The intake of ultra-processed beef impairs liver function, serum biochemistry and lipid deposition in Wistar Rats

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Introduction: The intake of highly oxidized ultra-processed muscle foods, with poor nutrient quality, is associated with higher incidence of non-communicable diseases (Handel et al., 2019). So, the present study was carried out to analyse the effect of a diet supplemented with ultra-processed beef protein on the liver function, serum biochemistry and lipid deposition in Wistar rats.

Material and methods: All protocols were performed according to Helsinki declaration and all applicable legal texts (approved by Animal Experimentation Ethical panel; process n° EXP-20200904). 20 Male Wistar rats were divided in three groups and maintained for 10 weeks with different diets: regular chow with 14% non-animal protein content (CON), an experimental chow supplemented with roasted beef (200°C/10 min) and 30% protein content (T); and an experimental chow supplemented with ultra-processed beef (roasted [200°C/10 min], chilled [4°C/10 days] and microwaved reheated [650KW/2 min) and 30% protein content (T-OX). Food and water were available ad libitum and replaced when necessary. Animal weight, water and feed consumption were monitored throughout the feeding period. At the end of week 10, animals were anaesthetised (4% isoflurane), euthanized (exsanguination) and necropsied. The adipose tissue from different locations, namely, total adipose tissue (TAT), external white adipose tissue (WAT), brown adipose tissue (BAT), visceral adipose tissue (VAT), was dissected and weighted. Blood was collected by cardiac puncture, stored into EDTA tubes and centrifuged to collect the plasma. A serum chemistry panel and a lipid profile were done. All statistical analysis was done using R Statistical Software (R 3.0.0) (Core, 2020) and figures were produced using the package ggplot2 (Wickman, 2016)). P was set at < 0.05.

Results: Higher water intake was observed in T and T-OX groups vs CON (35,66 vs 33.94 vs 18.60 g/animal/day) as a likely consequence of the high-protein intake. A significant increase in TAT and VAT weights were observed in OT group vs T and CON groups (116.40 vs 74.46 vs 72.18 and 88.5 vs 51.15 vs 50.29 mg/g life weight, respectively). These results are of clinical interest as VAT deposition is related to an enhanced secretion of proinflamatory cytokines and several diseases such as hypertension and dyslipidaemia (Kelley et al., 2000). Higher values of total protein and albumin were observed in T-OX group vs T and CON groups (2.98 vs 2.51 vs 2.31 g/dl). Likewise, increased values of creatinine and urea were found in T-OX group vs T and CON groups (0.64 vs 0.44 vs 0.43 and 77.47 vs 48.94 vs 21.78 mg/dl respectively). Similar results have been observed in humans upon cooked meat consumption (Toffaletti et al., 2018). Moreover, AST (Serum aspartate aminotransferase) values were higher in T-OX group than in T and CON groups (45.60 vs 31.33 vs 25.40 U/l respectively). Triglycerides, total cholesterol, LDL-cholesterol and HDL-cholesterol were significantly increased in T-OX group than in the other groups. Those altered serum lipid profiles could be related to an increased VAT deposition in the T-OX group. These results confirm recent findings in which the intake of oxidized pork induced assorted physiological impairments including high body weight, pancreatic and hepatic damage, and inflammation responses (Ge et al., 2020, 2021).

Conclusion: The intake of ultra-processed beef increased visceral adipose tissue depots and caused altered serum lipids profiles and liver function. These results could contribute to understanding the negative impact of severely processed foods on humans´ health.

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