Antihypertensive Effects of Sesamin in Humans

Takashi Miyawaki and et al.
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Presented by
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Ph.D. student in Biomedical Sciences
Hypertension is a chronic medical condition in which the blood pressure is elevated.

**Classification**
- **Essential hypertension** means that no medical cause.
- **Secondary hypertension** indicates that the high blood pressure is a result of another condition.
จากการศึกษาของ Framingham แสดงให้เห็นว่าผู้ที่เป็นโรคความดันโลหิตสูงมีโอกาสเป็นโรคหลอดเลือดหัวใจ 3 - 4 เท่า และโรคหลอดเลือดของสมอง 7 เท่า เมื่อเทียบกับผู้ที่มีระดับความดันโลหิตอยู่ในเกณฑ์ปกติ ความเสี่ยงของโรคหลอดเลือดหัวใจเพิ่มขึ้นร้อยละ 30 สำหรับความดันโลหิตที่สูงขึ้นทุกๆ 10 มม. ปรอท
Sesame

Scientific classification:
- Kingdom: Plantae
- Division: Magnoliophyta
- Class: Magnoliopsida
- Genus: Sesamun
- Species: S. indicum

Biomial name:
- Sesamum indicum L.

Sesame seed have been commonly used as a traditional health food since ancient times in Asia regions.
## Sesame seeds
Amount 0.25 cup, total weight 36 g

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount</th>
<th>%DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>calories</td>
<td>206.28</td>
<td>11.46</td>
</tr>
<tr>
<td>protein</td>
<td>6.40 g</td>
<td>12.80</td>
</tr>
<tr>
<td>fat - total</td>
<td>17.88 g</td>
<td>27.51</td>
</tr>
<tr>
<td>saturated fat</td>
<td>2.52 g</td>
<td>12.60</td>
</tr>
<tr>
<td>mono fat</td>
<td>6.76 g</td>
<td>28.17</td>
</tr>
<tr>
<td>poly fat</td>
<td>7.84 g</td>
<td>32.67</td>
</tr>
<tr>
<td>carbohydrates</td>
<td>8.44 g</td>
<td>2.81</td>
</tr>
<tr>
<td>dietary fiber</td>
<td>4.24 g</td>
<td>16.96</td>
</tr>
<tr>
<td>sugar - total</td>
<td>0.40 g</td>
<td></td>
</tr>
<tr>
<td>monosaccharides</td>
<td>-- g</td>
<td></td>
</tr>
<tr>
<td>disaccharides</td>
<td>0.32 g</td>
<td></td>
</tr>
</tbody>
</table>

### Characteristic lignans
- Sesamin (0.01-1.0%)
- Sesamolin

[http://www.whfoods.org]
Chemical structures of sesamin and sesamin metabolites

Sesamin was absorbed via the portal vein in the native form and metabolized to the mono- or di-catechol compound by enzymes in hepatocytes.

Sesamin
Biological activities of sesamin

- Anti-oxidative activity
- Cholesterol and lipid-lowering
- Protection against liver damage
- Synergy with α-tocopherol
- Improvement in the bioavailability of γ-tocopherol
- Anticarcinogenic activities
- Precursors of mammalian lignans
- Suppressed the development of hypertension in rat
Males with hypercholesterolemia, oral administration of 9 capsules (each capsule contained 3.6 mg sesamin and vitamin E) per day for 4 wk, followed by 18 capsules per day for 4 wk significantly reduced serum total and LDL-C level.

Hirata et al., 1996

- Inhibit the absorption of cholesterol in the intestinal tract
- Increase the excretion of cholesterol in bile
- Decrease the activity of HMG-CoA reductase
- Increase in 7-\(\alpha\)-hydroxylase activity

Ashakumary et al., 1999; Ide et al., 2000; Kushiro et al., 2002
Clinical study

36 mg sesamin 2 h before high intensity exercise suppressed the rise in plasma lipid peroxide levels significantly in 7 males college students.

Kiso et al., 2004

Oral intake of sesamin before smoking in male college students reduced the aversive effects of smoking on the cardiac autonomic nervous system.

Moritani et al., 2003
To investigate the effect of 4-wk administration of sesamin on blood pressure in mildly hypertensive humans.
Subjects characteristics

Twenty-five middle aged subjects with mild hypertension (23 men and 2 women, age 49.1 ± 1.8 yr)

• No diseases
• Mild hypertension
• No secondary cause of hypertension
• No medication
• No dietary supplements
The subjects were matched by age, BMI, SBP and DBP.

Table 1. Characteristics of the subjects at baseline.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>12</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>51.0±8.2</td>
<td>47.3±9.5</td>
<td>0.31</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>24.1±0.5</td>
<td>25.0±0.5</td>
<td>0.24</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>137.3±3.0</td>
<td>137.4±2.5</td>
<td>0.98</td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>87.8±1.7</td>
<td>86.8±1.7</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Data are the means±SE. Group A received sesamin first followed by a placebo, and Group B received the placebo first followed by sesamin. BMI, body mass index; BP, blood pressure.
Study design

A double-blind, cross-over, placebo controlled method

Administration Period 1

0

Group A; 60 mg sesamin
Group B; 180 mg wheat germ oil placebo

4

Administration Period 2

8

Group A; 180 mg wheat germ oil placebo
Group B; 60 mg sesamin

12

Washout

16 wk

Washout

Measurement of body weight and blood pressure
Statistical analysis

- Mean ± SE
- Unpaired *t*-test
- Paired *t*-test
- Repeated analyses of covariance
Fig. 2. Changes in the average levels of BP in Groups A and B. Group A (solid line) represents subjects who received sesamin first followed by a placebo, and Group B (broken line) represents subjects who received the placebo first followed by sesamin. *p<0.05 compared with BP before the administration period.
Sesamin ameliorated the development of deoxycorticosterone acetate (DOCA)-salt-induced vascular hypertrophy and prevented the development of hypertension.

Effects of sesamin metabolites on xanthine/xanthine oxidase induced \(\text{O}_2^\cdot\) production.

The antioxidative activity of sesamin feeding contributes to its antihypertensive action. However, the mechanisms by which sesamin feeding reduced the \(\text{O}_2^\cdot\) production were not clear because sesamin itself has little radical-scavenging ability in vitro.

Nakai et al., 2003
Sesamin improved impaired endothelium-dependent vasodilatory responses and vasorelaxation.

Nakano et al., 2002, Nakano et al., 2003, Nakano et al., 2006
Sesamin may improve hypertension by its ability to induce nitric oxide and inhibit endothelial cell.

Lee et al., 2004
Fig. 3. Changes in the average levels of BP with sesamin and the placebo during the study (Data for “Administration period” includes those in both Periods A and B. Data for “Washout” includes those after both Periods A and B). *p<0.05 compared with BP before the administration period.
The mean decreased levels of BP following the administration of sesamin were 3.5 mmHg SBP and 1.9 mmHg DBP. However, they were little changed by the placebo. After the 4 wk washout from the end of period 2, the average BP in the sesamin group increased to almost the baseline BP.
A 2-3 mmHg decrease in SBP is associated with a 4% lower risk of coronary death and a 6% lower risk of stroke death in middle age in the US and UK.

Stamler et al., 1989

A 2 mmHg decrease in SBP is associated with a 6.4% lower risk of mortality due to cerebral vessel disease in Japan.

Japanese Society of Hypertension, 2006
Conclusion

The 4-wk administration of sesamin significantly decreased both SBP and DBP in mildly hypertensive humans. These result suggest that sesamin has antihypertensive effects in humans.
Further study

• The optimum amount of sesamin
• Administration interval
• Administration times
Acknowledgement

Asst. Dr. Naruemon Leelayuwat
Thank you for your attention