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BMP15

# Serum High Sensitivity C-Reactive Protein Levels
## between Central Obesity and Healthy Normal Waist Circumference Adults
## ระดับของ High Sensitivity C-Reactive Protein ในซีรัมของผู้ใหญ่อ้วนลงพุงและผู้ใหญ่สุขภาพดีที่มีรอบเอวปกติ

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## ABSTRACT

This study aims to compare an inflammatory marker levels, serum high sensitivity C-reactive protein (hs-CRP), between central obesity and healthy volunteers with normal waist circumference and to examine the associations among hs-CRP, waist circumference (WC), and serum biochemistry analytes. Plasma glucose, serum lipids, and hs-CRP were determined in 400 samples (200 central obesity and 200 healthy with normal WC subjects). About 23% and 7% of participants in central obesity and healthy volunteers had hs-CRP values greater than 3 mg/L, respectively. The means of hs-CRP, HDL-C, and LDL-C between the two groups were significantly different ($p<0.05$) and hs-CRP concentration in central obesity was significantly correlated with WC (r = 0.221, $p<0.05$). In conclusion, hs-CRP level in central obesity volunteers was higher than healthy volunteers with normal WC. The central obesity should decrease their WC to avoid cardiovascular diseases.


## บทคัดย่อ

การศึกษานี้มีเป้าหมายเพื่อเปรียบเทียบระดับ hs-CRP ในซีรัมระหว่างอาสาสมัครที่มีภาวะอ้วนลงพุงและอาสาสมัครสุขภาพดีที่มีรอบเอวปกติ และเพื่อหาความสัมพันธ์ระหว่าง hs-CRP เส้นรอบเอว และสารชีวเคมีในซีรัม การศึกษานี้ได้ตรวจวัดระดับน้ำตาลในพลาสมา ระดับไขมันและ hs-CRP ในซีรัมในอาสาสมัคร จำนวน 400 ราย ซึ่งเป็นกลุ่มอ้วนลงพุง 200 ราย และกลุ่มรอบเอวปกติ 200 ราย พบว่ากลุ่มอ้วนลงพุงและกลุ่มรอบเอวปกติ ที่มีระดับ hs-CRP > 3 มิลิกรัม/ลิตร คิดเป็นร้อยละ 23 และร้อยละ 7 ของ ตามลำดับ ค่าเฉลี่ยของ hs-CRP , HDL-C และ LDL-C ในซีรัมของทั้งสองกลุ่ม มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ((p<0.05) และระดับ hs-CRP ในซีรัมกลุ่มที่มีภาวะอ้วนลงพุงมีความสัมพันธ์กับเส้นรอบเอวอย่างมีนัยสำคัญทางสถิติ (r=0.221, p<0.05) โดยสรุปอาสาสมัครที่มีภาวะอ้วนลงพุงมีระดับ hs-CRP ในซีรัมสูงกว่าอาสาสมัครสุขภาพดีที่มีรอบเอวปกติ และอาสาสมัครที่มีภาวะอ้วนลงพุงควรลดขนาดเส้นรอบเอวเพื่อป้องกันการเกิดโรคหัวใจและหลอดเลือด

**Key Words :** Abdominal obesity, Inflammatory maker, Lipid
**คำสำคัญ :** ภาวะอ้วนลงพุง สารบ่งชี้ภาวะอักเสบ ไขมัน

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**Introduction**

Central obesity is one of cardiovascular disease (CVD) risk factors that have been more prominent than general obesity as measured by BMI (Yusuf, S, Hawken, S, Ounpuu, S, et al(2005). The link between obesity and inflammation has been further illustrated by the increased plasma levels of several pro-inflammatory markers including cytokines and acute phase protein like C-reactive protein (CRP) in obese individuals (E. Ravussin, S.R. Smith (2003), H. Florez, S. Castillo-Florez, A. Mendez, et al. (2006). There is little information of those that exists in central obesity among Thais.

CRP is commonly called high sensitivity C-reactive protein (hs-CRP) because of increasing sensitivity of methodology used in clinical laboratory in CRP measurement (H. Florez, S. Castillo-Florez, A. Mendez, et al. (2006).

The objectives of this study were to compare serum hs-CRP levels between central obesity and healthy normal waist circumference volunteers and to examine the associations among hs-CRP, glucose, and lipids.

**Material and Methods**

**Subjects and procedures**

Four hundred volunteers, 200 central obesity and 200 healthy normal waist circumference, were recruited and collected for blood samples. The concentrations of plasma glucose, serum total cholesterol (TC), triglyceride (TG), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), and high sensitivity C-reactive protein (hs-CRP) were determined using the automated clinical chemistry analyzer, the OLYMPUS AU 640 (Olympus Corporation, Tokyo, Japan). The hs-CRP was measured twice and the second measurement was two weeks from the first determination. The concentrations of serum hs-CRP were classified into tertile (Table 1) according to the Center of Disease Control (CDC) and the American Heart Association guideline (Gary L. Myers, Nader Rifai, et. al. 2004, Ridker PM 2001).

**Exclude criteria for hs-CRP**

Participants that had any recent illness, tissue injury, infection, autoimmune diseases, cancer, general inflammation, and chronic inflammation were excluded from the study. The hs-CRP results also will be excluded if the concentration is higher than 10 mg/L.

**Data analysis**

The statistical analyses for the differences in the quantitative data were tested by T-test and qualitative data by Chi square. The relationships among concentration of biochemical markers were analyzed using the correlation and logistic regression statistical methods.

**Results and discussion**

CRP is synthesized primarily by the liver in response to IL-6 and IL-1. CRP normally circulates at very low levels, but acute inflammatory processes induce marked hepatic synthesis of hs-CRP, which can induce a 100-fold serum increase (Du Clos TW (2000). This study measured serum hs-CRP twice according to Gary L. Myers, Nader Rifai, et. al. had recommended in 2004.

Because of hs-CRP tests are measuring a marker of inflammation, any recent illness, tissue injury, infection, autoimmune diseases, cancer, general inflammation, and chronic inflammation, such as arthritis, will raise the amount of CRP and

give a falsely elevated estimate of risk, on the contrary antithrombotic medications (e.g. aspirin, cholesterol-lowering statin drugs, and ACE inhibitors) may also reduce CRP. Therefore, these subjects were excluded from the study. The hs-CRP results were excluded if the concentration was higher than 10 mg/L. Anthropometrics of the subjects were summarized in Table 2.

Relationships between waist circumference and anthropometrics were shown in Table 3. Waist circumference was significantly correlated with BMI, SBP, DBP, TG, HDL-C, LDL-C and hs-CRP ($p$<0.05) with correlation coefficient (r) 0.722, 0.166, 0.142, 0.133, -0.125, 0.101, and 0.189 respectively.

Table 4 shown comparison data of biochemical analytes between central obesity and

normal waist circumference participants. Means of HDL-C in central obesity were significantly differed from control group (p<0.05).

Classifications of hs-CRP by the CDC and AHA in central obesity and Normal waist circumference were showed in Table 5**.** The concentration of serum hs-CRP >3 mg/L was found in central obesity 23% higher than those found in normal waist circumference when the Chi square statistical methods was applied for data analysis. This may due to central obesity had been associated with adipose mass and expression of the proinflammatory gene tumor necrosis factor-$\alpha$ (G. S. Hotamisligil, N. S. Shargill, and B. M. Spiegelmam (1993).

**Table 1**. Cardiovascular disease risk classification using hs-CRP concentration by the Center of Disease Control (CDC) and The American Heart Association (AHA)

| Classification of risk | Value | |
|---|---|---|
| Low risk | < 1.00 | mg/L |
| Average risk | 1.00 - 3.00 | mg/L |
| High risk | > 3.00 | mg/L |

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**Table 2.** Anthropometrics of the subjects (total number of subjects = 400)

| Parameters | Normal WC  (n = 200) | | | | | Central obesity (n = 200) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Range | | | Mean | ± SD | Range | | | Mean | ± SD |
| Age (years) | 35 | - | 60 | 49 | ± 7 | 36 | - | 60 | 49 | ± 7 |
| BMI (kg/m$^2$) | 13 | - | 29 | 22 | ± 3 | 18 | - | 39 | 27 | ± 3 |
| WC (cm) | 62 | - | 90 | 78 | ± 6 | 81 | - | 115 | 91 | ± 7 |
| SBP (mmHg) | 89 | - | 139 | 120 | ± 11 | 94 | - | 139 | 124 | ± 11 |
| DBP (mmHg) | 49 | - | 120 | 76 | ± 9 | 58 | - | 96 | 77 | ± 8 |
| GLU (mg/dL) | 70 | - | 135 | 93 | ± 24 | 69 | - | 265 | 92 | ± 15 |
| TC (mg/dL) | 97 | - | 376 | 215 | ± 45 | 132 | - | 368 | 221 | ± 42 |
| TG (mg/dL) | 45 | - | 638 | 151 | ± 101 | 33 | - | 823 | 148 | ± 93 |
| HDL (mg/dL) | 20 | - | 101 | 41 | ± 13 | 29 | - | 97 | 55 | ± 11 |
| LDL (mg/dL) | 61 | - | 270 | 112 | ± 36 | 70 | - | 268 | 148 | ± 34 |
| hs-CRP (mg/L) | 0.1 | - | 9.4 | 1.24 | ± 1.2 | 0.1 | - | 5.6 | 1.99 | ± 1.6 |

BMI: body mass index; WC: waist circumference; SBP: systolic blood pressure; DBP: diastolic blood pressure; GLU: glucose; TC: Total
cholesterol; TG: triglyceride; HDL: high-density lipoprotein; LDL: low-density lipoprotein; hs-CRP: high sensitivity C‑reactive protein


**Table 3.** Relationships between waist circumference and anthropometrics

| Variables | Overall | |
|---|---|---|
| | r | p-value |
| Age (years) | -0.025 | 0.614 |
| BMI (kg/m$^2$) | 0.772 | <0.0001 |
| SBP (mmHg) | 0.166 | 0.001 |
| DBP (mmHg) | 0.142 | 0.004 |
| GLU (mg/dL) | -0.015 | 0.771 |
| TC (mg/dL) | 0.089 | 0.077 |
| TG (mg/dL) | 0.133 | 0.008 |
| HDL (mg/dL) | -0.125 | 0.012 |
| LDL (mg/dL) | 0.101 | 0.043 |
| hsCRP (mg/L) | 0.189 | 0.0001 |

*Significant correlation p-value <0.05*

 BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; GLU: glucose; TC: Total cholesterol;

TG: triglyceride; HDL: high-density lipoprotein; LDL: low-density lipoprotein; hs-CRP: high sensitivity C‑reactive protein

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**Table 4.** Comparisons of Glucose, Cholesterol, Triglyceride, HDL, LDL, hs-CRP between Central obesity and
Normal waist circumference participants

| Analytes (mg/dL) | Range | Normal WC, n=200 mean (SD | Central obesity, n=200 mean (SD) | P-value |
|---|---|---|---|---|
| Glucose (mg/dL) | 69-265 | 93 (24) | 92 (15) | 0.375 |
| Cholesterol (mg/dL) | 97-376 | 215 (45) | 221 (42) | 0.255 |
| Triglyceride (mg/dL) | 33-823 | 151 (101) | 148 (93) | 0.789 |
| HDL-cholesterol (mg/dL) | 20-97 | 41 (13) | 55 (11) | 0.041 |
| LDL-cholesterol (mg/dL) | 61-270 | 112 (36) | 148 (34) | 0.023 |
| hs-CRP (mg/L) | 0.1-9.4 | 1.24 (1.2) | 1.99 (1.6) | 0.043 |

*Significant differences p-value <0.05*

**Table 5.** hs-CRP Classifications in Central obesity and Normal waist circumference

| Participants | Range mg/l | Mean (SD) mg/l | <1 mg/l n (%) | 1-3 mg/l n (%) | >3 mg/l n (%) |
|---|---|---|---|---|---|
| Normal WC n=200 | 0.1-5.6 | 2.0 (1.6) | 118 (59) | 56 (28) | 26 (13) |
| Central obesity n=200 | 0.2-9.4 | 1.2 (1.2) | 74 (37) | 80 (40) | 46 (23) |

*Significant differences p-value <0.05*

**Conclusions**

In conclusion, the hs-CRP concentrations in central obesity were significant higher than normal waist circumference volunteers. The hs-CRP has emerged as a strongly independent risk factor of CVD. Therefore, central obesity was an increased risk of CVD and should consider to control their health.

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