

THE EFFECT OF TRANS-PALMITOLEIC ACID ON LIPID ACCUMULATION AND THE FATTY ACID SYNTHASE GENE EXPRESSION IN HEPATOCYTES

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INTRODUCTION

Fatty acids comprise a major part of the lipids and have remarkable effect on cell biology (1). Trans-palmitoleic acid (t-PA), a naturally occurring tFA has been shown to be related to better lipid profile including higher HDL-C and lower triglyceride, and associated with decreased insulin resistance, lower metabolic risk and incident of type2 diabetes (2).

AIM

the aim of this study was to investigate the effects of tPA on lipid accumulation in liver cells and the gene expression of fatty acid synthase (FAS) enzyme and the activity of peroxisome proliferator-activated receptor alpha (PPAR α), an important nuclear receptor in the regulation of lipid metabolism.

METHOD

- HepG2 liver cells were cultured and treated with different concentrations of tPA and palmitic acid.
- Intracellular triglyceride (TG) levels were evaluated by Oil red O staining of the cultured cells as well as extraction of cellular lipids and measurement with an enzymatic method. Cell viability was assessed by MTT.
- The expression of FAS gene was assessed by real-time PCR, after total RNA extraction and the synthesis of cDNA.
- The activity of PPAR α was evaluated by luciferase reporter assay, via transfecting HEK293T cells with the vector comprising the PPAR α response element.

RESULTS

Both tPA and palmitic acid caused TG deposition in liver cells; however, the TG levels were significantly lower in cells treated with tPA compared with the cells that were treated with palmitic acid ($P < 0.001$) (Figure 1). tPA did not have any detrimental effect on the viability of HepG2 cells and on the other hand, increased their survival (Figure 2)

The gene expression of FAS was enhanced by both fatty acids, but in cells treated with tPA, it was significantly lower than palmitic acid ($P < 0.001$) (Figure 3). tPA reduced palmitate-induced FAS induction (Figure 3B)

Treatment of cells with tPA resulted in the activation of PPAR α , especially at lower concentrations ($P < 0.001$), while palmitic acid did not have any effect on this nuclear receptor (Figure 4).

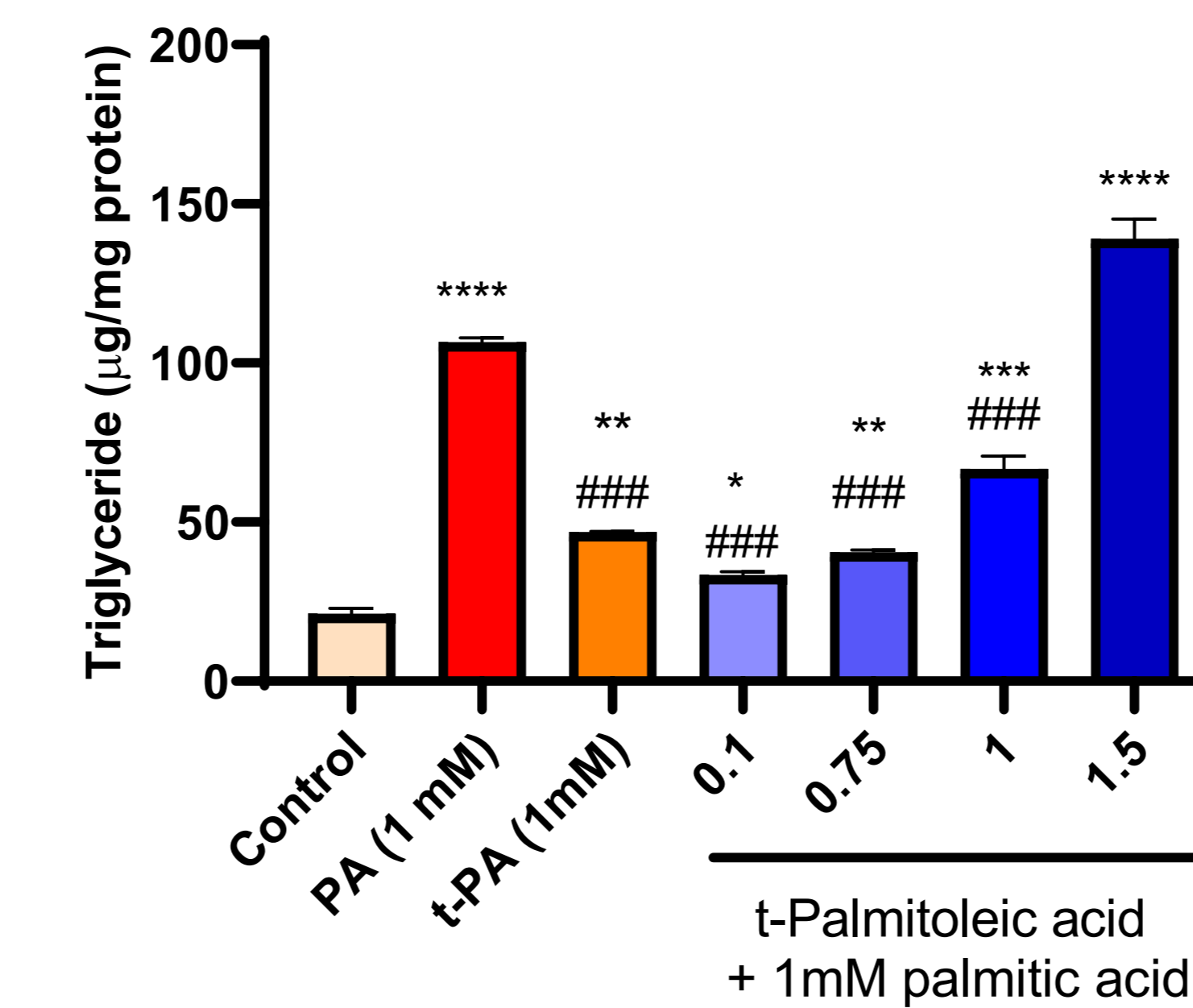


Figure 1- TG accumulation in HepG2 cells.
* Compared to control; # compared to palmitate (PA)

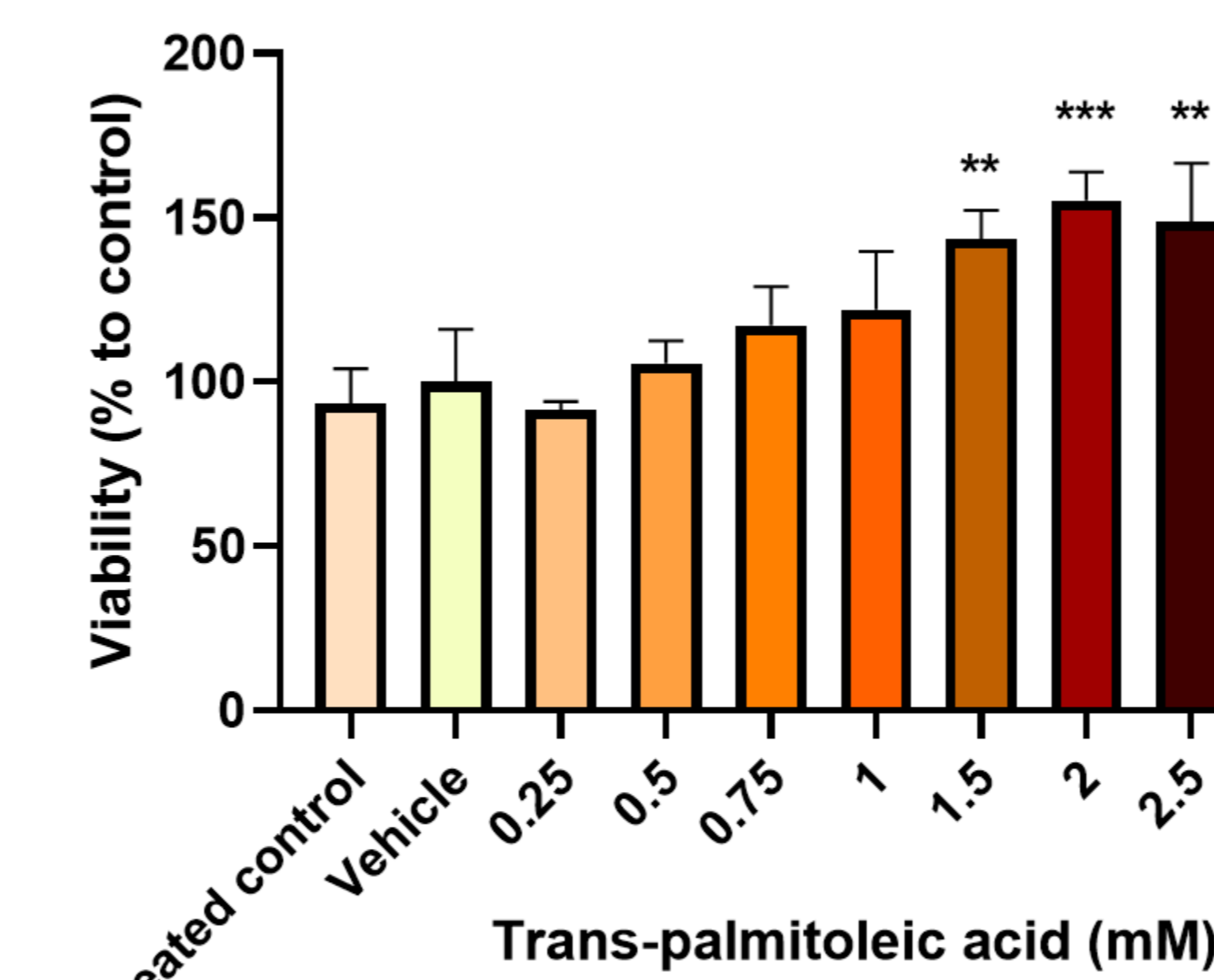


Figure 2- The effect of tPA on cell viability compared to control.

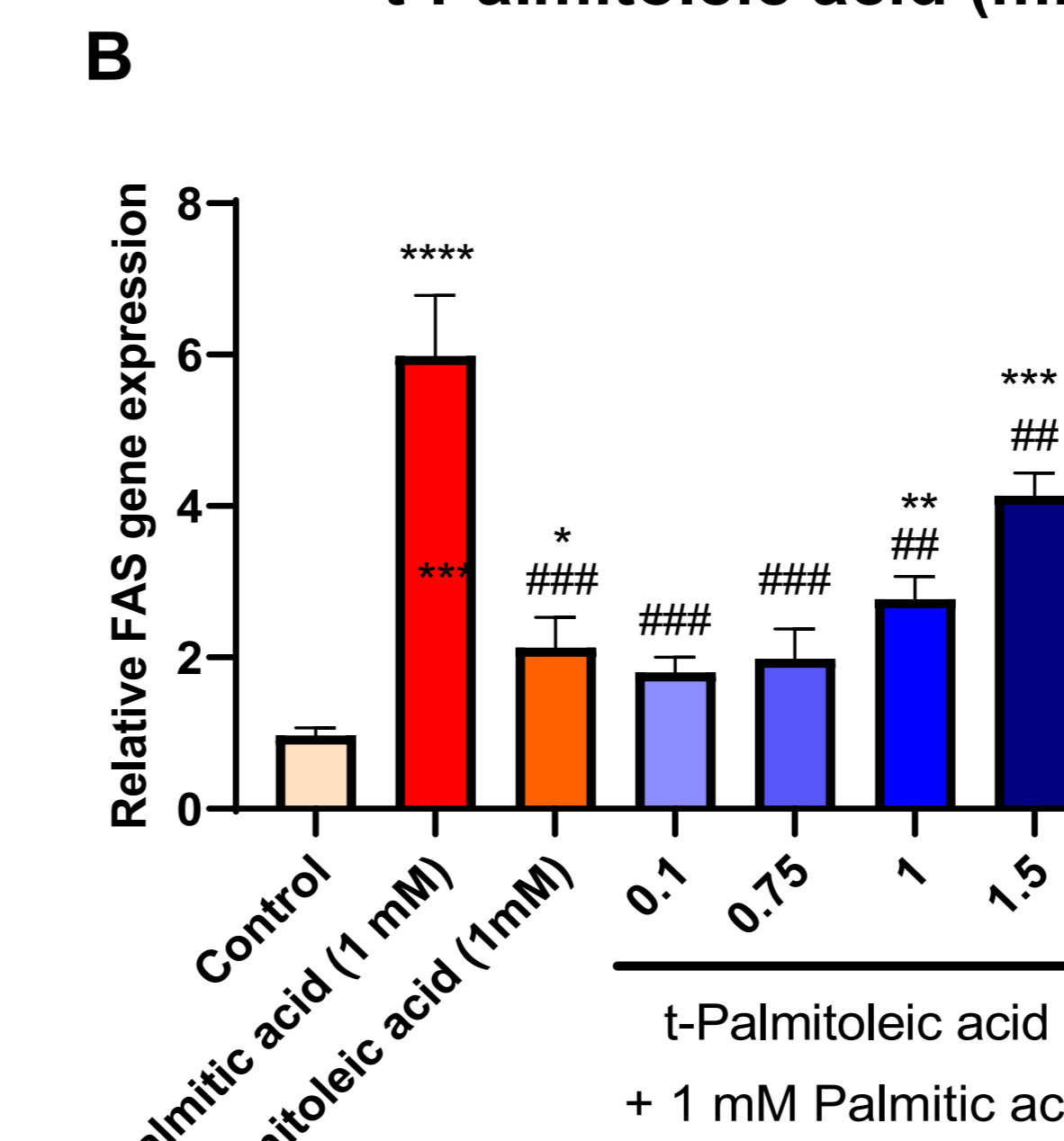
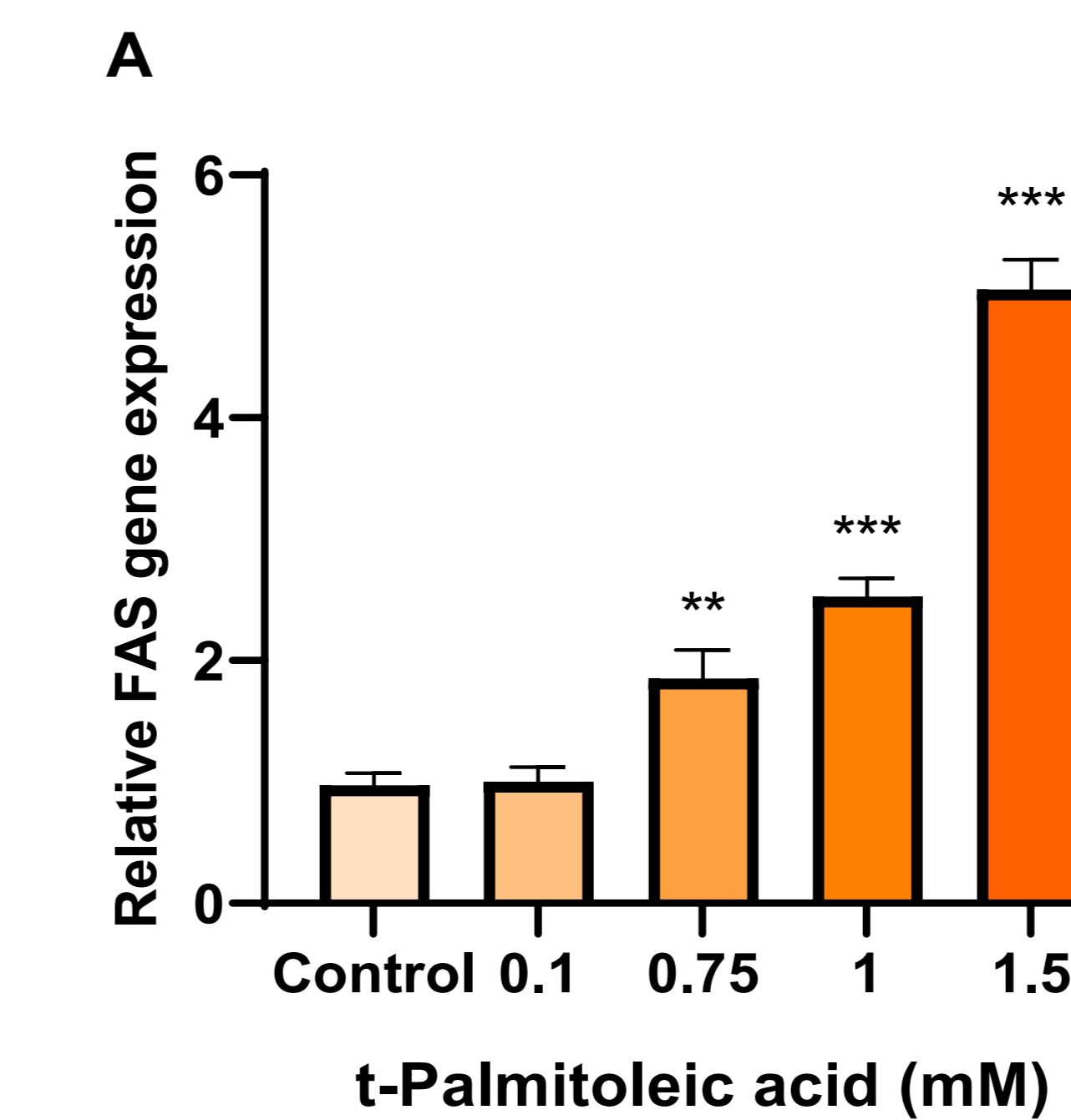


Figure 3- The effect of tPA alone (A) or combined with palmitate (B) on fatty acid synthase (FAS) gene expression.
* Compared to control; # compared to palmitate (PA)

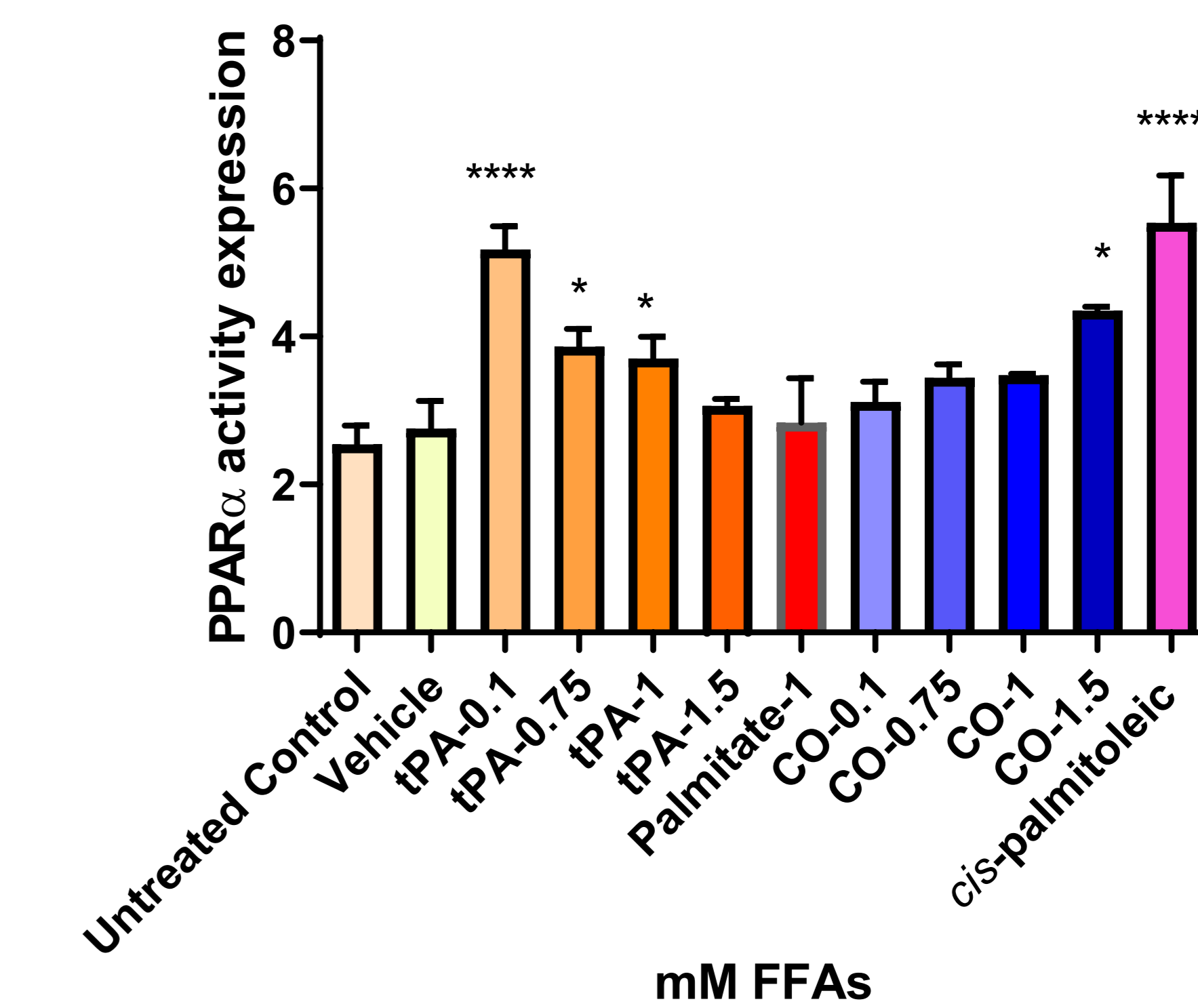


Figure 4- The effect of tPA alone or combined with palmitate (CO) on PPAR α transcriptional activity. * Compared to control; # compared to palmitate (PA)

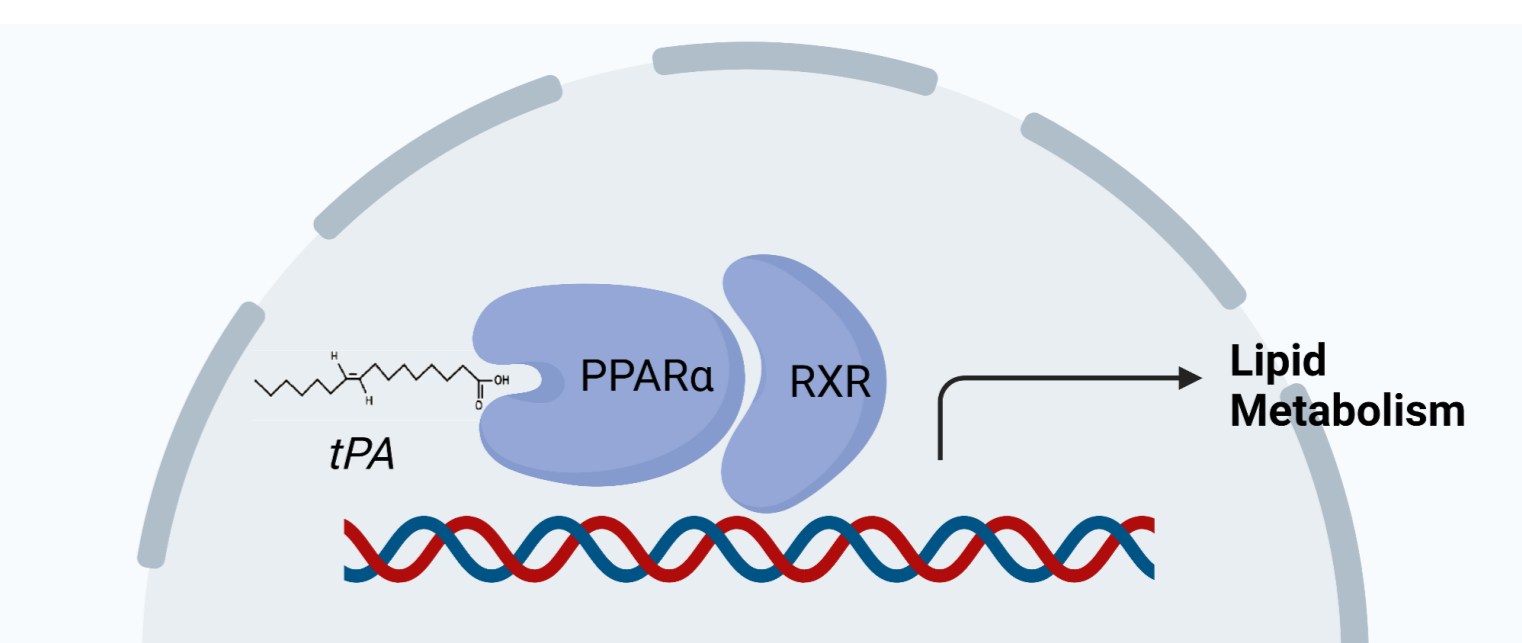


Figure 5- schematic representation of PPAR α action in increasing lipid metabolism and lowering lipid accumulation in hepatocytes. Image created with BioRender.com

CONCLUSIONS

The results showed that less TG is accumulated in liver cells treated with tPA compared to palmitic acid and thus this fatty acid has better influence on liver cells compared to its saturated counterpart.

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