cohesion force and cohesion energy resilience didn't show difference between the meat (CF=0.867, CEN=0.550) and CE (CF=0.866, CEN=0.583), but they were significantly higher than CB (CF=0.837, CEN=0.406).

It has been mentioned by Se-Jin [3] and Lin et al. [4] that CF, GM, CH and cohesiveness increased when the water content of meat analogues decreased.

AD of MT and CE were not significantly different (0.0030 and 0.0017 successively), while CB was not as adhesive as the MT ($Pr<0.05$).

Instrumental SP showed the lowest value for CE (0.8297), which was significantly different from MT (0.9028) and CB (0.9497). The hypothesis that was undertaken while measuring the water dynamic of the burgers was that a correlation with those parameters and the TPA attributes should be found. In fact, the TMC, the FTM and MCS were, all, positively correlated with CF, CEN, AD and SP according to Vasanthi et al. [5]. As well, as expected, were negatively correlated with the GM and CH ($Pr<.0001$).

Conclusions: TPA is normally performed on the sample in its original structure but given the objective difficulty in handling some types of burgers, TPA was applied to the raw homogenized product. Those results suggest the usefulness of TPA parameters to distinguish burgers of different compositions also on the homogenized sample and application on the cooked product is under consideration.

References:

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Key words: Plant-based burgers, Meat burgers, Texture profile analysis, Homogenized, Raw product.