Sesame oil therapeutically mitigates cardiac hypertrophy in chronic kidney disease by attenuating oxidative stress and hypertension

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Left ventricular hypertrophy (LVH)

- Complications
  - Myocardial infarction
  - Heart failure
  - Sudden cardiac death

- Predictor of cardiovascular morbidity and mortality (Go et al., 2013)

- High prevalence in patients with chronic kidney disease (CKD) (Levin et al., 1999)
Pathogenesis of CKD-associated LVH

Reactive oxygen species (ROS): superoxide, hydroxyl radical, peroxynitrite

CKD → Inactivation of NO, loss of vasodilatation → Increased vascular resistance → Reabsorption of Na⁺, retention of H₂O → Increased blood flow → LVH → Hypertension

(David et al., 2007)
Sesame oil

- *Sesamum indicum* L.

- Contains
  - Polyunsaturated fatty acids
  - Potassium, magnesium, calcium, phosphorus
  - Vitamin B&E
  - Phenolic lignans

- Antioxidative properties
  - Inhibit ROS generation
  - Increase antioxidants

*(Namiki, 2007)*

*(Hsu et al., 2011; Periasamy et al., 2012; Li et al., 2012)*
Objective

To investigate therapeutic effect of sesame oil on cardiac hypertrophy in rats with CKD.
Experimental design

- CKD-associated cardiac hypertrophy animal model: deoxycorticosterone acetate (DOCA)/salt model (Nakano et al., 2002)

Uninephrectomy

DOCA (15 mg/kg, s.c.) twice a week / salt (1% NaCl in drinking water)

Sesame oil (0.5, 1 ml/kg/day, oral)

kill
Therapeutic effect of sesame oil on renal dysfunction in CKD rats

A. BUN (mg/dl)
B. CRE (mg/dl)
C. Albuminuria (mg/day)
D. Urine volume (ml)
E. CCR (ml/min)

DOCA/salt
Sesame oil (ml/kg/day)
Group

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CCR: creatinine clearance rate
BUN: blood urea nitrogen
Therapeutic effect of sesame oil on histopathology in CKD rats

LBB = loss of brush border; CI = cellular infiltration; HC = hyaline protein cast
Therapeutic effect of sesame oil on oxidative stress in CKD rats

A

Hydroxyl radical counts (x10^5 units/mg protein)

DOCA/salt
Sesame oil (ml/kg/day) 0 0 0.5 1 1
Group I II III IV V

B

Peroxynitrite counts (x10^5 units/mg protein)

DOCA/salt
Sesame oil (ml/kg/day) 0 0 0.5 1 1
Group I II III IV V

C

MDA (nmol/mg protein)

DOCA/salt
Sesame oil (ml/kg/day) 0 0 0.5 1 1
Group I II III IV V

MDA: malondialdehyde
Therapeutic effect of sesame oil on hypertension in CKD rats

A

B

Systolic pressure (mmHg)

Diastolic pressure (mmHg)

DOCA/salt

Sesame oil (ml/kg/day)

Group

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* P < 0.05 vs. DOCA/salt
# P < 0.05 vs. sesame oil (0 ml/kg/day)
Therapeutic effect of sesame oil on cardiac hypertrophy in CKD rats
Therapeutic effect of sesame oil on cardiomyocyte numbers in CKD rats

A

Group I

Group II

Group III

Group IV

Group V

B

No. of cardiomyocytes/HPF

DOCA/salt
Sesame oil (ml/kg)
Group
I
II
III
IV
V

0
0
0.5
1
1

-+-+++

*#

12
Sesame oil → ROS (hydroxyl radical, peroxynitrite)

Glomerular/interstitial damage

Normal kidney → CKD

Hypertension

LV thickness ↓
Heart weight ↓

BUN ↓
CRE ↓
Albuminuria ↓
Urine volume ↓
CCR ↑
Conclusion

Sesame oil therapeutically mitigates LVH by inhibiting oxidative stress-associated hypertension in CKD rats.
Thank you for your attention!