

김범수 · 강진호 · 김경수 · 이상종 · 이만호 · 박정로

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## ABSTRACT

**KEY WORDS :** Lipid · Seasonal variation.

1122

가 , 9 11 가 , 12  
 12)13) 2 .  
 14 - 17) 통계방법 (statistical design)가  
 가 (Normality)  
 (homogeneity) 가  
 대상 및 방법 가 , BMI  
 1997 1 3 12 31 SPSS  
 32,375  
 31,067 BMI  
 17 BMI (covariate)  
 98 20,819 가  
 10,248  
 (p<0.001).  
 HDL Pearson's correlation  
 LDL (Body Mass Index, p 0.05  
 BMI)  
 LDL - C = Total Cholesterol - HDL - C - TG/5,  
 BMI = Weight/(Height)<sup>2</sup>  
 32,375  
 3 5 , 6 8 31,067

**Table 1.** Characteristics and overall mean lipid concentrations in screened population

	Total population	Male	Female
Number	31067	20819	10248
Age (year)	40.83 ± 8.81	40.90 ± 8.27	40.69 ± 9.82
Height (cm)	165.45 ± 8.03	169.60 ± 5.57	157.01 ± 5.12
Weight (kg)	64.14 ± 10.48	68.33 ± 9.08	55.64 ± 7.59
BMI (kg/m <sup>2</sup> )	24.38 ± 3.16	24.82 ± 2.98	23.47 ± 3.31
BP (mmHg)			
Systolic	122.39 ± 15.07	125.63 ± 13.98	115.79 ± 15.04
Diastolic	80.73 ± 10.58	83.23 ± 9.42	75.64 ± 10.97
T-chol (mg/dl)	190.22 ± 36.00	192.35 ± 35.62	185.89 ± 36.38
LDL chol (mg/dl)	111.91 ± 32.47	114.21 ± 32.41	107.24 ± 32.10
HDL chol (mg/dl)	53.58 ± 12.78	50.54 ± 11.27	59.77 ± 13.42
Triglyceride (mg/dl)	123.58 ± 80.87	137.95 ± 84.73	94.38 ± 63.02

BP : Blood pressure, BMI : Body mass index, T-chol : Total cholesterol, LDL chol : Low density lipoprotein cholesterol, HDL chol : High density lipoprotein cholesterol Mean ± SE

**Table 2.** Monthly mean lipid concentrations in men and women

Month	Sex	T-chol	LDL chol	HDL chol	Triglyceride
1	M	185.43 ± 33.39	108.53 ± 30.92	49.05 ± 10.88	139.21 ± 90.89
	F	186.26 ± 37.81	108.68 ± 33.60	56.45 ± 13.00	105.62 ± 75.19
2	M	187.25 ± 34.62	111.50 ± 31.27	49.50 ± 11.31	131.19 ± 77.08
	F	183.28 ± 34.43	106.05 ± 31.20	57.55 ± 12.63	98.40 ± 71.33
3	M	182.21 ± 31.26	107.51 ± 28.59	49.48 ± 11.29	126.06 ± 74.65
	F	177.22 ± 33.66	101.29 ± 29.82	59.00 ± 13.32	84.63 ± 47.69
4	M	188.86 ± 33.15	113.76 ± 30.23	49.80 ± 11.12	126.53 ± 80.75
	F	180.16 ± 33.73	104.36 ± 30.88	58.76 ± 12.48	85.15 ± 51.03
5	M	186.91 ± 33.30	110.75 ± 30.19	50.17 ± 10.86	129.93 ± 77.95
	F	178.85 ± 33.41	102.29 ± 28.89	59.55 ± 13.52	84.98 ± 54.33
6	M	190.34 ± 32.73	113.38 ± 30.05	49.98 ± 10.70	134.86 ± 79.75
	F	183.21 ± 33.18	106.20 ± 29.61	59.43 ± 12.59	87.89 ± 48.47
7	M	187.22 ± 33.60	109.81 ± 31.01	50.53 ± 10.63	134.37 ± 83.11
	F	180.91 ± 34.77	102.80 ± 29.94	58.80 ± 12.69	96.52 ± 76.18
8	M	190.10 ± 34.34	111.33 ± 31.49	50.47 ± 11.12	141.43 ± 91.26
	F	183.11 ± 33.79	104.84 ± 30.26	59.85 ± 12.97	92.06 ± 57.17
9	M	202.69 ± 39.74	120.50 ± 36.37	51.93 ± 11.16	151.27 ± 90.64
	F	192.79 ± 39.64	111.53 ± 35.08	61.58 ± 13.62	98.37 ± 67.65
10	M	204.65 ± 37.34	123.90 ± 34.33	51.61 ± 12.59	145.70 ± 86.48
	F	193.31 ± 37.94	111.93 ± 33.29	62.29 ± 15.06	95.41 ± 60.60
11	M	201.18 ± 36.99	120.98 ± 34.03	51.01 ± 11.68	145.91 ± 88.80
	F	196.45 ± 38.29	114.07 ± 34.83	61.73 ± 14.02	103.22 ± 73.53
12	M	197.65 ± 39.79	115.17 ± 36.85	52.05 ± 12.32	152.14 ± 90.57
	F	194.85 ± 39.01	113.78 ± 34.74	59.39 ± 13.05	108.34 ± 64.81

M : Male, F : Female, T-chol : Total cholesterol, LDL chol : Low density lipoprotein cholesterol, HDL chol : High density lipoprotein cholesterol, Mean ± SE

총콜레스테롤의 변화(Figs. 1 and 2)

20,819 10,248

17 98

가 192.35 mg

가 10

/dl, 185.89 mg/dl , LDL

가 114.21 mg/dl, 가 107.24

가 1 8

mg/dl , HDL 가 (p<0.001).

50.54 mg/dl, 가 59.77 mg/dl . 11 가 9

가 137.95 mg/dl, 가 94.38 mg/ 12 가

dl . Table 1 (p<0.001).

가 가

가 LDL , 가

가 9.05%가, 8.64%가 .

HDL 가 (Table 2).

(p<0.001).

LDL 콜레스테롤의 변화(Figs. 3 and 4)

HDL콜레스테롤의 변화(Figs. 5 and 6)

3 가 10  
9 12 가 (p<0.001).  
11 9 12 가  
(p<0.001).  
가  
가 (p<0.001), 가  
10.04%가, 9.60%  
가

12  
9 12 가  
(p<0.001) 10  
9 12 가 1 8  
(p<0.02).  
가 가  
,

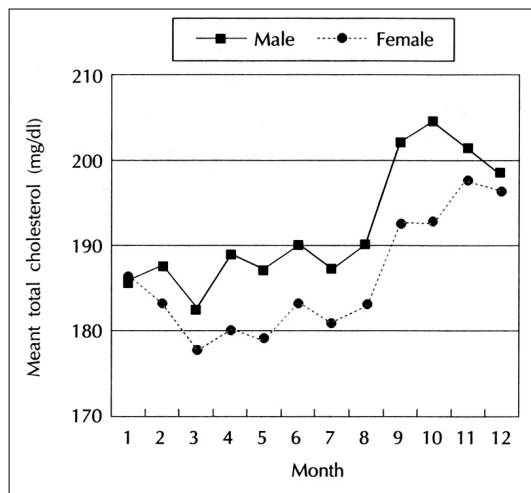


Fig. 1. Monthly mean serum total cholesterol concentrations in men and women.

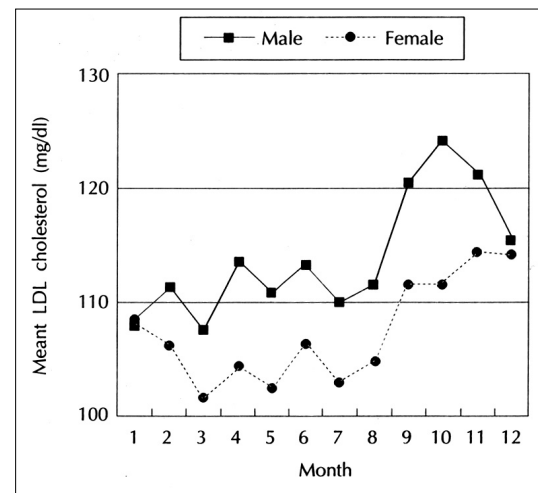


Fig. 3. Monthly mean serum LDL cholesterol concentrations in men and women.

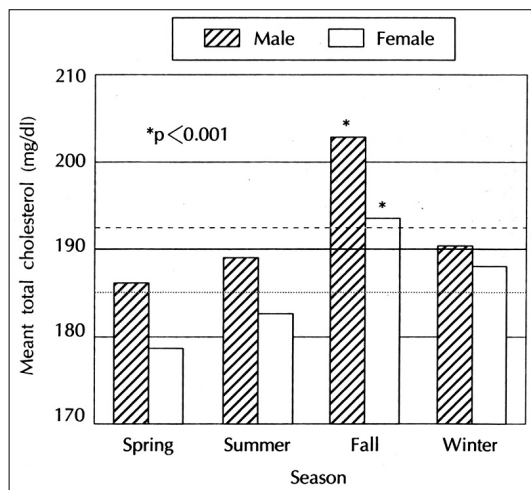


Fig. 2. Seasonal mean serum total cholesterol concentrations in men and women. (solid line : overall mean total cholesterol concentration, dashed line : mean total cholesterol concentrations in men, dotted line : mean total cholesterol concentrations in women)

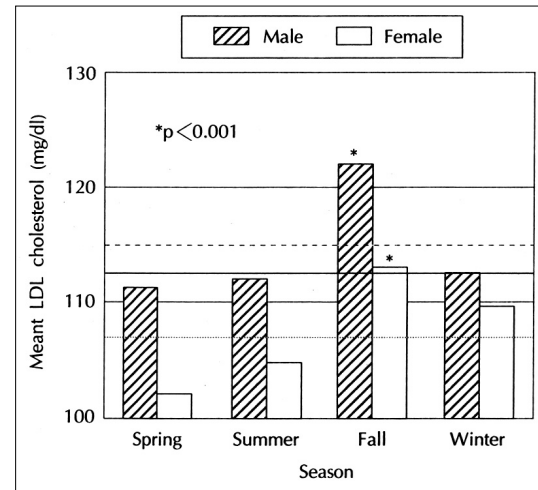


Fig. 4. Seasonal mean serum LDL cholesterol concentrations in men and women. (solid line : overall mean LDL cholesterol concentration, dashed line : mean LDL cholesterol concentrations in men, dotted line : mean LDL cholesterol concentrations in women)

중성지방의 변화(Figs. 7 and 8)

가 9 8  
12 가 1 7  
( $p<0.025$ ) 12  
1 2 7 12  
가 ( $p<0.04$ ).  
가 가  
( $p<0.001$ ).

가  
가 ( $p<0.001$ ).

15.78% ,  
23.56% .

연령별, 신체질량지수별 혈중지질의 분석(Figs. 9 and 10)

가 가 10

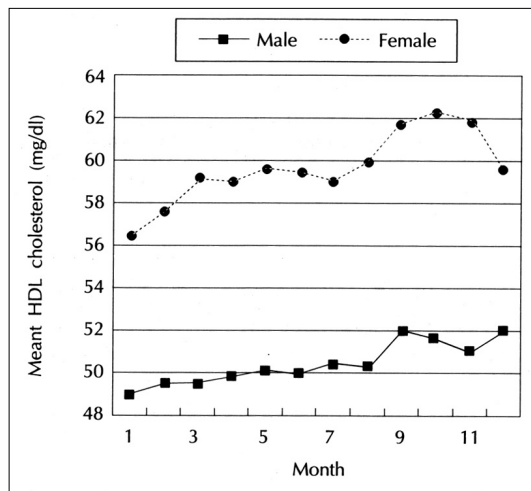


Fig. 5. Monthly mean serum HDL cholesterol concentrations in men and women.

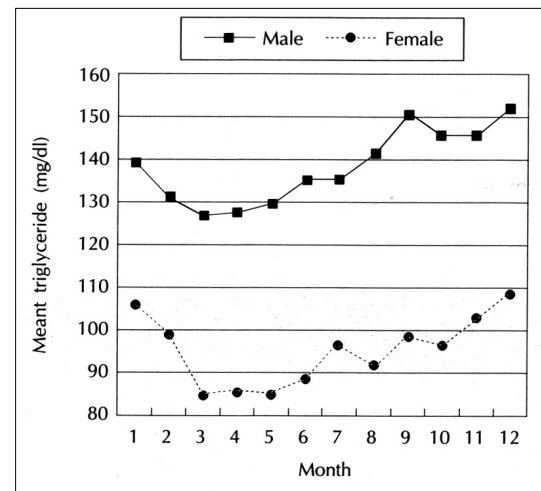


Fig. 7. Monthly mean serum triglyceride cholesterol concentrations in men and women.

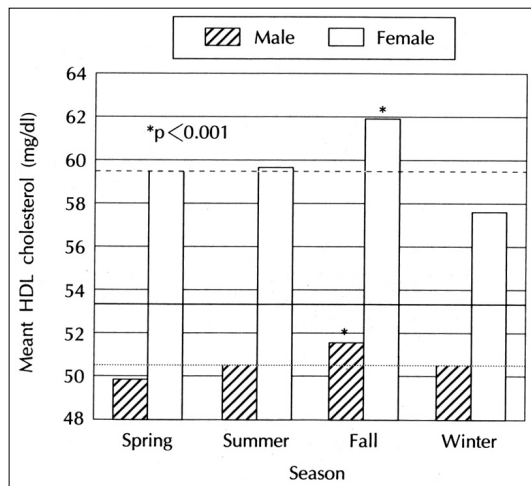


Fig. 6. Seasonal mean serum HDL cholesterol concentrations in men and women. (solid line : overall mean HDL cholesterol concentration, dashed line : mean HDL cholesterol concentrations in men, dotted line : mean HDL cholesterol concentrations in women)

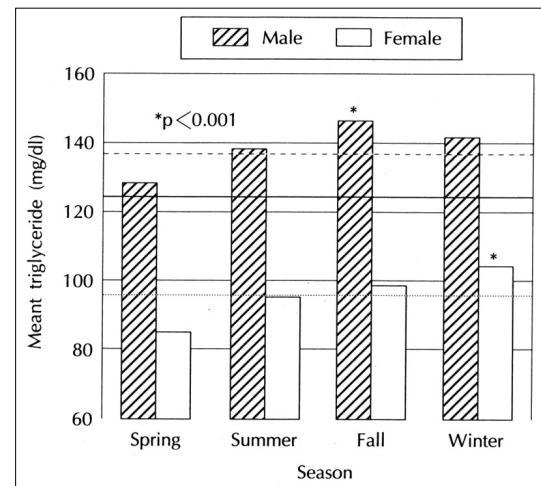
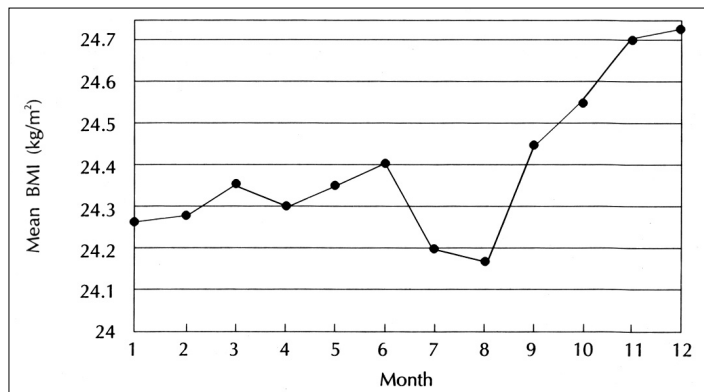


Fig. 8. Seasonal mean serum triglyceride cholesterol concentrations in men and women. (solid line : overall mean triglyceride cholesterol concentration, dashed line : mean triglyceride cholesterol concentrations in men, dotted line : mean triglyceride cholesterol concentrations in women)



**Fig. 9.** Monthly mean body mass index (BMI).

**Table 3.** Pearson correlation coefficients between lipids and several variables

	T-chol	LDL chol	HDL chol	Triglyceride
Age (year)	0.218*	0.124*	- 0.041 *	0.143*
Weight (kg)	0.207*	- 0.079*	- 0.383*	0.356*
BMI (kg/m <sup>2</sup> )	0.266*	- 0.023	- 0.316*	0.348*
BP (mmHg)				
Systolic	0.218*	0.042*	- 0.138*	0.271*
Diastolic	0.217*	0.034*	- 0.153*	0.278*
Month	0.152*	0.129*	0.069*	0.070*

T - chol : Total cholesterol, LDL chol : Low density lipoprotein cholesterol, HDL chol : High density lipoprotein cholesterol, BMI : Body mass index, BP : Blood pressure, \* :  $p < 0.001$

가 . 1950

가 60 1960

가

가

가 (p<0.001). 1960 Thomas 4) 4)20 - 23)

가 12 1 가

5 6 1970

1980

가 가

가 7)9)11)24 - 28) Pincherle 29) 7,000 2.5

(p<0.001). Table 3

가 Harlap 30) 5224

3

고 안 가 1983

가

1920

가 , 1924 Currie 18)

가 31) 1990

1932 McEachern Gilmour 19) David 32)

Korean Circulation J 1998;28(7):1122-1130

(p<0.001).

결 론 :

가 가

## 요 약

중심 단어 :

## REFERENCES

연구배경 :

가  
가

방 법 :

1997 1  
12 , 31,067  
가 20,189 가 10,248

결 과 :

1) , HDL , L -  
DL 10 9  
12 가 가  
가 가  
(p<0.001, HDL p<0.02).

2) 9 8  
12 가 가  
가 가 (p<0.025).  
12 7 2  
가 가  
(p<0.04).

3) ,  
가  
(p<0.001).  
가

- 1) Lipid Research Clinic Program. *The lipid research clinics coronary primary prevention trial results: II. Reduction in incidence of coronary heart disease. JAMA* 1984;251:351-64.
- 2) Wilhelmsen L, Wedel H, Tibblin G. *Multivariate analysis of risk factors for coronary heart disease. Circulation* 1973;48:950-8.
- 3) Kannel WB, Castelli WP, Gordon T. *Cholesterol in the prediction of atherosclerotic disease. New perspective based on the framingham study. Ann Intern Med* 1979;85-91.
- 4) Thomas CB, Holijes HWD, Eischberg FF. *Observations on seasonal variations in total serum cholesterol level among healthy young prisoners. Ann Int Med* 1961;54:413-30.
- 5) Carlson LA, Lindstedt S. *The Stockholm Prospective Study. 1. The initial values for plasma lipids. Acta Med Scand (Suppl)* 1968;493:1-56.
- 6) Thelle D, Ferde OH, Try K, Lehmann EH. *The Tromso Heart Study. Methods and main results of the cross-sectional study. Acta Med Scand* 1976;100:107-18.
- 7) Fuller JH, Grainger SL, Jarrett RJ, Keen H. *Possible seasonal variation of plasma lipids in a healthy population. Clin Chim Acta* 1974;52:305-10.
- 8) van Gent CM, van der Voort H, Hessel LW. *High-density lipoprotein cholesterol, monthly variation and association with cardiovascular risk factors in 1000 forty-year-old dutch citizens. Clin Chim Acta* 1978;88:155-62.
- 9) Miller NE, Clifton-Bligh P, Nestel PJ, Whyte HM. *Controlled clinical trial of a new bile acid-sequestering resin colestipol in the treatment of hypercholesterolemia. Med J Aust* 1973;1:1223-9.
- 10) Persson B. *Seasonal variation of lipoprotein lipase activity in human subcutaneous adipose tissue. Clin Sci Mol Med* 1974;47:631-4.
- 11) Mjos OD, Rao SN, Bjeru L, Henden T, Thelle DS, Forde OH, et al. *A longitudinal study of the biological variability of plasma lipoproteins in healthy young adults. Atherosclerosis* 1979;34:75-81.
- 12) Aldersberg D, Schaefer LE, Steinberg AG, Wang CI. *Age, sex, serum lipids and coronary atherosclerosis. JAMA* 1956;162:619-27.
- 13) McGandy RB, Hegsted DM, Stare FJ. *Dietary fats, carbohydrates and atherosclerotic vascular disease. N Engl J Med* 1967;277:186-94.
- 14) Mullins WL. *Age incidence and mortality in coronary occlusion: A review of 400 cases. Pa Med J* 1935;39:322-5.
- 15) Masters AM, Dack S, Jaffe HL. *Factors and events ass-*



- ociated with onset of coronary artery thrombosis. *JAMA* 1937;109:546-9.
- 16) Marchant B, Ranjadayalan K, Stevenson R, Wilkinson P, Timmis AD. Circadian and seasonal factors in the pathogenesis of acute myocardial infarction: The influence of environmental temperature. *Br Heart J* 1993;69:385-7.
  - 17) Nicolau GY, Haus E, Popescu M, Sackett-Ludeen L, Petrescu E. Circadian, weekly, and seasonal variations in cardiac mortality, blood pressure and catecholamine excretion. *Chronobiol Int* 1991;8:149-59.
  - 18) Currie AN. The cholesterol of blood in malignant disease. *Brit J Exp Path* 1924;5:293-8.
  - 19) McEachern JM, Gilmour CR. Studies in cholesterol metabolism. 2. Blood cholesterol in various conditions. *Canad Med Ass J* 1932;26:158.
  - 20) Keys A, Karvonen MJ, Fidanza F. Serum cholesterol studies in Finland. *Lancet* 1958;ii:175.
  - 21) Green KG, Inman W, Thorp JM. Multicenter trial in the United Kingdom and Ireland of a mixture of ethylchlorophenoxyisobutyrate and androsterone (Atromid). A preliminary report. *J Atheroscler Res* 1963;3:593.
  - 22) Kocemba J, Szopinska-Ciba L, Ciba T, Tochowicz L. Seasonal variations of serum cholesterol levels in healthy and in atherosclerotic subjects. *Bull Polish Med Sci Hist* 1963;6:10.
  - 23) Paul O, Lepper MH, Phelan WH, Dupertuis GW, MacMillan A, McKean H, et al. Longitudinal study of coronary heart disease. *Circulation* 1963;28:20.
  - 24) Samuel P, Lieberman S, Shmase FS, Meilman E, Toufexis G. Variation of total serum cholesterol concentration in patients with atherosclerosis. *Am J Clin Nutr* 1970;23:178-88.
  - 25) Glick JH Jr. Statistics of patients test values: Application to indirect normal range and to quality control. *Clin Chem* 1972;18:1504-13.
  - 26) Hedstrand H, Wide L. Serum thyrotrophin and lipid levels in summer and winter. *Br Med J* 1973;4:420.
  - 27) Letellier G, Desjarlais F. Study of seasonal variations for eighteen biochemical parameters over a four year period. *Clin Biochem* 1982;15:206-11.
  - 28) Broughton PMG, Holder R, Ashby D. Long-term trends in biochemical data obtained from two population surveys. *Ann Clin Biochem* 1986;23:474-86.
  - 29) Pincherle G. Factors affecting the mean serum cholesterol. *J Chron Dis* 1971;24:289-97.
  - 30) Harlap S, Kark JD, Baras M, Eisenberg S, Stein Y. Seasonal changes in plasma lipid and lipoprotein levels in Jerusalem. *Israel J Med Sci* 1982;18:1158-65.
  - 31) Sasaki J, Kumagai G, Sata T, Ikeda M, Tsutsumi S, Arakawa K. Seasonal variation of serum high density lipoprotein cholesterol levels in men. *Atherosclerosis* 1983;48:167-72.
  - 32) Robinson D, Bevan EA, Hinohara S, Takahashi T. Seasonal variation in serum cholesterol levels - evidence from the UK and Japan. *Atherosclerosis* 1992;95:15-24.
  - 33) Campbell DE. Influence of diet and physical activity on blood serum cholesterol of young men. *Am J Clin Nutr* 1966;18:79-85.
  - 34) Carlson LA, Lindstedt S. The Stockholm Prospective Study I The initial values for plasma lipids. *Acta Med Scand Suppl* 1968;493:1-135.
  - 35) Gordon DJ, Trost DC, John Hyde, et al. Seasonal cholesterol cycles: The Lipid Research Clinics Coronary Primary Prevention Trial placebo group. *Circulation* 1987;76:1224-31.
  - 36) Zifferblatt SM, Wilbur CS, Pinsky JL. Influence of ecologic events on cafeteria food selections: Understanding food habits. *J Am Diet Assoc* 1980;76:9-14.
  - 37) Fyfe T, Dunnigan MG, Hamilton E, Rae RJ. Seasonal variation in serum lipids and incidence and mortality of ischaemic heart disease. *J Atheroscler Res* 1968;8:591-6.
  - 38) Frerichs RR, Srinivasan SR, Webber LS, Berenson GS. Serum cholesterol and triglyceride levels in 3,446 children from a biracial community: The Bogalusa Heart Study. *Circulation* 1976;54:302-9.
  - 39) Fehilly AM, Phillips KM, Sweetnam PM. A weighed dietary survey of men in Caerphilly, South Wales. *Hum Nutr Appl Nutr* 1984;38:270-6.
  - 40) Rodwell VS, Shapiro DJ. Regulation of hepatic 3-hydroxy-3-methylglutaryl coenzyme A reductase and cholesterol synthesis. *J Biol Chem* 1971;246:3210-6.
  - 41) MacKinnon IL, MacKinnon PC. Seasonal rhythm in the morphology of the suprarenal cortex in women of childbearing age. *J Endocrin* 1958;17:456.
  - 42) Osiba S. The seasonal variation of basal metabolism and activity of thyroid gland in man. *Jap J Physiol* 1957;7:355.
  - 43) Thorp JM. Experimental approach to the problem of disordered lipid metabolism. *J Atheroscler Res* 1963;3:351.