

\*, \*\*

\* . \* . \* . \* . \* . \* . \*

cysteine 가

D. 가

1). 가, , , tocopherols carotenoids, homo-  
cysteine

가 2). oxidants

lipoprotein; LDL) 4) (low density

가 5). 1. 30 69

5). 가 152 93

가 6). carotenoids , E . 15 15

6. E 가 (heavy smoker), 1

homocysteine 가 가 1

homocysteine 7) (nondrinker), 10- 25g  
(moderate drinker), 25g  
(heavy drinker)

homocysteine 45%, 53%,

8. 65%가 homo-

2. ,

: 1998 12 16  
: 1999 2 20

24

(1996) N3

Program(N-squared Co. Ltd, OR, USA)

Benedict 9, 24

10

가

(body mass index: BMI)

(kg) (m)

tape

3.

CT(Hispeed Advantage, GE medical system, USA) 1 ( )

4 ( ) 가

Hounsfield number -150 -50

(visceral fat area), (subcutaneous fat area)

가 Hounsfield number -49 +100

, Hounsfield number -150 -50 (thigh fat area)

(calf fat area)

4.

, LDL

(Autoanalyzer Hitachi 7150, Hitachi Ltd., Tokyo, Japan)

, HDL (chylomicron),

LDL , VLDL

HDL

5.

(sex hormone-binding globulin; SHBG) Orion Diagnostica(Finland)

kit

testosterone Immuchem direct testosterone kit(ICN Biomedical, Inc. Comp., USA)

androgen tes-

tosterone (nmol/L)

(nmol/L) II, insulin like growth factor-1(IGF-1) Diagnostic Systems Laboratories(Texas, USA) kit

6. homocysteine

homocysteine Anderson

12 B, 500 $\mu$ l pH 9.0

borate buffer dithiothreitol 가 homocysteine -S L- norleucine (Sigma Chemical Co., St. Louis, USA) 20% sulpho-saicylic acid 가 3300rpm

15 0.2  $\mu$ m membrane filter(Waters, Millipore, MA, USA)

100 $\mu$ l Pharmacia Biotech (Cambridge, England)

post-column ninhydrin reaction system Bio20

D,L-homocysteine (Sigma Chemical Co., St. Louis, MO, USA) homocysteine

D,L-homocysteine 가

7. tocopherols, retinol carotenoids

tocopherols, retinol carotenoids

-70 , 2

Yeum 14)

HPLC . HPLC system Alliance Waters 2690 separating module, Waters 996 Photodiode array detector, Waters TM474

scanning fluorescence detector, C18 Symmetry 3.9×15cm column(Waters, Milford, MA, USA) (33 ), - (14 ), -  
 , mobile phase A(CH<sub>3</sub>CH:THF:d-H<sub>2</sub>O) (15 ) . Window  
 =50:20:30, v/v/v) B(CH<sub>3</sub>CH:THF: d-H<sub>2</sub>O=50:44 SPSS package(Statistical Package for the Social  
 :6, v/v/v) . 1.2ml/min , , ± Sciece, SPSS Ins., Chicago, IL, USA)  
 -tocopherol, -tocopherol 294nm, retinol 340nm , p<0.05  
 carotenoids - carotene, - carotene, cryp-  
 toxanthin, lycopene 450nm . LSD(least significant  
 difference) one- way ANOVA .  
 tocopheryl acetate .  
 tocopherols, retinol carotenoids  
 (mmol), (mmol) 1. , ,  
 .  
 8. GOT, GPT , , 가  
 (Table 1).  
 Glutathione peroxidase(GSH- Px) Paglia15  
 Deagen16 ,  
 . 1  
 1M2 1 NADPH nmoles 2. , ,  
 , (specific activity) 1mg 1  
 . Superoxide dismutase (Table 2). 1  
 (SOD) Marklund17) Sheri18) 가 ,  
 pyrogallol SOD가 . 1  
 . 1 pyrogallol 50% - 가 ,  
 . 1mg - , 1  
 malondialdehyde Buc- 16- 18g  
 kingham 19) , luminescence spec-  
 trophotometer(Aminco Bowman Series, NY, USA) 5%  
 500nm (excitation) 553nm - 36g 10% ,  
 (emission) - 53g 15%  
 . - 18, 20  
 . - 1 26  
 9. (Table 2).  
 ,  
 3. , ,  
 homocysteine  
 . - (33 ), - (11 , LDL ,  
 ), - (46 ), - HDL ,

**Table 1. Age, anthropometric parameters, blood pressure and GOT, GPT levels in healthy males by alcohol consumption and cigarette use**

Drinking Smoking	None		Moderate		Heavy	
	None (n=33)	Heavy (n=11)	None (n=46)	Heavy (n=33)	None (n=14)	Heavy (n=15)
Age	47.3 ± 1.93	45.1 ± 3.21	46.9 ± 1.55	43.7 ± 1.69	48.8 ± 2.07	44.7 ± 2.26
Weight(kg)	70.2 ± 1.53	69.3 ± 2.72	67.4 ± 1.34	70.0 ± 1.76	70.1 ± 2.31	73.6 ± 3.43
Height(cm)	172.2 ± 0.91	171.8 ± 1.74	169.9 ± 1.00	171.9 ± 1.02	170.2 ± 1.89	171.9 ± 1.33
Body mass index(kg/m <sup>2</sup> )	23.7 ± 0.46	23.5 ± 1.06	23.4 ± 0.48	23.7 ± 0.53	24.2 ± 0.73	24.8 ± 0.95
Waist hip ratio*	0.90 ± 0.01ab	0.92 ± 0.01ab	0.89 ± 0.01b	0.90 ± 0.01ab	0.93 ± 0.02a	0.93 ± 0.01a
Systolic BP(mmHg)	118.2 ± 3.66	115.1 ± 5.19	122.1 ± 2.31	122.6 ± 3.46	132.1 ± 6.13	124.2 ± 5.88
Diastolic BP(mmHg)	75.4 ± 2.04	74.6 ± 3.90	85.8 ± 2.89	80.7 ± 3.11	86.3 ± 5.14	81.9 ± 4.31
GOT(U/L)	21.4 ± 1.15	19.0 ± 1.71	23.6 ± 1.35	24.1 ± 2.30	26.6 ± 3.51	25.4 ± 1.63
GPT(U/L)	16.5 ± 1.09	13.2 ± 1.73	19.1 ± 2.00	19.2 ± 3.24	18.7 ± 4.52	19.9 ± 2.22

Mean ± S.E.

Values in the same row with different superscripts are significantly different(p<0.05) from each other.

If any combination matches, the difference between means is not significant.

\* ANOVA shows significant difference(p<0.05)

가 (Table 3). androgen, GSH-Px, (Fig. 1) HDL (Table 3) SOD malondialdehyde 가 (Table 4). homocysteine - 가 (Fig. 1). 4. transferrin IGF-1 가 (Fig. 2). testostosterone,

**Table 2. Calorie and macronutrient intakes, alcohol consumption and smoking in healthy males**

Drinking Smoking	None		Moderate		Heavy	
	None (n=33)	Heavy (n=11)	None (n=46)	Heavy (n=33)	None (n=14)	Heavy (n=15)
Total calorie intake (Kcal/d)	2140 ± 49	2115 ± 92	2125 ± 35	2161 ± 45	2428 ± 103	2481 ± 95
TEE	2339 ± 52	2320 ± 70	2225 ± 33	2332 ± 51	2272 ± 45	2324 ± 78
TEE/TCI	1.10 ± 0.02a	1.12 ± 0.06a	1.05 ± 0.02a	1.09 ± 0.02a	0.95 ± 0.04b	0.95 ± 0.14b
Protein(g/d)	98 ± 6ab	92 ± 6ab	89 ± 3ab	84 ± 3b	107 ± 8a	96 ± 9ab
Animal protein(g/d)	40 ± 5b	62 ± 9a	41 ± 4b	38 ± 3b	43 ± 9b	37 ± 5b
Fat(g/d)	46 ± 3b	69 ± 11a	46 ± 2b	43 ± 2b	48 ± 6b	39 ± 4b
Carbohydrate(g/d)	326 ± 12	27 ± 20	311 ± 10	325 ± 9	311 ± 18	327 ± 16
P/S intake	1.31 ± 0.36	1.19 ± 0.38	1.14 ± 0.29	1.28 ± 0.36	1.11 ± 0.30	1.42 ± 0.40
Alcohol(g/d)*	0	0	16 ± 3c	18 ± 3c	36 ± 8b	53 ± 9a
Smoking(cigarette/d)	0	18 ± 1b	0	20 ± 1b	0	26 ± 2a

TEE: total energy expenditure TCI: total calorie intake P/S intake: polyunsaturated/saturated fatty acids intake ratio Mean ± S.E.

Values in the same row with different superscripts are significantly different(p<0.05) from each other.

If any combination matches, the difference between means is not significant.

\* ANOVA shows significant difference(p<0.05)

**Fig. 1. Triglyceride level and plasma homocysteine level in healthy males by alcohol consumption and cigarette use**

Mean  $\pm$  S.E.  
 Values with different superscripts are significantly different ( $p < 0.05$ ) from each other.  
 If any combination matches, the difference between means is not significant.

**Fig. 2. Serum protein level in healthy males by alcohol consumption and cigarette use**

Mean  $\pm$  S.E.  
 Values with different superscripts are significantly different ( $p < 0.05$ ) from each other.  
 If any combination matches, the difference between means is not significant.

Fig. 3 Table 5 .  
 (Table 5),  
 가 (Fig. 3).  
 가  
 (Table 5).

75% (Fig. 4). cryptoxanthin  
 lycopene - -  
 , - -  
 32- 40%  
 - 54- 63%  
 (Fig. 5).  
 tocopherols, retinol, carotenoids  
 (Table 6).

5. tocopherols, retinol carotenoids  
 - tocopherol, -tocopherol, retinol,  
 - carotene 가 .  
 - carotene - -  
 , - - 가 , ,  
 45% 가 -



**Table 3. Serum lipid, protein and plasma homocysteine levels in healthy males by alcohol consumption and cigarette use**

Drinking Smoking	None		Moderate		Heavy	
	None (n=33)	Heavy (n=11)	None (n=46)	Heavy (n=33)	None (n=14)	Heavy (n=15)
Total cholesterol(mg/dl)	197.3 ± 7.79	201.7 ± 8.57	192.6 ± 5.54	200.7 ± 7.39	198.3 ± 13.3	204.3 ± 11.6
HDL cholesterol(mg/dl)*	47.5 ± 1.79b	47.2 ± 3.20b	51.5 ± 1.88ab	47.2 ± 1.58b	53.1 ± 2.41ab	55.8 ± 4.42a
LDL cholesterol(mg/dl)	123.4 ± 5.89	131.7 ± 9.20	115.5 ± 4.50	120.0 ± 7.19	112.8 ± 11.5	108.8 ± 9.85
Total/HDL cholesterol	4.33 ± 0.16	4.60 ± 0.35	3.87 ± 0.13	4.47 ± 0.23	3.86 ± 0.32	3.89 ± 0.29
Total protein(g/dl)	7.31 ± 0.14	7.30 ± 0.11	7.44 ± 0.08	7.38 ± 0.11	7.18 ± 0.18	7.32 ± 0.21
Albumin(g/dl)	4.58 ± 0.09	4.63 ± 0.09	4.62 ± 0.06	4.73 ± 0.07	4.53 ± 0.11	4.61 ± 0.11

Mean ± S.E.

Values in the same row with different superscripts are significantly different(p<0.05) from each other.

If any combination matches, the difference between means is not significant.

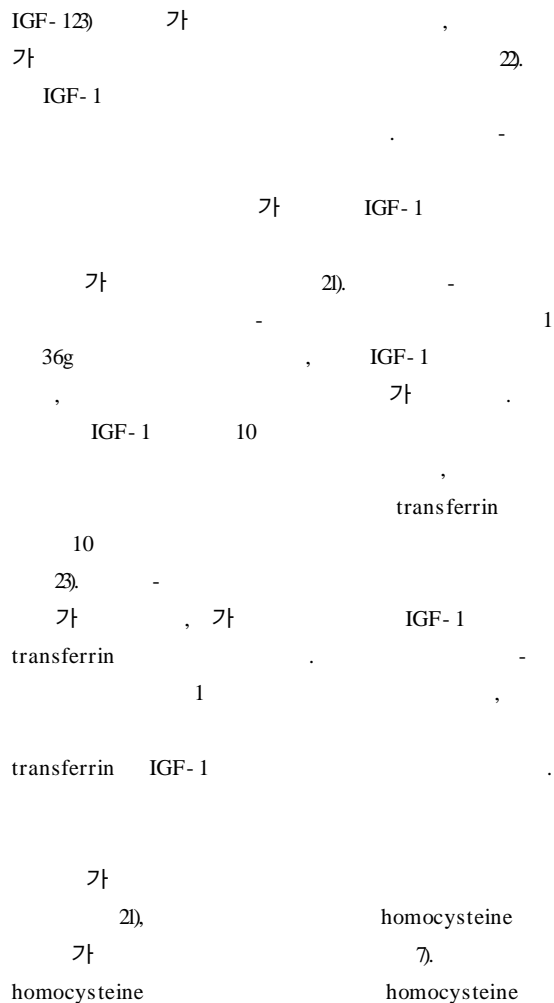
\* ANOVA shows significant difference(p<0.05)

**Fig. 5. Serum concentrations of carotenoids in healthy males by alcohol consumption and cigarette use**

Mean ± S.E.

Values with different superscripts are significantly different(p<0.05) from each other.

If any combination matches, the difference between means is not significant.



**Table 4. Serum sex hormone levels and antioxidant enzyme activities in healthy males by alcohol consumption and cigarette use**

Drinking Smoking	None		Moderate		Heavy	
	None (n=33)	Heavy (n=11)	None (n=46)	Heavy (n=33)	None (n=14)	Heavy (n=15)
Testosterone(ng/ml)	5.28 ± 0.33	5.24 ± 0.44	5.76 ± 0.24	5.90 ± 0.34	5.36 ± 0.43	5.19 ± 0.39
Sex hormone binding globulin(nmol/L)	48.0 ± 3.74	49.9 ± 4.16	51.8 ± 2.73	53.0 ± 3.19	54.2 ± 5.00	45.0 ± 4.88
Free androgen index	45.0 ± 4.74	37.6 ± 3.02	41.4 ± 2.18	42.6 ± 3.22	35.0 ± 2.19	47.8 ± 5.71
Glutathione peroxidase (nmol of NADPH/min/mg albumin)	39.2 ± 1.80	39.3 ± 2.23	40.9 ± 1.51	36.3 ± 1.78	37.8 ± 3.18	41.2 ± 3.81
RBC total SOD(U/mg albumin)	22.5 ± 2.52	20.3 ± 4.32	16.1 ± 1.82	20.6 ± 2.08	17.3 ± 5.48	22.5 ± 5.62
Serum total SOD(U/mg albumin)	5.47 ± 0.61	6.68 ± 0.99	5.36 ± 0.43	5.02 ± 0.46	5.07 ± 0.56	6.62 ± 0.76
Malondialdehyde(nmol/ml)	3.99 ± 0.30	3.73 ± 0.46	4.14 ± 0.25	4.30 ± 0.21	3.78 ± 0.31	3.96 ± 0.38

Mean ± S.E.

가 15- 16 μmol/L 2), homocysteine homocysteine ,  
 가 15 μmol/L 45 , , , , ,  
 10% 2), - , 7,25),  
 homocysteine 가 13.1 μmol/L , , , ,  
 15 5 33% 가 15 μmol/L . 가 , 65% 가  
 homocysteine 가 5 μmol/L  
 가 50% 가 ,  
 10% 가 7,25) -

**Table 5. Fat and muscle areas at different levels of body in healthy males by alcohol consumption and cigarette use**

Drinking Smoking	None		Moderate		Heavy	
	None (n=33)	Heavy (n=11)	None (n=46)	Heavy (n=33)	None (n=14)	Heavy (n=15)
1st lumbar(L1) vertebra						
Total fat(cm <sup>2</sup> )	189.8 ± 16.6	176.1 ± 26.8	173.1 ± 11.2	171.2 ± 14.9	235.7 ± 22.5	217.9 ± 24.9
Visceral fat(cm <sup>2</sup> )	122.8 ± 11.5	105.5 ± 14.7	110.2 ± 8.11	111.2 ± 10.9	154.1 ± 15.6	135.2 ± 17.3
Visceral/subcutaneous fat	1.98 ± 0.18	1.61 ± 0.15	1.73 ± 0.09	1.90 ± 0.12	2.02 ± 0.18	1.70 ± 0.19
4th lumbar(L4) vertebra						
Total fat(cm <sup>2</sup> )	223.5 ± 15.9	209.5 ± 20.6	217.5 ± 11.1	209.3 ± 15.0	262.1 ± 19.7	259.6 ± 23.7
Visceral fat(cm <sup>2</sup> )	102.9 ± 8.67	96.8 ± 15.0	103.3 ± 7.10	96.7 ± 7.92	121.6 ± 9.36	111.7 ± 14.1
Visceral/subcutaneous fat	0.85 ± 0.05	0.87 ± 0.14	0.90 ± 0.05	0.87 ± 0.05	0.98 ± 0.11	0.80 ± 0.10
Mid thigh						
Fat(cm <sup>2</sup> )	40.5 ± 2.45	42.0 ± 3.77	37.7 ± 1.79	36.3 ± 2.31	39.2 ± 2.92	41.1 ± 3.06
Muscle(cm <sup>2</sup> )	145.3 ± 3.16	144.0 ± 5.34	140.3 ± 2.47	148.9 ± 3.48	150.3 ± 4.22	145.4 ± 5.86
Calf						
Fat(cm <sup>2</sup> )	17.9 ± 4.41	14.8 ± 1.38	13.0 ± 0.62	12.9 ± 0.74	13.5 ± 0.74	14.4 ± 0.77
Muscle(cm <sup>2</sup> )	77.1 ± 1.68	72.1 ± 3.40	77.7 ± 1.67	78.3 ± 1.98	76.2 ± 3.46	80.6 ± 4.39

Mean ± S.E.



**Table 6. Serum concentrations of carotenoids and tocopherols in healthy males by alcohol consumption and cigarette use**

Drinking Smoking	None		Moderate		Heavy	
	None (n=33)	Heavy (n=11)	None (n=46)	Heavy (n=33)	None (n=14)	Heavy (n=15)
Uncorrected levels						
- carotene( $\mu\text{g}/\text{dl}$ )	3.46 $\pm$ 0.50	2.21 $\pm$ 0.45	2.89 $\pm$ 0.37	2.84 $\pm$ 0.46	2.63 $\pm$ 0.80	1.54 $\pm$ 0.34
Retinol( $\mu\text{g}/\text{dl}$ )	119.3 $\pm$ 14.5	95.9 $\pm$ 11.8	122.3 $\pm$ 13.9	97.6 $\pm$ 10.9	118.1 $\pm$ 26.6	124.0 $\pm$ 27.3
- tocopherol( $\mu\text{g}/\text{ml}$ )	10.7 $\pm$ 1.24	7.54 $\pm$ 1.18	9.20 $\pm$ 0.99	8.24 $\pm$ 0.80	10.1 $\pm$ 2.20	11.1 $\pm$ 3.09
- tocopherol( $\mu\text{g}/\text{ml}$ )	1.07 $\pm$ 0.17	1.15 $\pm$ 0.25	1.08 $\pm$ 0.15	1.13 $\pm$ 0.18	1.35 $\pm$ 0.39	1.61 $\pm$ 0.85
Lipid-corrected levels						
- carotene( $\mu\text{g}/\text{mmol}$ )	5.68 $\pm$ 0.90	3.50 $\pm$ 0.79	4.78 $\pm$ 0.58	3.94 $\pm$ 0.62	4.73 $\pm$ 1.86	2.08 $\pm$ 0.42
- carotene( $\mu\text{g}/\text{mmol}$ )*	103.3 $\pm$ 10.5a	57.4 $\pm$ 12.5bc	86.0 $\pm$ 11.7ab	52.5 $\pm$ 9.40bc	57.1 $\pm$ 10.1bc	22.4 $\pm$ 4.18c
Retinol( $\mu\text{g}/\text{mmol}$ )	194.2 $\pm$ 24.0	153.7 $\pm$ 23.4	207.7 $\pm$ 29.6	139.9 $\pm$ 17.8	188.5 $\pm$ 48.4	167.9 $\pm$ 32.4
- tocopherol( $\mu\text{g}/\text{mmol}$ )	1.81 $\pm$ 0.25	1.19 $\pm$ 0.20	1.48 $\pm$ 0.16	1.17 $\pm$ 0.12	1.48 $\pm$ 0.32	1.42 $\pm$ 0.30
- tocopherol( $\mu\text{g}/\text{mmol}$ )	0.18 $\pm$ 0.03	0.18 $\pm$ 0.04	0.18 $\pm$ 0.03	0.16 $\pm$ 0.03	0.22 $\pm$ 0.07	0.20 $\pm$ 0.08
Cryptoxanthin( $\mu\text{g}/\text{mmol}$ )*	134.9 $\pm$ 21.2a	85.2 $\pm$ 18.0ab	127.8 $\pm$ 16.2a	81.5 $\pm$ 14.8ab	101.8 $\pm$ 30.9ab	43.9 $\pm$ 8.68b
Lycopene( $\mu\text{g}/\text{mmol}$ )*	64.3 $\pm$ 8.23a	43.7 $\pm$ 8.91ab	65.2 $\pm$ 8.55a	37.4 $\pm$ 6.62ab	39.1 $\pm$ 8.07ab	23.2 $\pm$ 5.84b

Mean  $\pm$  S.E.Values in the same row with different superscripts are significantly different( $p < 0.05$ ) from each other.

If any combination matches, the difference between means is not significant.

\* ANOVA shows significant difference( $p < 0.05$ )

homocysteine 가 45%가 , -  
75%가  
homocysteine - carotene  
carotenoids carotenoids cryptoxanthin lycopene  
30- 40%가  
carotenoids ,  
5- 20) carotenoids ,  
carotenoids 20) 54- 63%가 . Lycopene  
- carotene 가 5 LDL  
- carotene 5- 20) 가  
carotenoids - carotene 30) carotenoids LDL  
carotenoids 가 carotenoids 30)  
30- 44% 가 - carotene 가  
5- 20) carotenoids ,  
carotenoids , tocopherol 가 LDL  
- carotene cryptoxanthin 10- 40% 가  
20) 30) 30) carotenoids  
- carotene - 5- 30) , - tocopherol  
- - 4- 5- 30)

carotenoids , -tocopherol  
 가 , -tocopherol  
 :  
 GSH- Px SOD homocysteine 가  
 가 tocopherols .  
 malondialdehyde 가 .  
 : 30 69  
 carotenoids tocopherols - (33 ) , -  
 carotenoids tocopherols (11 ) , - (46 ) , -  
 (33 ) , - (14 ) ,  
 . tocopherols carotenoids - (15 ) .  
 carotenoids가 15  
 -tocopherol 10-25g  
 5) , 25g .  
 - carotene ,  
 - carotene ,  
 5) , , ,  
 HDL 가 , homocysteine  
 HDL .  
 1 25g : - ,  
 65%가 ,  
 , 1 15 . 16-18g,  
 - carotene carotenoids 1/3가 53g .  
 19 -  
 , 1 26 . , , ,  
 가 , GOT, GPT 가 ,  
 ,  
 homocysteine 40% 가 , 가 .  
 - carotene 75%, cryptoxanthin - , HDL  
 lycopene 가 , transferrin IGF-1  
 , - carotene . homocysteine -  
 carotenoids 가 가 .  
 가 - carotene - .  
 , 45%가  
 가 , 75%가 .  
 cryptoxanthin lycopene  
 , carotenoids가 30-40%가 ,  
 가 , 54-63%가  
 가 . - carotene .

HDL : 가 ,  
가 ,  
carotenoids  
homocysteine 가 carotenoids  
가

=Abstract=

**Influence of alcohol consumption and smoking habits on cardiovascular risk factors and antioxidant status in healthy men**

Yang soo Jang, M.D., Oh Yeon Kim, M.S.\*  
Sock Ju Kwon, M.S.\*, Jong Ho Lee, Ph.D.\*  
Nam Sik Chung, M.D., Hyun Chul Lee, M.D.\*\*  
Kap Bum Huh M.D.\*\*

*Yonsei Cardiovascular Research Institute  
Department of Food and Nutrition, College of Human  
Ecology,\* Division of Internal Medicine, College of  
Medicine\*\*, Yonsei University, Seoul, Korea*

**Objective :** Upper-body fat distribution, hyperhomocysteinemia and a depletion in antioxidant status are considered risk factors for atherosclerosis and these factors are related to alcohol consumption and cigarette smoking. The purpose of this study was to determine the influence of alcohol consumption and smoking habits on cardiovascular risk factors in healthy men by using a cross-sectional design.

**Methods :** Smokers were defined as heavy smokers when they smoked more than 15 cigarettes per day. Group subdivision of drinkers were none, moderate (10-25g alcohol/d) and heavy(>25g alcohol/d) alcohol consumption. Subjects were divided into 6 groups: non-drinker-nonsmoker(n=33), nondrinker-heavy smoker (n=11), moderate drinker-nonsmoker (n=46), moderate drinker-heavy smoker(n=33), heavy drinker-nonsmoker (n=14) and heavy drinker-heavy smoker(n=15). Adipose tissue and muscle areas were calculated from computed tomography scans made at four body levels, first and forth lumbar vertebrae, mid portion of thigh and calf.

Fasting serum levels of lipids, proteins, hormones and antioxidants and plasma level of homocysteine were determined.

**Results :** Heavy drinker-heavy smokers showed similar intake of daily calorie and protein to other groups and 65% of them supplemented their diet with synthetic vitamin preparation. Heavy drinker-nonsmokers(36g/d) consumed nearly twice as much alcohol as moderate drinkers(16-18g/d) and heavy drinker-heavy smokers (53g/d) nearly three times as much. In comparison with non and moderate drinker-heavy smokers, heavy drinker-heavy smokers smoked more cigarettes(19 vs 26 cigarettes/d, p<0.05). Although there were no differences among 6 groups in means of age, body mass index, blood pressure and serum GOT and GPT levels, heavy drinkers showed the highest mean value of waist to hip ratio and subcutaneous fat area at first and forth lumbar vertebrae. Heavy drinker-heavy smokers showed higher serum levels of triglyceride and HDL-cholesterol but lower serum levels of transferrin and IGF-1, compared with nondrinkers. Plasma homocysteine level was higher in heavy drinker-heavy smokers than in nondrinker-nonsmokers. Serum levels of  $\alpha$ -carotene, cryptoxanthin and lycopene in heavy smokers or heavy drinkers showed a decrease by about 50% of those in men who did not drink and smoke and these levels were the lowest in heavy drinker-heavy smokers among 6 groups.

**Conclusion :** Our results show that heavy alcohol consumption can result in abdominal obesity, hypertriglyceridemia and a decrease in serum carotenoid levels, even though it can cause an increase in HDL-cholesterol level. In addition, a further decrease in serum carotenoids and an increase in plasma homocysteine level in heavy drinker-heavy smokers indicate the increased risk for atherosclerosis in the simultaneous heavy consumption of alcohol and cigarette.

**Key words :** alcohol, smoking, abdominal obesity, carotenoids, homocysteine

**REFERENCES**

- 1) Armellini F, Zamboni M, Frigo L, Mandragona R, Robbi R, Micciolo R, Bosello O: *Alcohol consumption, smoking habits and body fat distribution in Italian men and women aged 20-60 years. Eur J Clin Nutr 47:52-60, 1993*
- 2) Cefalu WT, Wang ZQ, Werbel S, Bell-Farrow A, Crouse JR, Hinson WH, Terry JG, Anderson R: *Contribution of visceral fat mass to the insulin resistance of aging. Metab 44:954-959, 1995*

- 3) Seidell JC, Cigolini M, Deslypere JP, Charzewska J, Ellsinger BM, Cruz A: *Body fat distribution in relation to physical activity and smoking habits in 38-year-old European men-the European fat distribution study.* *Am J Epidemiol* 133:257-265, 1991
- 4) Marangon K, Herbeth B, Lecomte E, Paul-Dauphin A, Grolier P, Chancerelle Y, Artur Y, Siest G: *Diet, antioxidant status, and smoking habits in French men.* *Am J Clin Nutr* 67:231-239, 1998
- 5) Stryker WS, Kaplan LA, Stein EA, Stampfer MJ, Sober A, Willett WC: *The relation of diet, cigarette smoking, and alcohol consumption to plasma beta-carotene and alpha-tocopherol levels.* *Am J Epidemiol* 127:283-296, 1988
- 6) Gross MD, Snowdon DA: *Plasma antioxidant concentration in a population of elderly women: finding from the nun study.* *Nutr Res* 16:1881-1890, 1996
- 7) Nygard O, Refsum H, Ueland PM, Vollset SE: *Major lifestyle determinants of plasma total homocysteine distribution: the Hordaland homocysteine study.* *Am J Clin Nutr* 67:263-270, 1998
- 8) Currie IC, Wilson YG, Scott J, Day A, Stansbie D, Baird RN, Lamont PM, Tennant WG: *Homocysteine: an independent risk factor for the failure of vascular intervention.* *Br J Surgery* 83:1238-1241, 1996
- 9) The Am Dietetic Asso: *Handbook of Clinical Dietetics.* 2nd ed., pp.5-39, MA, Yale Univ Press, 1992
- 10) Christian JL, Greger JH: *Nutrition for Living.* p.111, CA, The Benjamin/Cummings Publ. Comp. Inc., 1991
- 11) Carter GD, Holland SM, Alahband-Zadeh J, Rayman G, Dorrington-ward P, Wise PH: *Investigation of hirsutism: testosterone is not enough.* *Ann Clin Biochem* 20:262-263, 1983
- 12) Anderson A, Battström L, Isaksson A, Israelsson B, Hultberg B: *Determination of homocysteine in plasma by ion-exchange chromatography.* *Scand J Clin Lab Invest* 49:445-449, 1989
- 13) Ueland PM, Refsum H, Stabler SP, Mailnow MR, Andersson A, Allen RH: *Total homocysteine in plasma or serum : method and clinical applications.* *Clin Chem* 39:1764-1779, 1993
- 14) Yeum K-J, Lee-Kim YC, Yoon S, Lee KY, Park IS, Lee KS, Kim BS, Tang G, Russell RM, Krinsky NI: *Similar metabolites formed from -carotene by human gastric mucosal homogenates, lipoxygenase or linoleic acid hydroperoxide.* *Arch Biochem Biophys* 321:167-174, 1995
- 15) Paglia DE, Valentine WN: *Studies on the quantitative and qualitative characterization of erythrocyte glutathione peroxidation.* *J Lab & Clin Med* 70:158-169, 1967
- 16) Deagen JT, Butler JA, Beilstein MA, Whagner PD: *Effects of dietary selenite, selenocysteine and selenomethionine o-selenocysteine lyase and glutathione peroxidase activities on selenium levels in rat tissues.* *J Nutr* 117:91-98, 1987
- 17) Marklund S, Marklund G: *Involvement of the superoxide anion radical in the autooxidation of pyrogallol and a convenient assay for superoxide dismutase.* *European J Biochem* 47:469-474, 1974
- 18) Zheidenberg S, Keen CL, Hurley LS: *SOD activity and lipid peroxidation in the rats: developmental correlations affected by manganese deficiency.* *J Nutr* 113:2498-2504, 1983
- 19) Buckingham KW: *Effect of dietary polyunsaturated/saturated fatty acid ratio and dietary vitamin E on lipid peroxidation in the rat.* *J Nutr* 115:1425-1435, 1985
- 20) , , , :  
가  
 . 54:406-413, 1998
- 21) Wardlaw GM, Insel PM: *Perspectives in Nutrition* 2nd ed. pp 579-585, Mosby, MD, 1993
- 22) Björntorp P: *The regulation of adipose tissue distribution in humans.* *Int J Ob* 20:291-302, 1996
- 23) Ross RJM, Buchanan CR: *Growth hormone secretion: its regulation and the influence of nutritional factors.* *Nutr Res Rev* 3:143-162, 1990
- 24) Duell PB, Malinow MR: *Homocysteine: an important risk factor for atherosclerotic vascular disease.* *Curr Opin in Lipidol* 8:28-34, 1998
- 25) Boushey CJ, Beresford SAA, Omenn GS, Motulsky AG: *A quantitative assessment of plasma homocysteine as a risk factor for vascular disease.* *J Am Med Assoc* 274:1049-1057, 1995
- 26) Vogel S, Contosis JH, Tucker KL, Wilson PWF, Schafer EJ, Lammi-Keefe CJ: *Plasma retinol and plasma and lipoprotein tocopherol and carotenoid concentrations in healthy elderly participants of the Framingham Heart Study.* *Am J Clin Nutr* 66:950-958, 1997
- 27) Fotouchi N, Meydani M, Santos MS, Meydani S, Hennekens CH, Gaziano JM: *Carotenoid and tocopherol concentrations in plasma, peripheral blood mononuclear cells, and red blood cells after long-term -carotene supplementation in men.* *Am J Clin Nutr* 63:553-558, 1996
- 28) Margetts BM, Jackson AA: *The determinants of plasma -carotene and other lifestyle factors.* *Eur J Clin Nutr* 50:236-238, 1996
- 29) Albanes D, Virtamo J, Taylor PR, Rautalahti M, Pietinen P, Heinonen OP: *Effects of supplemental*

- carotene, cigarette smoking, and alcohol consumption on serum carotenoids: the alpha-tocopherol, beta-carotene cancer prevention study. *Am J Clin Nutr* 66:366-372, 1997
- 30) Clinton SK: *Lycopene: chemistry, biology, and implications for human health and disease*. *Nutr Rev* 56:35-51, 1998
- 31) Halliwell B: *Antioxidants and human disease: a general introduction*. *Nutr Rev* 55:S44-S52, 1997
- 32) Stahl W, Sies H: *Antioxidant defense: vitamin E and C and carotenoids*. *Diabetes* 46: S14-S18, 1997
- 33) Buring JE, Hanekens CH: *Antioxidant vitamins and cardiovascular disease*. *Nutr Rev* 55: S53-S60, 1997
- 34) Handelman GJ, Packer L, Cross CE: *Destruction of tocopherols, carotenoids, and retinol in human plasma by cigarette smoke*. *Am J Clin Nutr* 63:559-565, 1996
-