

관상동맥질환 환자와 정상인을 대상으로 한 식이섭취와 흡연상태, 혈장지질, Lipoprotein(a) 및 항산화영양소의 비교분석*

전선민 · 박의현** · 전재은** · 이연경 · 박용복*** · 최명숙

= Abstract =

Comparison of Dietary Intakes, Smoking Status, Plasma Lipids, Lipoprotein(a) and Antioxidant Nutrients in Patients with Coronary Heart Disease and Healthy Control

Seon-Min Jeon, Wee-Hyun Park, M.D.,** Jae-Eun Jun, M.D.,**
Yeon-Kyung Lee, Yong Bok Park,*** Myung-Sook Choi

Department of Food Science and Nutrition, Internal Medicine, ** Genetic Engineering, ***
Kyungpook National University, Taegu, Korea

Background : Hyperlipidemia has been known as an independent risk factor in the development of coronary artery disease. This study was carried out to compare nutrient intakes, smoking status, antioxidant vitamins, and plasma lipids in patients with coronary heart disease(CHD) and in normal healthy subjects among Korean population in Taegu. Possible causes of this disease in patients are discussed.

Methods : Anthropometric assessments included mean intakes of nutrients, and the levels of plasma lipids(apolipoprotein [Apo] A- , Lipoprotein [Lp] [a]), and antioxidant vitamins(such as vitamins A and E) were measured in female and male subjects with CHD against healthy controls.

Results : Dietary cholesterol and fat intakes were significantly higher in CHD groups in men and women. Total plasma cholesterol, LDL-C, triglyceride, thiobarbituric acid reactive substance (TB-ARS), atherogenic index and Lp(a) levels were significantly higher in CHD patients than in the normal group in both men and women. Apo A-I, HDL-C and vitamin E levels were lower in CHD patients than in the normal group. The number of smokers was higher in CHD patients than in the normal group in both sexes of subjects.

Conclusion : High fat and high cholesterol intakes seemed to be a major factor for the hyperlipidemia in the CHD patients. Their abnormal lipoprotein profile, which appeared in patient plasma, corresponded well to dietary intake patterns. However, long term studies are needed to investigate

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the effects of smoking on lipid metabolism in CHD patients among the Korean population.

KEY WORDS : Smoking · Lipid metabolism · Coronary heart disease · Apolipoprotein A-I · Lipoprotein(a) · Lipid peroxidation · Vitamin A · Vitamin E.

14,15)

서 론

심혈관 질환의 발생과 사망률에 영향을 미치는 요인 중 흡연은 중요한 역할을 하고 있다. 흡연은 혈관 내피를 손상시키고, 혈관 경화를 촉진하며, 혈중 지질 농도를 변화시킨다. 특히, 흡연은 LDL 지질 농도를 증가시키고, HDL 지질 농도를 감소시킨다. 또한, 흡연은 lipoprotein(a) 농도를 증가시키고, 혈중 지질 과산화물을 증가시킨다. 이러한 변화는 동맥粥样화증을 촉진하고, 심혈관 질환의 위험을 증가시킨다.

본 연구는 한국인 CHD 환자에서 흡연이 지질 대사에 미치는 영향을 조사하기 위해 수행되었다. 연구 대상은 1995년 6월과 1996년 3월 사이에 입원한 CHD 환자 83명이었다. 연구 방법은 다음과 같다.

대상 및 방법

1. 조사 대상

1995년 6월과 1996년 3월 사이에 입원한 CHD 환자 83명이었다. 연구 대상은 1995년 6월과 1996년 3월 사이에 입원한 CHD 환자 83명이었다. 연구 대상은 1995년 6월과 1996년 3월 사이에 입원한 CHD 환자 83명이었다.

2. 방 법

1) 신체 계측

body mass index(BMI) waist/hip ratio(WHR)

2) 식이 섭취조사

2000rpm 15
535nm
Malondialdehyde(MDA) Kwon Watts³²⁾
Tetra - methoxypropane(TMP)
가 , TMP 1mmol 100ml
0.01 N HCl 50 water bath
60 가 , 가 TMP
1ml 0.01 M Na₃PO₄(pH 7.0) buffer 100ml
MDA (1 × 10⁻⁴M)
MDA max (267nm)
MDA extinction coefficient
MDA
TBA - MDA chromopore
TBA MDA equivalent
3. 통계처리
SPSS package
Student's
t - test
Pearson's correlation coefficient

4) 혈장 지질분석

kit , HDL - C
Heparin - MgCl₂ kit(Sigma, USA)
HDL
HDL - C , LDL - C
HDL - C
Fridewald³⁰⁾

5) Apo A-I과 Lp(a) 농도 측정

Apo A - I (Korea)
kit immunonephelometric
, Lp(a) Immunozyne Lp(a)(Immuno,
Germany) 2 step sandwich ELISA

6) 혈장 지질과산화 상태 측정

Tarladgis³¹⁾
0.5ml 5% trichloro -
acetic acid 3ml 0.06M TBA(thio - barbituric acid)
1ml 80 90 가

결 과

1. 조사 대상자의 신체 계측치 및 흡연실태

Table 1

55.2 , 56.6 , 63.2
, 61.7

, BMI

가 waist/hip circumference
ratio(WHR)

Table 2

가
(62.2%) 53 33

2. 영양소 섭취량과 식품기호도

Table 3

가

Table 1. Age and anthropometric indices in Normal and CHD subjects

| | Group | Age(yr) | Ht(cm) | Wt(kg) | BMI(kg/m ²) | WHR |
|--------|----------------|-------------|-------------|------------|-------------------------|----------------|
| Male | Normal(n = 56) | 55.2 ± 13.7 | 167.2 ± 7.1 | 65.1 ± 1.4 | 23.5 ± 2.8 | 0.87 ± 0.05 |
| | CHD(n = 53) | 56.9 ± 9.6 | 166.8 ± 6.1 | 65.7 ± 8.5 | 23.5 ± 2.7 | 0.96 ± 0.04*** |
| Female | Normal(n = 41) | 63.2 ± 6.9 | 154.5 ± 4.4 | 57.5 ± 9.3 | 24.3 ± 3.4 | 0.85 ± 0.04 |
| | CHD(n = 30) | 61.7 ± 9.6 | 157.2 ± 6.1 | 55.3 ± 8.9 | 22.9 ± 3.1 | 0.92 ± 0.06*** |

Values are mean ± S.D.

Significant differences between normal and CHD by t-test(*** : p<0.001)

Normal : Healthy subjects, CHD : Coronary heart disease, BMI : Body mass index, WHR : Waist / hip ratio

Table 2. Smoking habits of the subjects

| Subjects | Male | | Female | |
|---------------------|----------------|-------------|----------------|-------------|
| | Normal(n = 56) | CHD(n = 53) | Normal(n = 41) | CHD(n = 30) |
| | No.(%) | No.(%) | No.(%) | No.(%) |
| Non-smoker | 22(39.3) | 9(17.0) | 35(85.4) | 20(66.7) |
| Smoker | | | | |
| : 1 pack(20)/day | 18(32.1) | 20(37.7) | 4(9.8) | 8(26.7) |
| : > 1 pack(20)/day | 3(5.4) | 13(24.5) | 0(0) | 2(6.6) |
| Ex-smoker | 13(23.2) | 11(20.8) | 2(4.9) | 0(0) |

² = 10.69

p<0.05

Normal : Healthy subjects CHD : Coronary Heart Disease

Table 3. Nutrient intakes in normal and CHD subjects

| Nutrients | Male | | Female | |
|------------------------------|----------------|----------------|----------------|----------------|
| | Normal(n = 56) | CHD(n = 53) | Normal(n = 41) | CHD(n = 30) |
| Calorie(Kcal) | 1764.5 ± 450.0 | 1913.1 ± 575.7 | 1625.4 ± 325.0 | 1725.3 ± 410.1 |
| Protein(g) | 67.6 ± 21.8 | 67.6 ± 27.9 | 59.8 ± 16.4 | 60.1 ± 20.3 |
| Fat(g) | 35.5 ± 13.1 | 43.7 ± 19.3* | 31.8 ± 12.6 | 39.4 ± 16.9* |
| Carbohydrate(g) | 293.5 ± 79.5 | 299.2 ± 76.1 | 275.6 ± 59.6 | 282.7 ± 60.3 |
| Fe(mg) | 16.1 ± 4.1 | 19.1 ± 13.5 | 15.7 ± 4.6 | 15.3 ± 3.7 |
| Ca(mg) | 701.9 ± 167.8 | 791.3 ± 965.8 | 734.5 ± 261.5 | 663.5 ± 192.6 |
| Vit. A(R.E) | 571.6 ± 151.1 | 439.4 ± 214.3 | 514.4 ± 112.7 | 451.7 ± 1552.5 |
| Vit. B ₁ (mg) | 1.15 ± 0.25 | 1.51 ± 0.41 | 1.09 ± 0.19 | 1.47 ± 2.13 |
| Vit. B ₂ (mg) | 1.15 ± 0.27 | 1.16 ± 0.42 | 1.25 ± 0.47 | 1.61 ± 0.66 |
| Niacin(mg) | 8.5 ± 4.95 | 18.5 ± 4.88 | 17.2 ± 3.34 | 23.5 ± 5.4 |
| Vit. C(mg) | 53.6 ± 15.9 | 54.3 ± 21.5 | 60.8 ± 27.6 | 70.3 ± 21.5 |
| % calories from protein | 15.3 ± 2.3 | 14.1 ± 3.1 | 14.5 ± 2.5 | 13.6 ± 1.8 |
| % calories from fat | 18.1 ± 5.2 | 20.4 ± 6.3* | 17.4 ± 6.0 | 20.2 ± 6.1* |
| % calories from carbohydrate | 66.6 ± 7.2 | 65.5 ± 8.5 | 68.1 ± 8.3 | 66.2 ± 7.1 |
| Cholesterol(mg) | 73.4 ± 13.3 | 121.7 ± 37.5* | 58.1 ± 17.5 | 133.2 ± 22.9* |
| Dietary fiber(g) | 15.3 ± 10.2 | 16.7 ± 7.3 | 23.8 ± 11.1 | 17.7 ± 9.5* |

Values are mean ± S.D.

Significant differences between normal and CHD by t-test(* : p<0.05)

Normal : Healthy subjects, CHD : Coronary heart disease

| | | | |
|---|-------------|---------------|-------|
| 가 | 237.5mg/dl | 가 223.3mg/dl, | 가 |
| 가 | mg/dl | 162.5mg/dl, | 175.9 |
| 가 | 179.7mg/dl, | LDL - C | |
| 가 | 99.7mg/dl, | 195.5mg/dl | |
| | 110.5mg/dl | | |

3. 혈장 지질농도

Table 5
LDL - C

HDL - C
HDL - C%

Table 4. The food preference test score in normal and CHD subjects

| | Normal(n = 97) | CHD(n = 83) |
|-----------|----------------|--------------|
| Beef | 4.06 ± 0.92 | 4.12 ± 0.98 |
| Pork | 3.46 ± 0.11 | 3.62 ± 0.23 |
| Chicken | 3.11 ± 0.91 | 3.31 ± 0.11 |
| Soybean | 4.03 ± 0.86 | 3.81 ± 0.78 |
| Mackeral | 3.81 ± 0.02 | 3.77 ± 0.85 |
| Hair tail | 4.01 ± 0.92 | 3.87 ± 0.70 |
| Egg | 3.39 ± 0.66 | 3.17 ± 0.93 |
| Sardine | 3.60 ± 0.03 | 3.55 ± 0.87 |
| Milk | 3.14 ± 0.19 | 2.91 ± 0.94 |
| Carrot | 3.86 ± 0.69 | 3.45 ± 0.80* |
| Pumpkin | 3.90 ± 0.74 | 3.53 ± 0.77* |
| Cabbage | 3.90 ± 1.83 | 3.55 ± 0.73* |
| Kimchi | 4.24 ± 0.82 | 3.65 ± 0.81* |
| Rice | 4.13 ± 0.64 | 4.00 ± 0.36* |
| Barley | 3.81 ± 0.74 | 3.58 ± 0.71 |
| Noodle | 3.68 ± 0.08 | 3.56 ± 0.84 |
| Bread | 2.85 ± 0.09 | 3.01 ± 0.98 |

Values are mean ± S.D.

Significant differences between normal and CHD by t-test(*; p<0.05)

Normal : Healthy subjects

CHD : Coronary heart disease

101.1mg/dl, 76.4mg/dl
93.8 mg/dl, 70.3mg/dl

4. 혈장 Apo A-I과 Lp(a) 수준

Table 6

HDL

Apo A -
Lp(a)

Apo A - I (;
108.9mg/dl, ; 109.1mg/dl)

Table 6. Plasma Apo A-I and Lp(a) concentrations in normal and CHD subjects

| | Group | Apo A-I | Lp(a) |
|--------|----------------|-----------------|----------------|
| Male | Normal(n = 56) | 124.2 ± 24.6 | 9.3 ± 5.23 |
| | CHD(n = 53) | 108.9 ± 17.4*** | 23.6 ± 10.4*** |
| Female | Normal(n = 41) | 126.3 ± 21.1 | 10.2 ± 9.52 |
| | CHD(n = 30) | 109.1 ± 18.9** | 17.1 ± 8.78* |

Values are mean ± S.D.

Normal : Healthy subjects

CHD : Coronary heart disease

Apo A-I : Apolipoprotein A-I

Lp(a) : Lipoprotein(a)

Significant differences between normal and CHD by t-test(*; p<0.05, **; p<0.01, ***; p<0.001)

Table 5. Plasma lipids concentrations in normal and CHD subjects

| | Group | Total- Cholesterol (mg/dl) | HDL- Cholesterol (mg/dl) | LDL- Cholesterol (mg/dl) | Triglyceride (mg/dl) | Atherogenic Index | HDL % |
|--------|----------------|----------------------------------|--------------------------------|--------------------------------|-------------------------|----------------------|----------------|
| Male | Normal(n = 56) | 162.5 ± 5.1 | 46.2 ± 2.5 | 99.7 ± 5.1 | 75.4 ± 5.6 | 3.10 ± 0.31 | 29.5 ± 1.51 |
| | CHD(n = 53) | 223.3 ± 8.9*** | 23.9 ± 2.1*** | 179.7 ± 8.8*** | 101.1 ± 6.0* | 10.81 ± 0.93*** | 11.2 ± 1.04*** |
| Female | Normal(n = 41) | 175.9 ± 6.3 | 51.4 ± 2.1 | 110.5 ± 6.1 | 70.3 ± 5.2 | 2.60 ± 0.17 | 30.3 ± 1.41 |
| | CHD(n = 30) | 237.5 ± 9.5*** | 23.1 ± 1.9*** | 195.5 ± 9.1*** | 93.8 ± 5.5** | 11.31 ± 1.03*** | 10.0 ± 0.88*** |

Values are mean ± S.D.

Significant differences between normal and CHD by t-test(*; p<0.05, **; p<0.01, ***; p<0.001)

A.I. : Atherogenic Index [(Total-cholesterol - HDL-cholesterol)/HDL-cholesterol]

(; 124.2mg/dl, ; 126.3mg/dl)
Lp(a) (;
23.6mg/dl, ; 17.1mg/dl) (; 9.2
mg/dl, ; 10.2mg/dl)

6. 변수간 상관성

Table 8

5. 혈장 항산화영양소와 지질과산화 농도

Table 7 Vit. A(re-
tinol) Vit. E(- tocopherol)
Vit. A
(0.56 µg/dl) (0.45 µg/dl)
Vit. E
(; 27.7 µg/dl, ; 27.4 µg/dl)
(; 40.1 µg/dl, ; 36.9 µg/dl)

LDL - C(r=0.9479),
AI(r=0.5459), Lp(a)(r=0.3017), WHR(r=0.4585)
, TG(r=
0.2577), (r=0.1587)
HDL - C (r= -0.1958) 가
HDL - C LDL - C(r= -0.4667), AI
(r= -0.6910), Lp(a)(r= -0.2347)
가 , Apo A - I (r=
0.4241) . LDL - C AI(r=0.6920), Lp
(a)(r=0.3397), WHR(r=0.4062)
, Vit. E (r=
WHR
(r=0.2340) 가 , AI Lp(a)(r=
0.4137), WHR(r=0.3375)

Table 7. Plasma vitamin A, E and TBARS levels in normal and CHD subjects

| Group | | Vitamin A(µ g/dl) | Vitamin E (µ g/dl) | TBARS(nmol/ml) |
|--------|----------------|--------------------|---------------------|----------------|
| Male | Normal(n = 56) | 0.45 ± 0.19 | 40.14 ± 16.1 | 2.52 ± 1.21 |
| | CHD(n = 53) | 0.56 ± 0.22* | 27.70 ± 8.6*** | 3.21 ± 1.27* |
| Female | Normal(n = 41) | 0.48 ± 0.22 | 36.90 ± 12.3 | 2.64 ± 1.34 |
| | CHD(n = 30) | 0.52 ± 0.21 | 27.38 ± 12.4* | 2.92 ± 1.13 |

Values are mean ± S.D.

Significant differences between normal and CHD by t-test(* ; p<0.05, ** ; p<0.01, *** ; p<0.001)

Normal : Healthy subjects, CHD : Coronary heart disease, TBARS : thiobarbituric acid reactive substance

Table 8. Correlation coefficients between plasma lipids and plasma antioxidant nutrients and anthropometric measurements in normal and CHD subjects

| | Total-C | HDL-C | LDL-C | TG | AI | Lp(a) | Apo A-I | TBARS | Vit. A | Vit. E | BMI | WHR |
|---------|-----------|------------|-----------|---------|------------|----------|---------|---------|-----------|------------|-----------|-----------|
| HDL-C | -0.1958* | | | | | | | | | | | |
| LDL-C | 0.9479*** | -0.4667*** | | | | | | | | | | |
| TG | 0.2577** | -0.0100 | 0.0986 | | | | | | | | | |
| AI | 0.5459*** | -0.6910*** | 0.6920*** | 0.0898 | | | | | | | | |
| Lp(a) | 0.3017*** | -0.2347** | 0.3397*** | 0.0535 | 0.4137*** | | | | | | | |
| Apo A-I | 0.0096 | 0.4241*** | -0.1239 | 0.0764 | -0.4227*** | -0.1823* | | | | | | |
| TBARS | -0.0722 | -0.0759 | -0.0277 | -0.1229 | 0.0554 | 0.0500 | -0.0460 | | | | | |
| Vit. A | 0.1280 | -0.1612 | 0.1415 | 0.1330 | 0.1159 | 0.0379 | -0.1793 | 0.0371 | | | | |
| Vit. E | -0.1843 | 0.1227 | -0.2309* | 0.1698 | -0.2153* | -0.1839 | -0.0220 | -0.0715 | 0.3494*** | | | |
| BMI | 0.0604 | 0.1217 | 0.0118 | 0.0655 | -0.0058 | -0.0797 | -0.0915 | -0.0258 | 0.2145 | 0.1433 | | |
| WHR | 0.4585*** | -0.0779 | 0.4062*** | 0.2340* | 0.3375*** | 0.1873 | -0.0537 | 0.0392 | 0.3130* | -0.2485* | 0.4870*** | |
| Age | 0.1587* | -0.0329 | 0.1467 | 0.0724 | 0.1336 | 0.1315 | 0.0356 | 0.0216 | -0.1618 | -0.4712*** | -0.1165 | 0.4372*** |

A.I. : Atherogenic Index [(Total-cholesterol-HDL-cholesterol)/HDL-cholesterol]

Lp(a) : lipoprotein(a), TBARS : thiobarbituric acid reactive substance, BMI : body mass index, WHR : waist/hip ratio

* ; p<0.05, ** ; p<0.01, *** ; p<0.001

Apo A - I($r = -0.4427$), Vit. E($r = -0.2153$) , ,
. Vit. A Vit. E , 가
($r = 0.3494$) , Vit. E 가
($r = 0.4712$) . BMI WHR
($r = 0.4870$) 가 , WHR .
($r = 0.4372$) . , LDL - C

고 안 가 (37 - 39) . HDL - C
. WHR Apo A - I
123.5mg/dl (40),
(33) . Apo A - I HDL - C
. HDL - C 가 Apo A - I
가 WHR
0.96, 0.92 Lp(a) 가
, (34) 가 WHR Lp(a)
(41,42) .
Lp(a)
, Lp
(35) (a) 가 가 plasminogen
plasmin , 가
1502kcal, 1826kcal, 43) . Lp(a)
1525kcal, 1964kcal, 14.9mg/dl⁽⁴⁴⁾
98 142mg, 105 214mg
. , (36)
가 2088kcal, 1995kcal, Lp(a) 가 30 mg/dl
2155kcal, 1939kcal 가 , Lp(a)
, 317mg, (43) . Lp(a)
221mg, 440mg, 269mg 가 ,
(cerebral infarction),
, (36) (45) .
100mg , (46) 50 59
, 127mg/dl,
. 60 111 114mg/dl
가
Vit. C, E
가 (47) .
가
가 LDL
LDL

가
^{48,49)} .
thiobarbituric acid reactive substances , VLDL
(TBARS) malondialdehyde(MDA)⁵⁰⁾ 가 ⁵⁸⁾ . prostacyclin
conjugated diene⁵¹⁾ ,
가 ⁵²⁾ .
가 ⁴⁶⁾ .
LDL ^{59,60)} LDL
⁶¹⁾ . Vit. E
LDL
가 ⁴⁶⁾ . 가
LDL
. 2.52 2.64 MDA nmol/ml . LDL
²²⁾ ⁵³⁾ . 가 Chen ⁶²⁾
가 Vit. C Vit. E , stress
^{54,55)} ,
, tar free radical
가
⁵⁶⁾ . Vit. C
Vit. E . CHD
Vit. E
, Vit. E 가
, E , 가
가 Vit. E
Vit. A
가
가 Vit. E
가가
LDL Vit. E, C
^{54,55)} , 가 Vit.
E Vit. E
. 연구배경 :
VLDL - TG 가 , LPL(li -
poprotein lipase) 가
HDL - C 가 ⁵⁷⁾ .
(nicotine) ca -
techolamine 가
⁵⁷⁾ , epinephrine, norepinephrine .

방 법 :

83

97

, Apo A - I, Lp(a),

결 과 :

Vit. E

, HDL - C,

LDL - C,

결 론 :

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