



Effects of an onion extract rich in polyphenols on the hepatic steatosis in Zucker rats

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INTRODUCTION AND OBJECTIVES

Hepatic steatosis is the most common form of Non Alcoholic Fatty Liver Disease (NAFLD) (1). This pathology is considered a benign condition, asymptomatic and reversible. However, fatty liver could lead to more severe pathologies, such as steatohepatitis, fibrosis, cirrhosis or even cancer. Its prevalence is increasing exponentially worldwide. In fact, nowadays the incidence of NAFLD is suggested to be 20%-30% in Western societies (2,3).

In order to find a new therapeutic approach, different extracts rich in polyphenols have been proposed as suitable tools. Some of these extracts show beneficial effects on insulin resistance, hepatic steatosis and steatohepatitis, exercising its mechanism of action on oxidative stress, lipolysis, lipogenesis, inflammation or fatty acid oxidation (1,4,5).

The objective of this study is to analyze the effect of two polyphenol rich extract, obtained from apple and onion, on hepatic steatosis in Zucker (*fa/fa*) rats. For this purpose, the expression of different proteins related to lipogenesis and fatty acid oxidation and its activities have been analyzed.

MATERIAL AND METHODS

- 24 Zucker *fa/fa* rats, a genetic model of obesity which is widely used for the study of hepatic steatosis.

- 3 experimental groups (n=8 per group; 8 weeks)

- O: Obese + standard diet (control group)
- OA: Obese + standard diet + 10% Apple extract
- OO: Obese + standard diet + 10% Onion extract



- Liver extraction was carried out to determine:

- Hepatic triglyceride accumulation by colorimetry.
- Protein expression related to lipogenesis and lipid oxidation by Western Blot:
 - Phosphorylated and total Acetyl CoA Carboxylase (pACC and tACC)
 - Cluster of Differentiation 36 (CD36)
 - Fatty Acid Transport Protein 2 (FATP2)
 - Fatty Acid Transport Protein 5 (FATP5)
 - Aquaporin 9 (AQP9)
 - Mitochondrial Transcription Factor A (mtTFA)
- Protein activity related to lipogenesis and lipid oxidation by colorimetry:
 - Fatty Acid Synthase (FAS)
 - Carnitine Palmitoyl Transferase-1a (CPT-1a)

- Statistical analyses were performed using SPSS 24 statistical software:

- One-way ANOVA
- Post-hoc: Tukey

- The effect size was calculated by using Cohen's *d* parameter.

RESULTS

- All values are presented as means ± SEM.

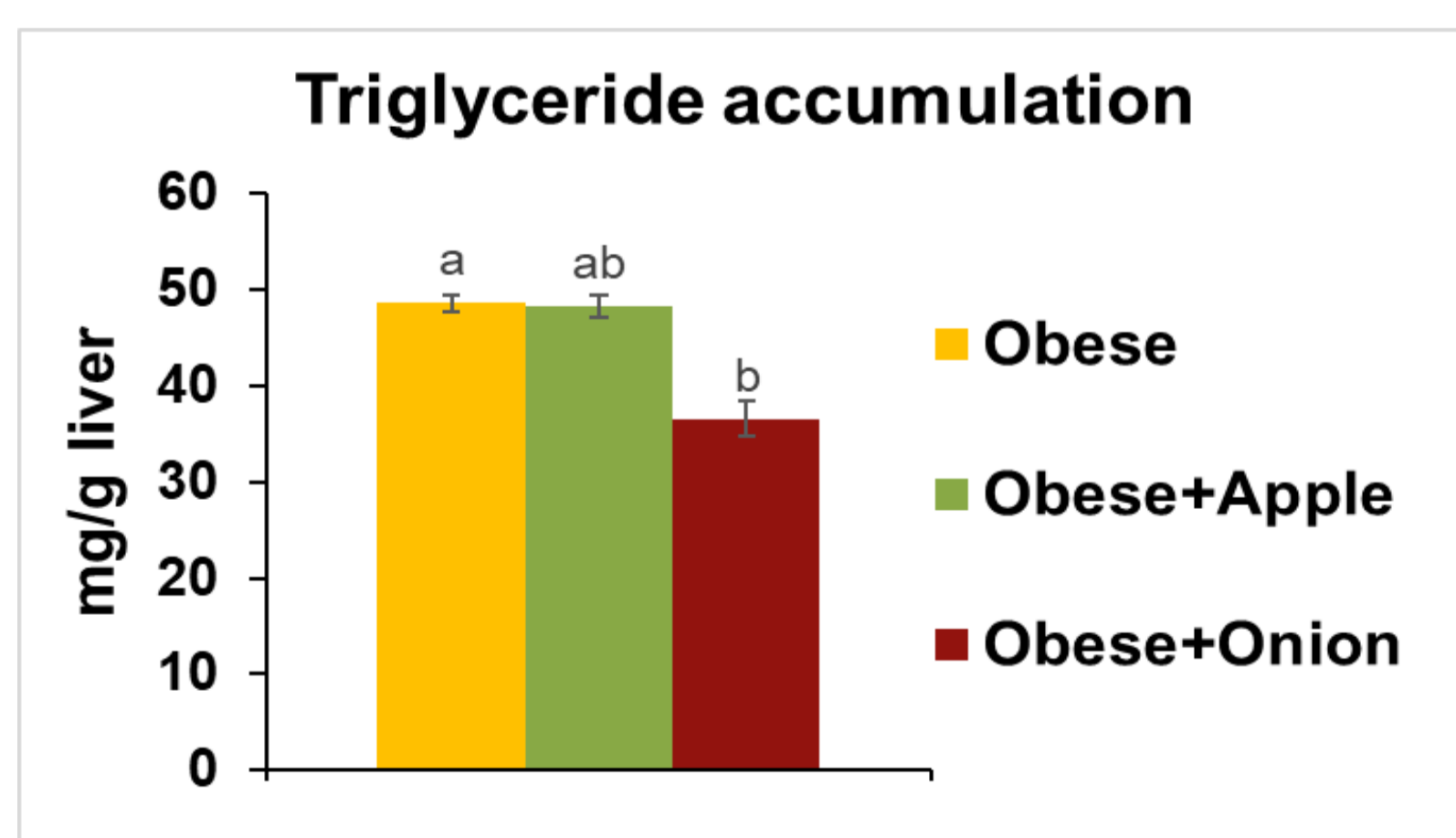


Fig 1. Effects of an apple extract and onion extract on hepatic triglyceride accumulation of Zucker *fa/fa* rats.

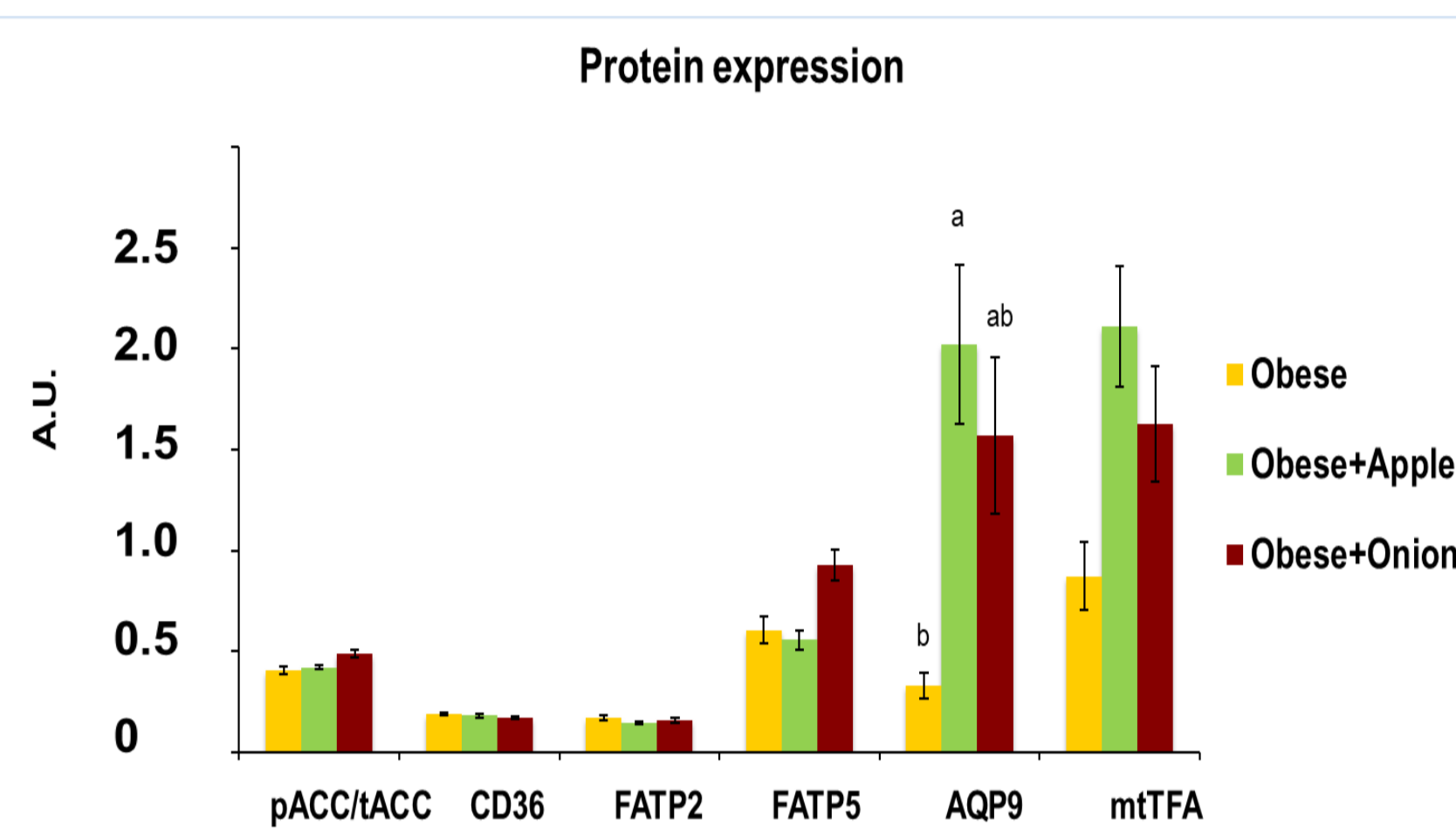
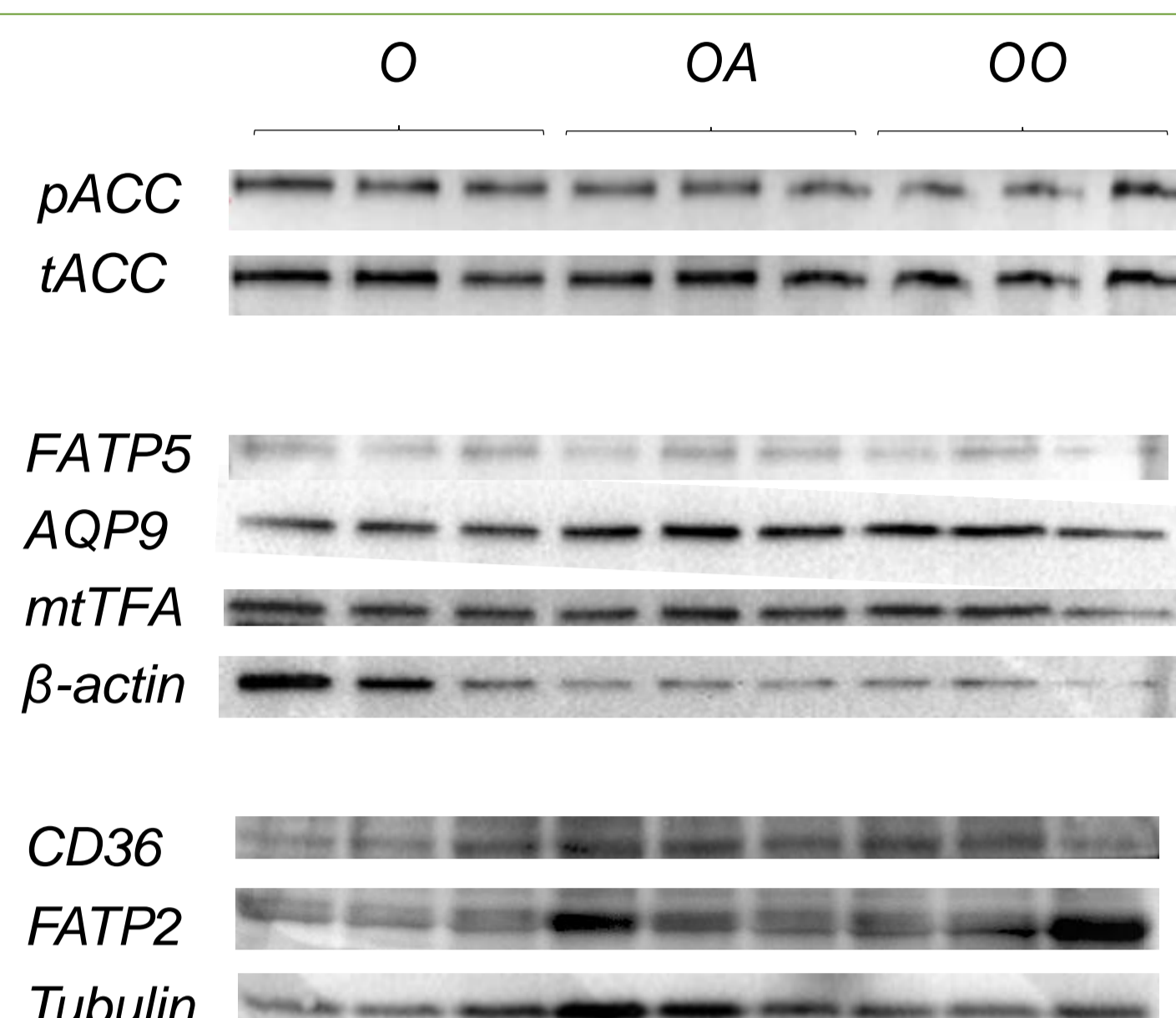


Fig 2. Effect of an apple extract and an onion extract on the relation of hepatic pACC/tACC, CD36, FATP2, FATP5, AQP9 and mtTFA, expression of Zucker *fa/fa* rats.

- Looking at size effect (Cohen's *d*), OA and OO groups show a moderate effect upon mtTFA expression (Cohen's *d* value: 0.5-0.8). This fact can be taken out as an effect on mtTFA protein expression is likely in the extract-treated rats although not statistical differences have been observed.
- Apple extract could avoid the compensatory mechanism that appears in hepatic steatosis (the decrease of AQP9) (6).

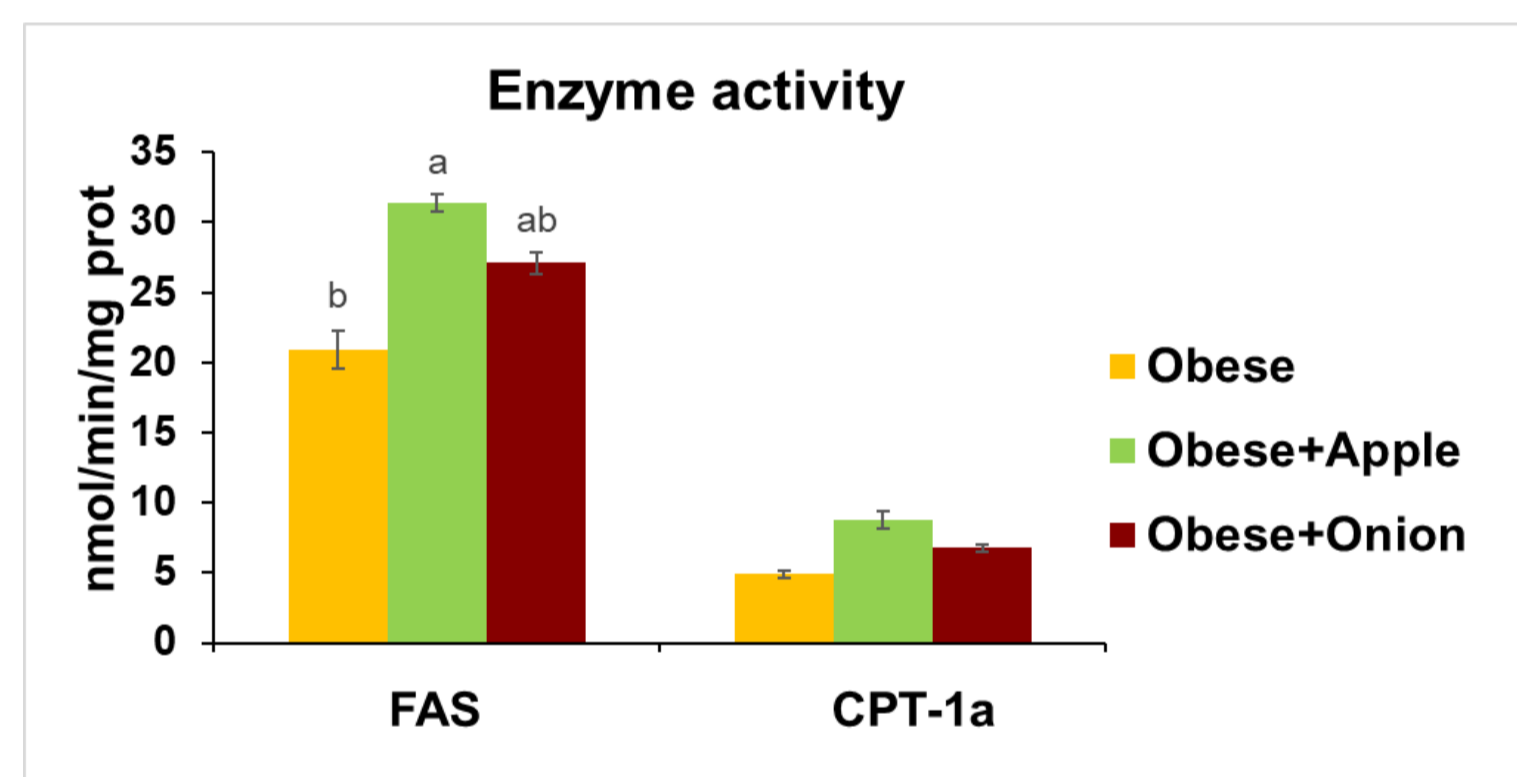


Fig 3. Effects of an apple extract and onion extract on hepatic CPT-1a and FAS activities in Zucker *fa/fa* rats.

- FAS activity is increased in OA group, probably due to the higher food intake in the group treated with apple extract.
- As far as CPT-1a is concerned, no statistical differences were observed (ANOVA=0.094). However, Cohen's *d* values were >0.8 for the OA experimental group (large effect) and between 0.5-0.8 (moderate effect) for the OO group. This means that a compensatory mechanism by increasing CPT-1a activity is likely, at least in the apple extract treated group.

CONCLUSIONS

- Onion extract could be useful in the prevention of hepatic steatosis in Zucker *fa/fa* rats.
- The prevention of hepatic triglyceride accumulation could be explained, in part by the enhance of the lipid oxidation in hepatocytes.
- These results are not enough to explain the mechanisms of action of the onion extract. Therefore, more research is needed.

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