

**THE EFFECT OF EXTRA VIRGIN OLIVE OIL ON FOAM  
CELLS AND TNF- $\alpha$  IN HIGH FAT DIET WISTAR RATS**

**EFEK MINYAK ZAITUN EXTRA VIRGIN PADA SEL  
BUSA DAN TNF  $\alpha$  PADA TIKUS WISTAR DENGAN  
DIET TINGGI LEMAK**



**Thesis**

**Submitted as partial fulfilling of the requirement  
for Master Degree of Biomedical Science**

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**APPROVAL PAGE**

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## **DECLARATION**

I hereby declare that this thesis is my own work and it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, Information derived from the published or unpublished work of others has been acknowledged in the text and a list of reference is given.

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## LIST OF ABBREVIATION

AHA	: American Heart Association
C	: Control group consist of control negative and control positive
CHD	: Coronary heart disease
CSF	: Colony-stimulating factors
CVD	: Cardiovascular disease
ECs	: endothelial cells
ELISA	: enzyme-linked immunosorbent assay
EVOO	: Extra virgin olive oil
HDL	: High-density lipoprotein
HFD	: High fat diet
HSD	: Honestly significant difference
IL-1	: Interleukin 1
IL-1 Ra	: Interleukin 1 receptor antagonist
IL-6	: Interleukin 6
IFN $\gamma$	: Interferon gamma
LD	: lipid droplet
LDL	: Low-density lipoprotein
LPS	: Lipopolysaccharide
MUFA	: Monounsaturated fatty acids
NASH	: non-alcoholic steatohepatitis
NK	: Natural killer cell
OA	: Oleic acid

OT1A	:	Outcome from treatment group I for TNF $\alpha$
OT1B	:	Outcome from treatment group I for foam cell
OT2A	:	Outcome from treatment group II for TNF $\alpha$
OT2B	:	Outcome from treatment group II for foam cell
OT3A	:	Outcome from treatment group III for TNF $\alpha$
OT3B	:	Outcome from treatment group III for foam cell
PARS	:	Peroxisome proliferators activated receptor gamma
PC	:	Phenolic compounds
PAI-1	:	Plasminogen activator inhibitor-1
R	:	Random allocation in 5 groups
T	:	Treatment
TAGs	:	Triacylglycerol
TGF	:	Transforming growth factors
Thc	:	T helper cells
TG	:	Triglyceride
TMD	:	Traditional Mediterranean diet
TNF $\alpha$	:	Tumor necrosis factor
VOO	:	Virgin olive oil
VCAM-1	:	Vascular cell adhesion molecule 1
WHO	:	World health organization
XT1	:	Treatment group I ( high fat diet and olive oil dossage I)
XT2	:	Treatment group I ( high fat diet and olive oil dossage II)
XT3	:	Treatment group I ( high fat diet and olive oil dossage III)

## ABSTRACT

**Background:** Deleterious effects of HFD are an increase TNF-  $\alpha$  levels and foam cells on animal model. Anti-inflammatory effect of EVOO might be beneficial in HFD rats. It was expected that EVOO reduced TNF-  $\alpha$  levels and the presence of foam cells of HFD rats.

**Objective :** to investigate effect of EVOO in reducing TNF-  $\alpha$  levels and the presence of foam cells of HFD rats.

**Methods :** This study used 30 rats novergicus strain wistar. Rats were allocated into 2 control groups and 3 treatment groups. Negative control group received standard diet and positive control group received HFD. Treatment groups received HFD and EVOO doses for 8 weeks. Then rats killed, (TNF- $\alpha$ ) measured by (ELISA) and foam cells by using histopathological method.

**Results:** Serum TNF- $\alpha$  levels of positive control, negative control and treatment groups are  $3.71 \pm 91.41$  (mean  $\pm$  SD) pg/ml,  $2.43 \pm 159.98$ ,  $3.84 \pm 112.56$ ,  $3.26 \pm 55.23$ , and  $2.46 \pm 39.37$ , respectively. Kruskal-wallis test showed no significant different of TNF- $\alpha$  levels among 5 groups ( $p=0.070$ ). The presence of foam cells found in positive control 6 (100%), negative control 0 (0%), while in treated groups were 5 (83.3%), 2 (33.3%), and 2 (40%) respectively.  $X^2$  test showed significant different among all groups ( $p = 0.004$ ), among positive control and treated groups ( $p = 0.043$ ), among negative control and treated groups ( $p = 0.031$ ), but among treated groups ( $p = 0.175$ ).

**Conclusion:** EVOO might play a minor effect in reducing TNF-  $\alpha$  levels. EVOO at any dose studied is able to reducing the presence of foam cells.

**Key Words:** Extra virgin olive oil, high fat diet, TNF- $\alpha$  and foam cells.

## ABSTRAK

**Latar belakang:** Efek buruk DTL antara lain adanya peningkatan kadar TNF- $\alpha$  dan jumlah sel busa pada model binatang. Efek anti-inflamasi EVOO kemungkinan menguntungkan pada tikus yang diberi DTL. Harapannya EVOO dapat menurunkan kadar TNF- $\alpha$  dan mencegah adanya sel busa pada tikus dengan DTL.

**Tujuan:** meneliti efek EVOO dalam menurunkan kadar TNF- $\alpha$  dan mencegah adanya sel busa pada tikus dengan DTL.

**Metode:** 30 tikus galur Wistar norvegicus dikelompokkan menjadi 2 kelompok kontrol dan 3 kelompok perlakuan. Kelompok kontrol negatif hanya menerima diet standar dan kontrol positif hanya menerima DTL. Tiga kelompok perlakuan menerima DTL dan EVOO dalam dosis selama 8 minggu. Tikus selanjutnya diterminasi dan penanda inflamasi TNF- $\alpha$  serum diukur dengan metode ELISA dan jumlah sel busa diamati secara histopatologis.

**Hasil:** Kadar TNF- $\alpha$  serum masing-masing kelompok kontrol positif, kontrol negatif, kelompok yang menerima DTL dan EVOO adalah  $3.71 \pm 91.41$  (mean  $\pm$  SD) pg/ml,  $2.43 \pm 159.98$ ,  $3.84 \pm 112.56$ ,  $3.26 \pm 55.23$ , and  $2.46 \pm 39.37$ . Uji Kruskal-Wallis memperlihatkan tidak ada perbedaan bermakna kadar TNF- $\alpha$  diantara 5 kelompok ( $p=0.070$ ). Sel busa ditemukan pada 6 tikus (100%) kontrol positif dan 0 (0%) kontrol negatif, sementara pada kelompok perlakuan DTL dan EVOO masing – masing adalah 5 (83.3%), 2 (33.3%), dan 2 (40%). Uji  $X^2$  memperlihatkan perbedaan bermakna diantara semua kelompok ( $p=0.004$ ), antara kontrol positif dan kelompok perlakuan ( $p = 0.043$ ), and antara kontrol negatif dan kelompok perlakuan ( $p = 0.031$ ), tetapi tidak didapatkan diantara kelompok perlakuan ( $p = 0.175$ ).

**Simpulan:** EVOO bersamaan dengan pemberian DTL kemungkinan kecil perannya dalam menurunkan kadar TNF- $\alpha$ . EVOO dalam berbagai dosis yang diteliti, dapat mencegah pembentukan sel busa.

**Kata Kunci:** Minyak zaitun extra virgin, diet tinggi lemak, TNF- $\alpha$  dan sel busa.