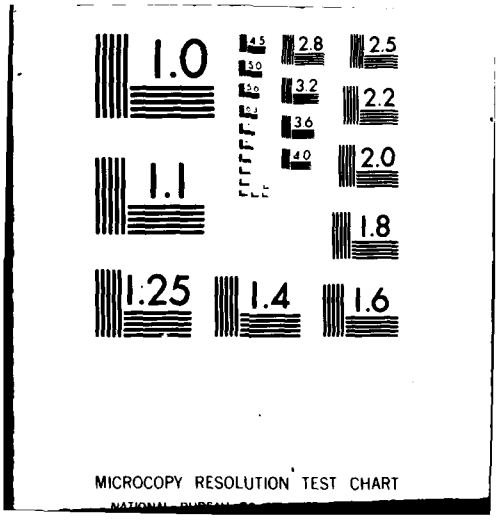
AD-A112 885 SCHOOL OF AEROSPACE MEDICINE BROOKS AFB TX F/G 6/5
SERUM LIPID LEVELS IN SELECTED AIR FORCE OFFICERS DURING THE FI--ETC(U)
DEC 81 D A CLARK, W G JACKSON, K L FUSTO
UNCLASSIFIED SAM-TR-81-34 NL

END
DATE FILMED
4-82
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART

(12)

Report SAM-TR-81-34

AD A112885

SERUM LIPID LEVELS IN SELECTED AIR FORCE OFFICERS DURING THE FIRST FOUR YEARS AFTER GRADUATION FROM THE USAF ACADEMY

Dale A. Clark, Ph.D.
William G. Jackson, Jr., M. Stat.
Karen L. Fusto, First Lieutenant, USAF, BSC

December 1981

Final Report for Period July 1972 - December 1980

USAF SCHOOL OF AEROSPACE MEDICINE
Aerospace Medical Division (AFSC)
Brooks Air Force Base, Texas 78235

NOTICES

This final report was submitted by personnel of the Clinical Pathology Branch, Clinical Sciences Division, USAF School of Aerospace Medicine, Aerospace Medical Division, AFSC, Brooks Air Force Base, Texas, under job order 7755-18-03.

When U.S. Government drawings, specifications, or other data are used for any purpose other than a definitely related Government procurement operation, the Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The voluntary informed consent of the subjects used in this research was obtained in accordance with AFR 169-3.

This report has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

DALE A. CLARK, Ph.D.
Project Scientist

RAYMOND G. TROXLER, Colonel, USAF, MC
Supervisor

ROY L. DEHART
Colonel, USAF, MC
Commander

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER SAM-TR-81-34	2. GOVT ACCESSION NO. AD A112 885	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* SERUM LIPID LEVELS IN SELECTED AIR FORCE OFFICERS DURING THE FIRST FOUR YEARS AFTER GRADUATION FROM THE USAF ACADEMY		5. TYPE OF REPORT & PERIOD COVERED Final Report July 1972 - December 1980 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Dale A. Clark, Ph.D.; William G. Jackson, Jr., M. Stat.; and Karen L. Fusto, First Lieutenant, USAF, BSC		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS USAF School of Aerospace Medicine (NG AND BR) Aerospace Medical Division (AFSC) Brooks Air Force Base, Texas 78235		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62202F 7755-18-03
11. CONTROLLING OFFICE NAME AND ADDRESS USAF School of Aerospace Medicine (NG and BR) Aerospace Medical Division (AFSC) Brooks Air Force Base, Texas 78235		12. REPORT DATE December 1981 13. NUMBER OF PAGES 11
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Lipids, serum
Cholesterol, serum levels
Triglycerides, serum levels
Body composition in young officers

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This study was conducted to obtain information from which to assess the impact of attendance at the USAF Academy upon factors recognized to indicate risk of cardiovascular disease. Since an earlier study of West Point cadets found that serum levels of cholesterol and lipoproteins rose to peak levels 2 years after graduation from the United States Military Academy, this study also followed the subjects in the study through their years at the USAF Academy and for almost 4 years thereafter.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

20. ABSTRACT (Continued)

During the years at the USAF Academy, only transient elevations in serum cholesterol and uric acid levels were found, but these were apparently related to short-term stress.

During the 3 1/2 to 4 years after graduation, serum cholesterol levels increased slightly, but the average remained below the level for U.S. males of comparable age. There were numerically small, but statistically significant ($P < .05$), increases in both weight and percent body fat. Dietary intakes of protein, fat, and carbohydrate appeared typical for normal active young men; the average total caloric intake was approximately 2300 cal/day.

Among the men who responded to requests for information after graduation, there is no evidence of increases in cardiovascular risk factors for the group as a whole; in fact, these men on the average have lower levels of risk factors than men of comparable age in the general population of the United States.

SERUM LIPID LEVELS IN SELECTED AIR FORCE OFFICERS DURING THE FIRST FOUR YEARS AFTER GRADUATION FROM THE USAF ACADEMY

INTRODUCTION

A study of the men who entered the United States Military Academy (USMA) at West Point in 1952 found that mean levels of the serum cholesterol and low density lipoproteins rose markedly during the first six years after entry into the USMA (4). Elevated levels of these quantities are important indicators of risk of cardiovascular disease (8, 9, 12). The increase in the levels therefore raised the question of whether attendance at the USMA somehow resulted in increased risk of cardiovascular disease in later years. Since the lifestyle at other military academies has much in common with the lifestyle at the USMA, the question of increased risk of cardiovascular disease broadened into a question of whether attendance at other military academies was associated with an increased risk of such disease in subsequent years. For the U.S. Air Force, it became pertinent to determine whether men who attended the USAF Academy showed any changes in risk factors that would imply an increased risk of cardiovascular disease later in their careers as fliers.

PURPOSE AND PLAN

The purpose of this study was to obtain information from which to assess the impact of attendance at the USAF Academy upon factors recognized to indicate risk of cardiovascular disease. In the West Point study, the peak levels of serum cholesterol and low density lipoproteins occurred 2 years after graduation from the USMA. The study of USAF Academy cadets was conducted during the years the cadets attended the Academy and continued 3 1/2 years after graduation in order to cover the time frame during which peak lipid values occurred in the parent USMA study. This plan allowed the collection of additional data that would indicate whether after graduation there were significant trends in cardiovascular disease risk factors, as well as in body weight. An earlier report (2) summarized the findings of the study during the years the subjects were at the USAF Academy (1972-1976). The purpose of this report, therefore, is to summarize the results obtained during the last years of the study (1976-1979).

MAJOR FINDINGS

During the years at the USAF Academy, neither the lipid cardiovascular risk factors nor the proportion of body fat was found to increase (2). During the first weeks and at the end of the first year at the Academy, there were transient elevations in serum cholesterol and uric acid levels (5), but these were apparently related to short-term stress.

During the 3 years after graduation there were numerically small (but statistically significant, $P < .05$) increases in serum cholesterol, weight, and percent body fat. Nevertheless, the average cholesterol levels remained below those for U.S. males of comparable age (11). Dietary intakes of protein, fat, and carbohydrate appeared typical for normal active young men; the average total caloric intake was approximately 2300 cal/day.

The conclusions for the period after 1976 are qualified by the fact that only 65% of the original group responded to the requests for serum and data. Nevertheless, there is no evidence that the subjects who responded were at increased cardiovascular risk vis-a-vis their average U.S. male counterparts, either during their years at the USAF Academy or during the subsequent 4 years. In fact, the opposite appears to be true; these men on the average have lower levels of risk factors than men of comparable age in the general population of the United States.

METHODS

Upon entry into the USAF Academy in 1972, 232 young men were randomly selected. Informed consent was obtained from all who were continued in the study, which is described in an earlier report (2). Just before graduation, 131 subjects were still active in the study. Of the other 101 men, 93 were lost from the Academy by attrition and 8 declined to continue participation in the study.

After graduation, the subjects were followed by questionnaire and requests for serum samples that were shipped to the USAF School of Aerospace Medicine (USAFSAM) for analyses of serum lipids. The times of, and the responses to, those requests are listed in Table 1. The number of subjects for whom data were available for the entire postgraduation period was relatively small. As a consequence, tests for changes were limited to paired comparisons of data from each of the postgraduation sampling periods to the April 1976 data.

TABLE 1. DATA COLLECTIONS AFTER GRADUATION FROM THE USAF ACADEMY

Data set number	14	15	16
Date	Fall 1977	Fall 1978	Fall 1979
Responses			
14, 15 and 16	27 (21%)[a]	27 (21%)[a]	27 (21%)[a]
14 & 15 only	15 (11%)	15 (11%)	
15 & 16 only		6 (5%)	6 (5%)
14 & 16 only	7 (5%)		7 (5%)
Once only	19 (15%)	2 (2%)	8 (6%)
Total number	68 (52%)	50 (38%)	48 (37%)

[a]Percents are the percent of the 131 subjects remaining in the study at graduation.

Information about weight, waist measurements, exercise, smoking, and stress was collected by questionnaires. A 3-day record of all food and beverages consumed was requested in the fall of 1979.

Blood was drawn at the subject's base clinic, and serum was prepared and shipped to USAFSAM for analyses. A few subjects provided fresh serum during a visit to USAFSAM. Laboratory methods have been previously described (2). After 1976, however, lack of manpower forced discontinuation of both lipoprotein electrophoresis and separation of various serum lipid fractions. Both cholesterol and triglyceride analyses were changed to use enzymatic methods carried out with an automated apparatus. The earlier methods and the enzymatic methods for both lipid analyses were standardized against controls so that the change in methodology should not have affected the measured levels.

Estimates of body composition were made from height, weight, and waist measurements using the formula of Wright and Wilmore (15). It was not feasible to use either the body volumeter or the complex anthropometric measurements (3) to measure body composition after the subjects left the USAF Academy. The ponderal index (height in inches divided by the cube root of the weight in pounds) was also computed for each subject.

RESULTS AND DISCUSSION

Table 2 summarizes the data relevant to cardiovascular disease risk factors for those variables measured after graduation. For data on other variables, e.g., lipoproteins measured during the Academy years, refer to the summary of those years (2).

The data in Table 2 show numerical increases in mean weights and in mean % body fat after April 1976. Although the mean increases in body weight are small (1.1 to 1.7 kg), weight gains up to 11.4 kg occurred. The mean values for the group are significantly higher ($P < .01$) in 1977, 1978, and 1979 than in April 1976. Similarly, the increases in mean % body fat after April 1976 are statistically significant, but the increases are small. The mean value in fall 1979 was only 15.2%, which is a low normal value.

The mean increase in diastolic blood pressure between April 1976 and both fall 1977 and fall 1978 was statistically significant ($P < .01$) but has uncertain biological importance. Through the USAF Academy years, blood pressures were measured almost entirely by one individual, whereas after April 1976 these pressures were measured by different individuals in various clinics. Between the pressures measured before and after April 1976, there were numerous instances of ± 10 to 20 mm differences in diastolic pressures within the same subject. There is no way to determine how much of the changes between April 1976 and later years is due to changes in measurement techniques and how much is physiological.

The mean of the changes in serum cholesterol levels during the first year after graduation was not statistically significant, but during the two subsequent years the mean levels were significantly ($P \leq .05$) above the mean levels

TABLE 2. SUMMARY OF GROUP DATA (mean ± standard deviation)

	Date of collection															
	Jul 1972	Sep 1972	Jan 1973	Apr 1973	Sep 1973	Jan 1974	Apr 1974	Sep 1974	Jan 1975	Apr 1975	Oct 1975	Feb 1976	Apr 1976	Fall 1977	Fall 1978	Fall 1979
No. of subj.	231	203	157	168	148	148	141	135	133	129	124	127	133	65	47	47
Weight (kg)		70.7 7.7	71.8 8.1		73.6 8.3	73.3 8.6	74.0 8.1	73.9 8.6	73.8 8.8	73.8 8.5	74.5 8.5	74.5 8.5	75.2 8.3	76.1 8.5	75.6 8.1	77.5 8.1
Height (cm)		179.4 6.4			179.7 6.4	178.4 6.2	179.1 6.3	179.5 6.2	179.2 6.3	179.2 6.2	179.5 6.4	179.5 6.4	179.8 6.4	179.7 6.4	179.4 6.7	180.7 6.1
Ponderal Index		1? 0.4			13.0 0.4	12.9 0.5	12.9 0.4	13.0 0.4	12.9 0.4	12.9 0.4	12.9 0.4	12.9 0.4	12.9 0.4	12.9 0.4	12.8 0.4	12.8 0.4
% Body fat		11.8 2.9	11.8 3.1		13.3 3.2	12.5 3.5	12.6 3.2	12.4 3.3	12.5 3.5	12.4 3.1	13.1 3.2	13.2 3.3	13.4 3.1	14.9 4.1	13.9 6.5	15.2 3.9
Systolic BP					115.8 8.5	118.9 8.6	115.7 9.0		116.9 8.8	117.7 9.3	115.8 8.3	115.9 9.2	116.2 9.6	118.9 9.4	117.2 9.1	118.1 9.5
Diastolic BP					70.7 6.2	73.8 6.0	71.8 6.6		72.5 6.3	73.1 8.4	74.1 5.4	72.8 5.7	72.6 6.1	75.1 8.4	75.8 7.3	74.3 8.0
Cholesterol (mg/dl)	193.7 32.3	197.9 33.4	182.0 29.1	190.4 32.6	178.9 30.6	173.3 30.0	176.6 28.2	163.0 24.6	166.9 24.9	164.5 26.5	160.3 22.3	181.6 26.4	179.3 27.7	175.6 26.2	186.1 33.9	186.6 32.2
Triglyceride (mg/dl)	38.6 11.8	60.4 27.8	74.9 31.3	64.2 26.7	86.6 43.9	75.3 32.6	69.5 42.3	71.9 40.5	68.9 36.1	64.8 25.8	78.9 45.0	76.3 29.7	76.5 31.1	65.7 41.6	100.3 50.9	96.3 44.1

just before graduation. Even the highest average value, however, was still below the average of 196 mg/dl for U.S. males of comparable ages (10, 11).

Mean triglyceride values for 1978 and 1979 were higher ($P < .01$) than in 1976. However, the mean levels were low normal values. Their increase above earlier levels probably reflects changes in eating habits after graduation from the USAF Academy.

Three and one-half years after graduation, the mean body weight of the responding group was 2.3 kg (5 lb) above the mean of all 131 subjects at graduation. However, for the 48 men who responded in 1979, the mean increase over April 1976 was only 1.7 kg. The data are summarized in Table 3.

TABLE 3. WEIGHT CHANGES AFTER GRADUATION

	Date of collection			
	April 1976	Fall 1977	Fall 1978	Fall 1979
No. of subj.	131	68	50	48
Mean Weight				
kg	75.2	76.1	75.6	77.5
lb	165.8	167.8	166.7	170.9
Changes from April 1976				
Average				
kg		1.47	1.10	1.69
lb		3.25	2.44	3.73
Maximum				
kg		8.84	8.89	11.45
lb		19.5	19.6	25.2
Minimum				
kg		- 5.44	- 7.94	- 5.67
lb		-12.0	-17.5	-12.5

To evaluate possible association between changes in weight and changes in serum cholesterol levels, the changes in each were tabulated for all individuals for the September 1972, January 1973, April 1974, April 1976, fall 1977, fall 1978, and fall 1979 data sets.

Results are summarized in Table 4. All of the correlations are quite small in magnitude, although two are statistically significant ($P \leq .05$). During the first year after graduation, some subjects changed weight appreciably, and changes in serum cholesterol levels were significantly correlated with the changes in weight during that year, but not subsequently.

TABLE 4. CORRELATIONS BETWEEN CHANGES IN BODY WEIGHT AND CHANGES IN SERUM CHOLESTEROL LEVELS

	Times compared					
	From Sep 1972 to			From Apr 1976 to		
	Jan 1973	Apr 1974	Apr 1976	Fall 1977	Fall 1978	Fall 1979
Corr. coef.	0.128	0.158	0.222	0.334	0.280	0.222
P value	0.14	0.085	0.014	0.008	0.062	0.143
No. of subj.	134	120	123	62	45	45
Mean change						
Cholesterol	-16.2	-21.5	-21.4	-0.6	6.7	7.9
Weight (kg)	1.33	3.75	5.14	1.47	1.10	1.69

Sometime after September 1979, a total of 41 subjects recorded the food they ate during a Monday through Wednesday period chosen at the discretion of each subject. The quantities and identities of the food items were tabulated for each meal and converted into grams of protein, fat, or carbohydrate. Associated caloric intakes were computed. The findings are summarized in Table 5.

The total caloric intakes averaged approximately 2300 cal/day. This intake seems appropriate because, although most subjects are pilots, they are not sedentary. Most have a regular exercise program, and some engage in strenuous physical activity for more than an hour daily.

The pattern of caloric intakes by meals is interesting. On the average, approximately one-fifth of the calories were consumed at breakfast, one-fourth at lunch, slightly less than one-half at dinner, and one-tenth as snacks between meals. Of the 41 subjects 3 did not eat snacks. Other individuals, however, sometimes consumed over 1000 cal, or approximately 50% of that day's caloric intake, as snacks. In some cases, high caloric snack intakes probably reflect the impact of irregular flying hours on regular meals.

The intakes of protein, fat, and carbohydrate were typical of American diets. Protein intakes generously exceeded the recommended minimum intake. Fat accounted for 38% of the caloric intake, in keeping with the eating habits of most Americans (7).

Cholesterol intakes averaged near 400 mg/day. This figure is below the average U.S. daily intake of 500 mg/day or more (7), perhaps because some subjects in the study tried to limit their cholesterol intakes (1). Other subjects, however, recorded cholesterol intakes of as high as 1800 mg/day. To assess possible relationships between cholesterol intake and serum cholesterol level, the correlation coefficient was computed and found to be 0.23. In Table 6, the extremes of the 3-day average cholesterol intakes are listed with the associated serum cholesterol levels, and the extremes of the serum cholesterol levels are listed with the associated 3-day average cholesterol intakes. Inspection of these data illustrates the weakness of the association between intakes of cholesterol and serum cholesterol levels. Of the men with the five highest cholesterol intakes, two had serum cholesterol levels below the mean, while the five lowest intakes were associated with serum levels above the mean in two men. Of the men with the five highest serum cholesterol

TABLE 5. DATA FROM THREE-DAY DIET DIARIES OF 41 SUBJECTS

CALORIC INTAKES

Day	Breakfast Cal	Breakfast % Total	Lunch Cal	Lunch % Total	Dinner Cal	Dinner % Total	Snacks Cal	Snacks % Total	Total cal
Mon	435	17.9	629	25.5	1021	44.8	309	11.8	2394
Tues	425	19.1	610	25.9	912	42.1	316	12.8	2263
Wed	386	16.7	675	29.9	900	41.6	288	11.8	2229
Avg	415	17.9	638	27.1	944	42.8	298	12.1	2295

INTAKES BY CATEGORIES

Day	Protein g/day	Protein Cal	Protein % Total cal	Fat g/day	Fat Cal	Fat % Total cal	Carbohydrate g/day	Carbohydrate Cal	Carbohydrate % Total cal
Mon	98	382	16.8	104	932	38.8	261	1044	42.9
Tues	90	352	15.7	95	853	37.2	250	1000	43.8
Wed	89	345	15.6	92	825	37.9	258	1031	45.3
Avg	92	360	16.0	97	870	38.0	256	1025	44.0

CHOLESTEROL INTAKES

Day	Breakfast mg	Breakfast % Total	Lunch mg	Lunch % Total	Dinner mg	Dinner % Total	Snacks mg	Snacks % Total	Total
Mon	176	24.3	106	27.8	160	43.0	24	4.9	465.8
Tues	173	26.4	111	25.1	181	40.7	29	7.9	499.8
Wed	47	14.5	104	28.9	170	51.0	19	5.7	340.0
Avg	132.0	21.7	106.9	27.3	170.6	44.9	24.0	6.2	435.2

TABLE 6. RELATIONSHIPS BETWEEN EXTREMES OF CHOLESTEROL INTAKES AND SERUM LEVELS

Extremes of intakes		Extremes of serum levels	
Intakes mg/day	Serum levels mg/dl	Serum levels mg/dl	Intakes mg/day
	Five highest		
981	155	294	752
949	146	243	768
838	190	239	345
768	243	225	672
752	294	223	411
	Five lowest		
185	157	119	239
191	212	131	398
194	197	144	273
194	163	146	949
215	176	148	319

levels, two had cholesterol intakes less than the mean, while the five lowest serum levels were associated with less than average cholesterol intakes except for one high intake. Reasons for the lack of close association between cholesterol intake and serum level would include both (a) the peculiar individual interactions of physiological mechanisms with life styles and food choices (13, 14) and (b) the highly variable intakes of cholesterol from day to day, which made it difficult to get a good estimate of an individual intake.

Throughout the study, smoking habits were recorded because cigarette smoking increases the risk of cardiovascular disease (12). The subjects were assigned to smoking groups "heavy" if they smoked 1 or more packs/day, "light" if they smoked between 0 and 1 pack/day, or "none" if they smoked 0 packs/day. The mean values of several variables for these smoking groups are listed in Table 7. The numerical differences between group means were small, and none were statistically significant. Nor did the differences form a consistent pattern in terms of estimated risk of cardiovascular disease. The heavy group may have had slightly higher cholesterol levels for the data sets of April 1976 and thereafter; however, after graduation, that group did not include more than 9 men at any one time, and the individuals in the group changed from year to year. Under these conditions, moderate changes are not likely to be detected. From the standpoint of cardiovascular disease, however, the small number of smokers constitutes a favorable characteristic of the group as a whole.

TABLE 7. MEAN VALUES FOR VARIABLES BY SMOKING GROUPS

	Sep 1972	Jan 1973	Sep 1973	Apr 1974	Apr 1975	Apr 1976	Fall 1977	Fall 1978	Fall 1979
				SMOKING GROUP "NONE" (0 packs/day)					
No. of subj.[a]	106	106	105	103	103	106	55	41	40
Weight	70.5	71.7	74.0	74.8	74.4	75.4	76.8	75.6	77.8
% Body fat	11.6	11.6	13.3	12.7	12.6	13.4	15.1	13.4	15.3
P.I.	13.2	13.1	13.0	12.9	12.9	12.9	12.8	12.9	12.9
Syst B.P.			115.6	116.1	117.8	117.1	119.9	117.0	118.1
Diast B.P.			70.7	72.4	73.3	73.0	76.0	75.3	75.1
Cholesterol	204.0	186.7	182.5	181.4	165.2	179.3	175.0	186.1	188.1
LDL	219.4	334.5	243.7	272.1	235.6	242.0			
HDL	223.9	212.4	243.6	169.9	206.0	224.0			
				SMOKING GROUP "LIGHT" (between 0 and 1 pack/day)					
No. of subj.[a]	8	8	7	8	8	8	4	2	2
Weight	67.2	68.3	70.7	68.7	68.3	72.5	75.5	74.0	69.4
% Body fat	10.7	11.0	13.4	11.7	10.4	14.5	15.0	18.1	8.2
P.I.	13.0	13.0	12.9	12.9	12.9	12.7	12.5	12.1	12.7
Syst B.P.			113.4	113.7	117.2	113.4	118.0	128.0	117.0
Diast B.P.			65.7	68.3	72.0	69.4	73.3	74.0	68.0
Cholesterol	173.7	168.7	166.7	169.1	152.8	170.3	166.3	161.0	169.0
LDL	190.8	260.8	236.8	251.1	196.3	225.8			
HDL	226.3	218.1	263.4	179.8	216.0	223.9			
				SMOKING GROUP "HEAVY" (1 or more packs/day)					
No. of subj[a]	16	15	14	16	16	16	9	7	6
Weight	69.8	71.4	73.8	73.0	72.5	74.0	71.9	75.8	77.9
% Body fat	11.5	11.8	13.6	12.5	11.8	13.0	13.9	15.3	17.2
P.I.	13.1	13.1	13.0	12.9	13.0	12.9	13.0	12.8	12.9
Syst B.P.			116.7	116.8	115.5	111.5	112.3	117.0	118.2
Diast B.P.			70.8	72.4	73.2	70.8	69.4	78.9	71.8
Cholesterol	199.5	176.7	170.5	173.2	165.4	183.6	184.5	193.4	182.8
LDL	223.3	322.7	233.1	256.3	226.7	239.8			
HDL	240.3	211.1	239.7	167.4	202.0	219.3			

[a]Values are approximate because for each sampling time there were missing values for some parameters.
Abbreviations used: P.I. = ponderal index; syst B.P. = systolic blood pressure; diast B.P. = diastolic blood pressure; LDL = low-density lipoproteins; HDL = high-density lipoproteins.

As stated earlier, the mean cholesterol levels for the group of men in this study were below the average for men of comparable age in the United States. This fact, plus the generally active, exercise-oriented life style and the low percentage of smokers should make the group generally a low-risk group, so far as cardiovascular disease is concerned. There was no evidence that the mean level of cholesterol for these USAF Academy attendees rose in the marked way previously seen in the West Point Study. Possible reasons for this have been discussed elsewhere (6). However, a few individuals did have risk factor levels that suggest increased risk of cardiovascular disease in the future. For such individuals, modification of the risk factors before the disease process has progressed enough to cause overt symptoms becomes a legitimate goal for further effort.

ACKNOWLEDGMENTS

The authors thank SSgt Jimmie Wood, SSgt William Everett, SSgt Billy Dold, and Mr E. L. Mosser for their performance of the analyses of the samples.

REFERENCES

1. Beveridge, J. M. R., et al. The response of man to dietary cholesterol. J Nutr 71:61-65 (1960).

2. Clark, D. A. Serum lipids and lipoproteins in USAF Academy cadets: Overall summary. SAM-TR-77-13, June 1977.

3. Clark, D. A. A physical model for estimating body fat. SAM-TR-76-41, Dec 1976.

4. Clark, D. A., M. F. Allen, and F. H. Wilson. Longitudinal study of serum lipids. 12-year report. Am J Clin Nutr 20:743-752 (1967).

5. Clark, D. A., et al. Serum urate and cholesterol levels in Air Force Academy cadets. Aviat Space Environ Med 46:1044-1048 (1975).

6. Clark, D. A., et al. Serum cholesterol levels in selected Air Force cadets compared with levels in the West Point Study. Aviat Space Environ Med 51:6-10 (1980).

7. Connor, W. E. The relationship of hyperlipoproteinemia to atherosclerosis: The decisive role of dietary cholesterol and fat, pp. 371-418: In A. M. Scanu, R. Wissler, and G. Getz (eds.). The Biochemistry of Atherosclerosis. New York: Marcel Dekker, Inc., 1979.

8. Holme, I., et al. Four and two-thirds years incidence of coronary heart disease in middle-aged men: The Oslo study. Am J Epidemiol 112:149-160 (1980).

9. Kannel, W. B., et al. Serum cholesterol, lipoproteins, and the risk of coronary heart disease. The Framingham Study. Ann Intern Med 74:1-12 (1971).

10. Levy, P. S., et al. Total serum cholesterol values of youths 12-17 years. National Center for Health Statistics, Series 11, Number 156. U.S. Dept of Health, Education, and Welfare. Public Health Service, May 1976.

11. Moore, F. E. Serum cholesterol levels in adults. National Center for Health Statistics, Series 11, Number 22. U.S. Dept of Health, Education, and Welfare. Public Health Service, March 1967.

12. Patton, J. F., and J. A. Vogel. Prevalence of coronary heart disease risk factors in a young military population. Aviat Space Environ Med 51:510-514 (1980).

13. Truswell, A. S. Diet and plasma lipids--a reappraisal. Am J Clin Nutr 31:977-989 (1978).

14. Turpeinen, O. Effect of cholesterol-lowering diet on mortality from coronary heart disease and other causes. Circulation 59:1-7 (1979).

15. Wright H. F., and J. H. Wilmore. Estimation of relative body fat and lean body weight in a United States Marine Corps population. Aerospace Med 45:301-306 (1974).