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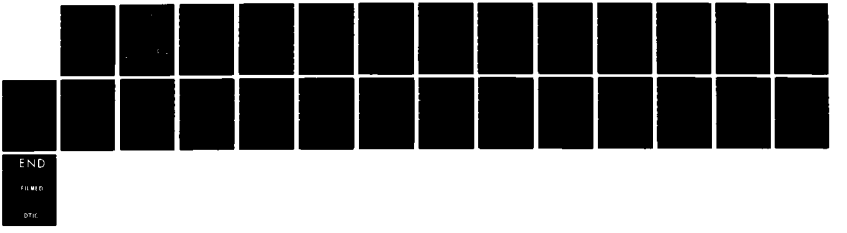

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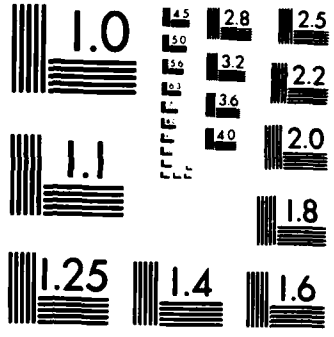

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FITNESS OF YOUNG PEOPLE ENTERING THE NAVY

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REPORT NO. 84-32

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SUMMARY

- A pilot study assessing the physical fitness of recruits entering the Navy and at the completion of recruit training was conducted at the request of the Chief of Naval Operations (CNO).
- The study sample consisted of five companies of male recruits formed at the Recruit Training Command (RTC), San Diego, during February 1984, and seven companies of female recruits formed during March 1984 at RTC, Orlando.
- Physical fitness was assessed using the Navy's Physical Readiness Test (PRT) in which 1.5-mile run time, number of sit-ups done in two minutes, sit-reach distance, and percent body fat are measured. In addition, the number of sit-ups performed in the first minute of the 2-minute test, and triceps skinfold thicknesses were measured for all recruits as well as maximum number of pull-ups for male recruits and flexed-arm hang time for female recruits.
- Recruit fitness was compared to the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) national norms for 17-year old high school students where possible, as well as to PRT scores for a sample of active duty Navy personnel.
- Compared to high school norms, male recruits both at entry and at graduation ran 1.5 miles faster, did fewer sit-ups in one minute and did fewer pull-ups. Sit-reach distance for male recruits was less at entry but did not differ from high school normative values at graduation. Triceps skinfold thickness did not differ from high school norms at entry or at graduation.
- Compared to high school norms, female recruits ran 1.5 miles faster both at entry and at graduation. Sit-reach distance and number of sit-ups in one minute were less than the high school norms for women at entry, but did not differ at graduation. Triceps skinfold thickness and flexed-arm hang time did not differ from high school normative values either at entry or at graduation.
- In general, recruit fitness improved significantly over the course of the training. Only two measures showed no change between pre- and post-training testing: triceps skinfold thickness for both male and female recruits, and sit-ups performed in one minute for male recruits. One measure, number of pull-ups for male recruits, showed a significant decrease over the course of training.
- Compared to active duty personnel, male recruits were faster on the 1.5-mile run at both entry and graduation. They could do fewer sit-ups and had shorter sit-reach distances at entry than their active duty counterparts, but by the end of recruit training were comparable to the active duty personnel. At entry, male recruits had

the same average body fat as active duty males, but by the end of training they were significantly leaner.

- Compared to active duty personnel, female recruits were leaner both at entry and graduation, ran 1.5 miles more slowly at entry but faster at graduation, did not differ on sit-ups in two minutes at entry but did significantly more at graduation, and reached a shorter distance at entry but did not differ at graduation.
- It was concluded that inadequate normative data on civilian populations and technical constraints in study administration make interpretation of the comparisons with civilians difficult. However, it was clear that recruit training improved the physical fitness of recruits. Finally, these data suggest that graduates of recruit training enter the fleet somewhat more fit than fleet sailors, and there is a need to explore the reasons for these fitness differences.

BACKGROUND

In November 1983 the Joint Chiefs of Staff were briefed by members of the President's Council on Physical Fitness and Sports (PCPFS). The Council members expressed concern that with the decreased requirements for high school physical education in many states, the level of physical fitness among individuals entering the services may be declining. Subsequent to the briefing by the PCPFS, the CNO requested information from the Naval Military Personnel Command (NMPC) on the fitness of personnel entering the Navy. It was determined that only fragmentary data were available concerning the fitness of incoming recruits. A pilot study assessing the physical fitness of recruits entering the Navy and at the completion of recruit training was requested by CNO. The RTCs at San Diego and Orlando were tasked to collect the physical fitness information on male and female recruits, respectively. The Naval Health Research Center (NHRC) was tasked with the design, development, and management of the pilot study, including collation and analysis of the fitness data.

This report contains the findings from that pilot study. Three primary questions were addressed: (a) How does the physical fitness of individuals entering recruit training compare with national fitness norms developed from studies conducted during the 1970's? (b) Comparing entry versus graduation performance on the Navy's physical readiness test, do recruits show significant change in fitness over the course of recruit training? (c) Relative to the Navy's fitness standards, how do recruits compare with active duty personnel currently working in the fleet?

METHODS

Recruit Sample

The study sample consisted of five companies of male recruits formed during February 1984 at RTC, San Diego and seven companies of female recruits formed during March 1984 at RTC, Orlando. During their first week of recruit training, the Navy physical readiness test (PRT, cf., OPNAVINST 6110.1B) and two additional fitness measures were administered to 357 male recruits and 457 female recruits. Of these recruits, 302 males and 393 females were retested during the week prior to graduation from training. The retested recruits who represent the sample for analysis, included only those who entered and graduated from the same company. Drop-outs and roll-backs were not included because their training was atypical. The 302 male recruits ranged in age from 17-34 years (mean = 20.0, SD = 2.88). The 393 female recruits ranged from 17-35 years of age (mean = 20.6, SD = 3.18).

Comparison Groups

The recruits fitness test scores were compared with two other groups where comparable measures were available: (a) national norms for 17-year-old high school students, and (b) active duty naval personnel stationed at various shore-based commands located on the West Coast, primarily in the San Diego area. The high school norms were based on data collected during 1975 as part of the Youth Fitness Project (AAHPER, 1976) and during 1979 as part of the Health Related Fitness Test sponsored by the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD, 1980, 1984). Data on active duty naval personnel were collected during 1983 to provide baseline data for the first year of Health and Physical Readiness Program implementation (Nice, Dutton, and Seymour, 1984).

Test Procedures

In accordance with the procedures set forth in OPNAVINST 6110.1B, recruits were tested on four components of physical fitness: time to complete a 1.5-mile run, number of sit-ups done in two minutes, sit-reach flexibility, and estimated body composition. Two additional measures were included for comparison with high school national norms: triceps skinfold thickness and either the number of pull-ups one could do (if male) or the number of seconds one could hang in a flexed-arm position (if female).

1.5-mile run. Recruits ran a course covering 1.5 miles. Course distances at each site (RTC, San Diego and RTC, Orlando) had been measured prior to the run. All members of a company ran the course at the same time. As each participant crossed the finish line, his/her time to the nearest second was called out. (At RTC, San Diego an electronic timer with digital time display was also provided at the finish line.) The participant was required to remember his/her time and report it to a timekeeper at the conclusion of the run.

Sit-ups. The number of sit-ups which could be performed in two minutes was recorded for each participant. Participants lay flat on their backs with their knees bent and heels positioned approximately ten inches from the buttocks. Their arms were folded across the chest and their feet were held by a partner. Sit-ups were performed by curling the upper torso upwards until the elbows touched the thighs, and then curling back down until the shoulders touched the floor. Participants were instructed to perform as many sit-ups as they could in two minutes. The number of sit-ups performed in the first minute of the test was also recorded. The sit-up procedures described in OPNAVINST 6110.1B are consistent with those described in the AAHPERD Health Related Fitness Test Manual (1980) with the exception that the AAHPERD test is a one minute test rather than a two minute one. The one minute value was then used for comparison with the high school normative data.

Sit-reach test. Each participant was given a chance to warm-up by stretching and then

instructed to sit on the floor with legs straight and feet spread six inches apart. The participant then reached as far forward as he/she could, touching the floor between the legs with the fingertips. The instructor monitored each participant to see that the knees remained extended during the stretch. The participant was required to hold the reach for three seconds and the distance from the bottom of the heel to the fingertips was measured. Distances beyond the heel were scored as positive inches, those short of the heel as negative inches.

Body composition. Body composition was expressed as percent body fat (%BF), which is the percentage of body weight attributable to fat. Percent body fat was estimated from body circumferences using equations of Wright, Dotson, and Davis (1980, 1981). These equations are the basis for the tables contained in OPNAVINST 6110.1B. Two body circumferences were measured on male participants: neck circumference, measured around the neck at a slight angle with the tape passing just below the larynx; and abdominal circumference, measured around the abdomen, level to the deck, at the level of the umbilicus. Three additional body circumferences were measured on female participants: biceps circumference, measured at the largest circumference of the arm with the arm extended parallel to the deck and the palm facing up; forearm circumference, measured at the largest circumference of the forearm, again with the arm extended parallel to the deck and the palm facing up; and thigh circumference, measured around the left thigh just below the buttock with tape placed level to the deck. The circumference measurements were made in series going from head to foot. Two series of measurements were made on each participant. If two circumference measures differed by more than one-fourth inch a third measurement was taken. The average of all measurements taken at a particular site was used in the data analyses.

Triceps skinfold thickness. For comparison with high school normative data, one additional body composition measurement was made, triceps skinfold thickness. The skinfold thicknesses were measured to the nearest 0.1 mm with Harpenden calipers by personnel trained in the technique. The calipers were placed over the triceps muscle on the long axis of the arm at a point midway between the olecranon of the elbow and the acromion of the scapula. As with the circumferences, two measurements were made. If the two measurements differed by more than 0.6 mm, a third measurement was taken. The average of all measurements was recorded for analysis.

Pull-ups. The number of pull-ups which could be performed was measured for each male recruit. The pull-up test was administered in accordance with the procedures given in the AAHPER Youth Fitness Test Manual (1976): Participants were assisted up to a one and one-half inch diameter bar from which they could hang with arms and feet fully extended while grasping the bar with their hands, with the palms facing away from the body. The participant pulled himself up until his chin cleared the bar and then lowered himself to full extension. The body

was not allowed to swing during the exercise, and the participant was not allowed to raise his knees. The exercise was repeated as many times as possible and the total number of repetitions recorded.

Flexed-arm hang. The number of seconds a participant could hang from a bar with arms flexed was measured for each female recruit. The flexed-arm hang was also administered in accordance with the procedures given in the AAHPER Youth Fitness Test Manual (1976): The participant was lifted up to a one and one-half inch bar and allowed to support herself with an overhand grip, elbows flexed, chest held close to the bar, and chin held above the bar. The participant was then released, and a stopwatch started. She was required to hold herself up, maintaining her chin above the level of the bar with her head straight for as long as possible. The watch was stopped when the participant's chin dropped below the level of the bar, and the time in seconds recorded.

Analyses

Comparisons between recruits at entry and national normative data were made using Student's t-test for uncorrelated means. The normative mean values were considered population parameters. Changes in fitness associated with recruit training were assessed using the Student's t-test for correlated means. Comparisons between mean values for recruit and active duty samples were made using the t-test for uncorrelated means. All statistical analyses were performed using the SPSS^X (SPSS, Inc; 1983).

Neither the AAHPERD nor active duty groups were ideal for making comparisons with our sample of recruits because the age distributions differed among these groups. For example, the most available national norms (AAHPERD) which were suitable for comparison with recruits were for 17-year-old men and women. Norms for the 1.5-mile run were determined for individuals 13-18 years of age. AAHPERD combined run times for 13-18 year olds because there were no significant age trends in their data (Dr. Andrew Jackson, University of Houston, personal communication).

To minimize any confounding effects due to age in comparisons between recruits and the AAHPERD norms, we used only data from 17- to 19-year old recruits. When comparing recruits with the active duty personnel, both samples were restricted to include only individuals 17-25 years old, again to get groups as well-matched on age as possible. This age range was selected because it included over 90% of recruits. However, even with this restriction, the active duty personnel were older on the average than recruits (287 male recruits: mean = 19.5 years, SD = 1.74; 355 female recruits: mean = 19.8 years, SD = 1.82; 1393 active duty males: mean = 22.7 years, SD = 1.97; 425 active duty females: mean = 21.9 years, SD = 1.83). Yet, such

restrictions on age ranges were expected to reduce the possibility that group differences in fitness are due to confounding age effects.

RESULTS

Comparison of Recruits with AAHPERD Norms

Several significant ($p<0.05$) differences were found between recruits at entry and the AAHPERD students. As Table 1 indicates, both male and female recruits entering recruit training ran the 1.5-mile significantly faster but did significantly fewer sit-ups and were significantly less flexible than AAHPERD high school students; recruits did not differ significantly from the AAHPERD students on the triceps skinfold measure. Male recruits could do significantly fewer pull-ups than AAHPERD students, whereas female recruits did not differ from AAHPERD norms on the flexed-arm hang.

Table 1

Comparison of Entry and Graduation Fitness Test Scores for 17-19 Year Old Recruits with AAHPERD Norms

Test	AAHPERD Norms	Recruits Entry		Recruits Grad.	
	Mean	Mean	SD	Mean	SD
MEN (n = 184-187)					
1.5-Mile Run (min:sec)	11:28	11:02*	1:10	10:16*	0:38
1-Minute Sit-up	46.0	35.8*	7.0	34.9*	6.3
Sit-Reach (in)	3.1	2.0*	3.3	3.0	2.9
Triceps Skinfold (mm)	9.0	9.5	3.8	9.6	3.6
Pull-ups	7.3	6.0*	3.9	5.4*	3.5
WOMEN (n = 197-200)					
1.5-Mile Run (min:sec)	16:56	15:47*	2:04	13:59*	1:44
1-Minute Sit-up	36.7	34.5*	6.7	36.6	7.9
Sit-Reach (in)	4.3	3.3*	2.9	4.0	2.8
Triceps Skinfold (mm)	16.5	16.2	4.3	16.5	3.8
Flexed-Arm Hang (sec)	12.0	12.4	10.8	13.3	10.8

* Differed significantly from AAHPERD norms at $p < .001$

Table 1 also presents the comparisons between AAHPERD norms and recruits' fitness scores at graduation as an indication of any changes that took place during training. At the end of

recruit training male recruits ran even faster but still did significantly fewer sit-ups and pull-ups than AAHPERD males. Female recruits also ran even faster at the end of training than AAHPERD females, but there were no significant differences on the other fitness measures.

Recruit Entry and Graduation Fitness

Table 2 summarizes recruits' performance on the four PRT items and the three additional AAHPERD test items at entry and graduation from training. Both men and women showed significant ($p<.000$) improvement on all PRT items. Men took 48 seconds and women took 1 minute, 37 seconds off their average run times. Men increased the average number of sit-ups they could do in two minutes by 5.1 sit-ups and women by 6.5 sit-ups. By graduation men were

Table 2

Fitness Scores at Entry and Graduation from Recruit Training

Test		Entry	Grad.	Change (Grad.-Entry)	T-test	p
MEN (n = 297-302)						
1.5-Mile Run (min:sec)	Mean	11:07	10:19	-0:48	13.53	.000
	S.D.	1:12	0:42			
Sit-ups (2-min)	Mean	50.7	55.8	5.1	10.05	.000
	S.D.	12.7	10.9			
Sit-reach (in)	Mean	1.9	2.9	1.0	9.89	.000
	S.D.	3.2	2.8			
% Body Fat	Mean	14.9	13.3	-1.6	10.43	.000
	S.D.	5.7	4.4			
Sit-ups (1st min)	Mean	35.5	34.9	-0.6	1.67	.096
	S.D.	7.1	6.4			
Triceps Skinfold (mm)	Mean	9.6	9.7	0.1	.78	.436
	S.D.	3.8	3.6			
Pull-ups	Mean	5.9	5.4	-0.5	5.22	.000
	S.D.	4.0	3.7			
WOMEN (n = 378-393)						
1.5-Mile Run (min:sec)	Mean	15:40	14:03	-1:37	18.91	.000
	S.D.	2:04	1:46			
Sit-ups (2-min)	Mean	49.6	56.1	6.5	15.58	.000
	S.D.	12.6	11.9			
Sit-reach (in)	Mean	3.0	3.7	0.7	8.56	.000
	S.D.	3.0	2.9			
% Body Fat	Mean	19.0	17.4	-1.6	10.45	.000
	S.D.	3.7	3.6			
Sit-ups (1st min)	Mean	34.0	35.9	1.9	5.57	.000
	S.D.	7.4	8.3			
Triceps Skinfold (mm)	Mean	16.7	16.5	-0.2	1.17	.242
	S.D.	4.6	4.0			
Flexed-Arm Hang (sec)	Mean	13.2	14.3	1.2	3.13	.002
	S.D.	12.0	11.9			

able to stretch 1 inch further and women 0.7 inch further on the sit-reach test. Both men and women decreased their body fat by 1.6 percent fat units on the average. In addition, male recruits showed a small but significant decrease in the number of pull-ups they could do and had no significant change in triceps skinfold thickness or number of sit-ups performed in the first minute. Female recruits showed significant increases in flexed-arm hang time and the number of sit-ups performed in one minute, but no change in triceps skinfold thickness

Comparison of Recruits with Active Duty Personnel

Table 3 lists the mean PRT item scores for the active duty sample personnel and the recruits both at entry and graduation. Tables 4 - 8 show the distributions of the PRT item score classifications for active duty personnel and recruits both at entry and graduation from training. Again, analyses comparing these groups were restricted to include only individuals who were 25 years of age or younger to minimize age effects.

Table 3

Comparison of Entry and Graduation Fitness Test Scores for 17-25 Year Old Recruits[a] with Active Duty[b] Test Scores

Test	Active Duty		Recruits Entry		Recruits Grad.	
	Mean	SD	Mean	SD	Mean	SD
MEN						
1.5-Mile Run (min:sec)	12:19	1:96	11:04*	1:12	10:17*	0:38
Sit-ups	54.8	16.2	51.0*	12.6	56.3	10.8
Sit-reach (in)	2.7	2.9	1.9*	3.2	3.0	2.8
% Body Fat	15.2	5.5	14.8	5.6	13.2*	4.4
WOMEN	Mean	SD	Mean	SD	Mean	SD
1.5-Mile Run (min:sec)	14:57	2:02	15:46*	2:07	14:01*	1:45
Sit-ups	49.6	16.7	49.6	12.3	55.9*	11.7
Sit-reach (in)	3.6	2.9	3.1*	3.1	3.8	2.9
% Body Fat	21.2	5.3	18.8*	3.7	17.3*	3.5

* Differed significantly from Active Duty scores ($p<0.05$)

[a] For male recruits, N = 283-287;
For female recruits, N = 347-355

[b] For male active duty personnel, N = 1027-1350;
For female active duty personnel, N = 312-428

Table 4

Classification Ratings for 1.5-Mile Run

Classification		Active Duty	Recruits Entry	Recruits Grad.
MEN				
Fail	%	6.4	0.7	0.0
	(N)	(85)	(2)	(0)
Minimum	%	6.7	0.7	0.0
	(N)	(89)	(2)	(0)
Satisfactory	%	21.7	2.8	0.0
	(N)	(287)	(8)	(0)
Good	%	42.8	55.2	21.7
	(N)	(567)	(156)	(62)
Excellent	%	14.4	28.6	60.5
	(N)	(190)	(81)	(173)
Outstanding	%	8.0	12.0	17.8
	(N)	(106)	(34)	(51)
Total	%	100.0	100.0	100.0
	(N)	(1324)	(283)	(286)
WOMEN				
Fail	%	10.8	28.6	7.2
	(N)	(45)	(100)	(25)
Minimum	%	11.0	11.4	2.6
	(N)	(46)	(40)	(9)
Satisfactory	%	27.8	27.7	15.9
	(N)	(116)	(97)	(55)
Good	%	34.1	21.1	43.5
	(N)	(142)	(74)	(151)
Excellent	%	9.6	8.9	25.0
	(N)	(40)	(31)	(87)
Outstanding	%	6.7	2.3	5.8
	(N)	(28)	(8)	(20)
Total	%	100.0	100.0	100.0
	(N)	(417)	(350)	(347)

Table 5

Classification Ratings for Percent Body Fat

Classification		Active Duty	Recruits Entry	Recruits Grad.
MEN				
Fail	%	10.3	12.6	5.6
	(N)	(105)	(36)	(16)
Minimum	%	7.1	4.2	1.4
	(N)	(73)	(12)	(4)
Satisfactory	%	9.0	5.9	5.2
	(N)	(92)	(17)	(15)
Good	%	13.1	8.4	9.4
	(N)	(134)	(24)	(27)
Excellent	%	14.4	11.9	10.8
	(N)	(147)	(34)	(31)
Outstanding	%	46.1	57.0	67.6
	(N)	(471)	(163)	(194)
Total	%	100.0	100.0	100.0
	(N)	(1022)	(286)	(287)
WOMEN				
Fail	%	6.1	0.0	0.0
	(N)	(19)	(0)	(0)
Minimum	%	1.6	0.0	0.3
	(N)	(5)	(0)	(1)
Satisfactory	%	18.1	9.3	3.1
	(N)	(56)	(33)	(11)
Good	%	14.8	10.1	4.5
	(N)	(46)	(36)	(16)
Excellent	%	31.0	36.9	33.0
	(N)	(96)	(131)	(117)
Outstanding	%	28.4	43.7	59.1
	(N)	(88)	(155)	(210)
Total	%	100.0	100.0	100.0
	(N)	(310)	(355)	(355)

Table 6

Classification Ratings for Sit-Ups

Classification		Active Duty	Recruits Entry	Recruits Grad.
MEN				
Fail	%	1.4	6.3	0.3
	(N)	(19)	(18)	(1)
Minimum	%	8.5	4.5	1.4
	(N)	(115)	(13)	(4)
Satisfactory	%	26.5	33.2	25.4
	(N)	(358)	(95)	(73)
Good	%	49.5	51.1	66.6
	(N)	(668)	(146)	(191)
Excellent	%	12.2	4.9	6.3
	(N)	(164)	(14)	(18)
Outstanding	%	1.9	0.0	0.0
	(N)	(26)	(0)	(0)
Total	%	100.0	100.0	100.0
	(N)	(1350)	(286)	(287)
WOMEN				
Fail	%	1.2	2.5	0.0
	(N)	(5)	(9)	(0)
Minimum	%	5.1	1.7	0.3
	(N)	(22)	(6)	(1)
Satisfactory	%	30.1	21.8	7.6
	(N)	(129)	(77)	(27)
Good	%	43.5	61.2	65.6
	(N)	(186)	(216)	(233)
Excellent	%	15.2	12.2	25.1
	(N)	(65)	(43)	(89)
Outstanding	%	4.9	0.6	1.4
	(N)	(21)	(2)	(5)
Total	%	100.0	100.0	100.0
	(N)	(428)	(353)	(355)

Table 7

Classification Ratings for Sit-Reach

Classification		Active Duty	Recruits Entry	Recruits Grad.
MEN				
Fail	%	5.6	11.5	2.4
	(N)	(76)	(33)	(7)
Minimum	%	1.9	3.1	2.1
	(N)	(26)	(9)	(6)
Satisfactory	%	4.8	7.3	7.3
	(N)	(65)	(21)	(21)
Good	%	9.3	10.2	7.0
	(N)	(125)	(29)	(20)
Excellent	%	12.1	15.3	18.5
	(N)	(162)	(44)	(53)
Outstanding	%	66.3	52.6	62.7
	(N)	(893)	(151)	(180)
Total	%	100.0	100.0	100.0
	(N)	(1347)	(287)	(287)
WOMEN				
Fail	%	5.2	9.3	3.9
	(N)	(22)	(33)	(14)
Minimum	%	1.6	2.1	0.0
	(N)	(7)	(7)	(0)
Satisfactory	%	16.9	14.6	18.1
	(N)	(72)	(52)	(64)
Good	%	11.7	15.2	11.5
	(N)	(50)	(54)	(41)
Excellent	%	12.4	14.6	16.1
	(N)	(53)	(52)	(57)
Outstanding	%	52.2	44.2	50.4
	(N)	(223)	(157)	(179)
Total	%	100.0	100.0	100.0
	(N)	(427)	(355)	(355)

Table 8

Overall Classification Ratings

Classification		Active Duty	Recruits Entry	Recruits Grad.
MEN				
Fail	%	18.6	23.8	7.7
	(N)	(180)	(67)	(22)
Minimum	%	15.1	9.3	4.2
	(N)	(146)	(26)	(12)
Satisfactory	%	27.3	27.4	30.1
	(N)	(265)	(77)	(86)
Good	%	31.6	37.0	53.1
	(N)	(307)	(104)	(152)
Excellent	%	6.9	2.5	4.9
	(N)	(67)	(7)	(14)
Outstanding	%	0.5	0.0	0.0
	(N)	(5)	(0)	(0)
Total	%	100.0	100.0	100.0
	(N)	(970)	(281)	(286)
WOMEN				
Fail	%	16.8	34.8	10.7
	(N)	(49)	(121)	(37)
Minimum	%	12.1	12.1	2.0
	(N)	(35)	(42)	(7)
Satisfactory	%	39.9	31.6	32.9
	(N)	(116)	(110)	(114)
Good	%	25.4	17.5	44.3
	(N)	(74)	(61)	(154)
Excellent	%	4.8	4.0	9.8
	(N)	(14)	(14)	(34)
Outstanding	%	1.0	0.0	0.3
	(N)	(3)	(0)	(1)
Total	%	100.0	100.0	100.0
	(N)	(291)	(348)	(347)

Male comparisons. Male recruits were significantly faster in the 1.5-mile run than active duty male personnel both at entry into recruit training and at graduation (see Table 3). As shown in Table 4, 13% of active duty men fell into the "fail" or "minimum" run classification categories, whereas only 1.4% of entering recruits fell into the two lowest categories. By graduation not one recruit fell into the lowest three classification categories for the run test and 78% fell into the "excellent" or "outstanding" categories. Only 22% of active duty males met the excellent or outstanding run standards.

At entry into recruit training, male recruits did not differ significantly from the active

duty male personnel in %BF. However, over the eight weeks of recruit training their body fat decreased and at graduation was significantly less on the average than that of the active duty personnel (see Table 3). This same finding is reflected in the PRT percent fat classification distributions shown in Table 5. Whereas almost 17% of entering male recruits fell into the "fail" or "minimum" categories, which was the same as active duty males, only 7% of graduating recruits fell into the lowest two categories. On the other end of the continuum, 78% of graduating recruits fell into the "excellent" or "outstanding" categories, whereas 69% of entering recruits and 60% of active duty males fell into the two highest categories for %BF.

As can be seen by examining the mean values shown in Table 3 and the rating distributions in Tables 6 and 7, male recruits at the beginning of recruit training actually performed significantly worse than active duty males on the sit-ups and sit-reach tests. However, because recruits improved their performance on these two tests over the course of training, by graduation they showed essentially no overall differences on the sit-ups and sit-reach tests when compared with active duty males.

Female comparisons. In contrast to the findings for male recruits, female recruits had significantly less fat on the average than the active duty female personnel both at entry into and at graduation from recruit training (see Tables 3 and 5). As Table 5 indicates, even at the start of training no female recruits failed to meet minimum standards, whereas 6% of active duty females failed to meet minimum body fat standards. By graduation from recruit training, less than 4% of recruits fell into the lowest three categories, while 26% of active duty females fell into the three lowest classification categories. Similarly, 92% of graduating recruits fell into the "excellent" or "outstanding" categories, but only 59% of active duty females met the two highest rating standards for %BF.

The biggest improvement in female recruits was seen in the 1.5-mile run. At entry into recruit training, female recruits were on the average significantly slower than their active duty counterparts. At the completion of recruit training, however, they had improved to the point of being significantly faster than the female active duty personnel (see Table 3). Upon entering recruit training, over 28% of recruits failed to meet minimum standards for the run test, whereas only 11% of active duty females failed to meet minimum standards (see Table 4). However, by graduation only 7% of female recruits did not meet minimum run standards. At the other end of the continuum, 11% of recruits fell into the two highest categories for their run times at the beginning of training, while 31% of female recruits fell into the "excellent" or "outstanding" categories by graduation. This can be contrasted with 16% of active duty females who met the two highest category standards for the 1.5-mile run test.

Women recruits also showed improvement on the sit-ups test over the course of training

(see Tables 3 and 6). At the time of entry into recruit training, female recruits could perform the same number of sit-ups on the average as the active duty female personnel. By the time of graduation, they could do significantly more than their active duty counterparts. In terms of PRT sit-up classifications, 26% of the female recruits fell into the lowest three categories at the start of training, whereas only 8% of them fell into the lowest three categories at graduation. This can be contrasted with 36% of active duty women who fell into the lowest three categories on the sit-ups test. Entering women recruits performed slightly worse on the sit-reach test than active duty women; however, by the time the recruits graduated, performance in the two groups was very similar (see Tables 3 and 7).

DISCUSSION

Comparison of Recruits with AAHPERD Norms

Comparison of recruit fitness test performance with that of the AAHPERD high school normative data suggested the following: 1) Both male and female recruits are more aerobically fit than the high schoolers as indicated by their lower average times for the 1.5-mile run; 2) Both male and female recruits at entry could perform fewer sit-ups than the AAHPERD high school group, although at graduation the female recruits matched the high school performance; 3) Both the male and female recruits appeared to be less flexible than the high school population at entry and no different from them at graduation; 4) Body composition as indicated by triceps skinfold thickness did not differ between the high school population and our male or female recruit samples either at entry or at graduation; 5) Compared to the high school group, male recruits appeared to have less muscle strength based upon their pull-up performance at entry and at graduation; 6) Female recruit flexed-arm hang time did not differ significantly from the high school normative values either at entry or at graduation. However, there are procedural differences between AAHPERD test administration and PRT administration which must be considered when evaluating these results.

Procedures for the administration of the sit-ups and sit-reach tests in this study differed from those upon which national normative data were based (AAHPERD Health Related Test Manual, 1980). For the AAHPERD test, the participant is required to perform the maximum number of sit-ups he/she can do in one minute. In this study we counted the number done in the first minute of a two minute test. Because the sit-up test was longer, the one minute value recorded may reflect "pacing" during the first minute to achieve maximal two-minute performance rather than maximal one minute performance. That this might be the case is suggested by comparison of the changes in one minute and two minute sit-up values with recruit training (see Table 2).

The number of sit-ups performed in two minutes improved by 10.1% and 13.1% for men and women, respectively, over the course of recruit training. The number of sit-ups performed in one minute actually decreased by 1.7% for men and increased by only 5.6% for women. These findings suggest, at least for the post-training test, that the number of sit-ups recruits performed in one minute has been biased by pacing to perform the maximum number possible in two minutes. The extent to which this was true of the pre-training test cannot be determined from these data. However, any bias that exists would be in the direction of underestimation of one minute sit-up performance, and the finding of poorer performance by incoming recruits than by AAHPERD sample participants must be interpreted with caution.

Flexibility in the AAHPERD sit-reach test was measured with fingers outstretched on a specially constructed box at a height slightly greater than 12 inches above the floor rather than on the floor as was done in the PRT. In a small sample of 11 male and female subjects (Dr. J. A. Hodgdon, unpublished data), measurements were made of sit-reach distances both at floor level (as described in OPNAVINST 6110.1B) and on a bench at a height of 12.75 inches above the floor (corresponding approximately to the AAHPERD test height). The mean difference between measures for this small sample was 3.0 inches ($\pm$ 1.44) with the AAHPERD test procedure resulting in greater reach distance. The regression equation to predict AAHPERD test performance from PRT performance was: AAHPERD sit-reach = 3.153 + (0.625 X PRT sit-reach). The correlation coefficient between the two sit-reach measures was 0.93 with a standard error of 0.84 inches. Using this equation to predict AAHPERD sit-reach performance in our Navy recruit sample we obtained mean predicted sit-reach values of 4.37 inches ($\pm$ 2.05) and 5.22 inches ($\pm$ 1.79) for incoming male and female recruits respectively. These mean values are significantly ($p<0.05$) <u>greater</u> than the corresponding AAHPERD sample norms (in contrast to the raw score comparisons). Conclusions about the relative flexibility levels of incoming Navy recruits and high school students must await the collection of more data which either 1) further defines the relationship between the sit-reach test as performed by AAHPERD and that performed by the Navy; or 2) includes measurement of AAHPERD sit-reach performance of Navy recruits.

Incoming Navy recruits were found to be more aerobically fit than AAHPERD high school mean values. In order to obtain estimates of their aerobic capacity in terms of maximal rates of oxygen consumption (VO_2 max), we turned to tables developed by Dr. Ken Cooper (Cooper, 1977; pp 280-281) to evaluate recruit 1.5-mile run times. Using Cooper's tables, the mean male and female recruit 1.5-mile run times are equivalent to mean VO_2 max values of 47.7 ml02/kg-min for men and 35.2 ml02/kg-min for women. These values are roughly comparable to those found by Vogel and Patton (1978) for incoming Army recruits.

In addition to estimation of VO_2 max, these tables have an age-adjusted six-point fitness classification scheme developed by Dr. Cooper and based upon his evaluation of people who have come to the Aerobics Center in Dallas for fitness testing. However, applying the Cooper classification scheme to recruit 1.5-mile run times places them near the middle of the scale. Mean Cooper classifications were 3.74 for men and 3.31 for women, where a rating of 3.0 is considered "fair" and a rating of 4.0 "good." It remains to be determined whether Cooper's classifications offer a better basis for comparison with the American non-military population than the AAHPERD high school norms.

Recruit Entry and Graduation Fitness

In general, fitness among Navy recruits improved markedly over the course of recruit training. There were, however, two exceptions to this general finding: pull-up performance of male recruits, and triceps skinfold thickness for both male and female recruits. Pull-up performance, generally taken to be an indicator of muscle strength, actually declined slightly for male recruits from pre- to post-training measurement. This finding was not surprising since the recruit physical training program emphasizes running and calisthenics which do not develop upper body strength.

On the other hand, women recruits did show significant increases in flexed-arm hang time. Flexed-arm hang time is touted as an equivalent test for pull-ups (AAHPER Youth Fitness Test Manual, 1976). However, since the flexed-arm hang does not require acceleration of the body mass as pull-ups do, it would appear to be more a muscle endurance test and less a muscle strength test than are pull-ups. Elements of recruit training such as the rifle drills will develop upper torso muscle endurance (but not much muscle strength due to the relatively light weight of the piece), and therefore the finding of increased upper body muscle endurance for female recruits was not surprising.

The lack of change in triceps skinfold thickness over the course of training was somewhat surprising given the decrease in %BF predicted from body circumferences for both men and women recruits. This lack of change most likely reflects the fact that triceps skinfold by itself is a less precise indicator of obesity than is the aggregate of several body circumferences. Cross-validation of the equations used for prediction of percent fat in the PRT gives validities of 0.87 (std. err. meas. = 3.99 % fat units) for men and 0.80 (std. err. meas. = 4.19 % fat units) for women based on a data set of anthropometric and body density values of 602 male and 214 female Navy personnel (see Hodgdon and Beckett; 1984a, 1984b). Using the same data set, comparable validities for prediction of %BF from triceps skinfold alone are 0.73 (std. err. meas. = 5.49 % fat units) for men and 0.70 (std. err. meas. = 4.93 % fat units) for women. Future work comparing recruit fitness to normative data will require identification of

other normative body composition data based upon more valid measures than simply triceps skinfold thickness. If we use the 5-point classification scale of "very lean," "lean," "average," "fat," and "very fat" proposed by Cooper (1977), and the %BF values derived from circumference measures, male recruits would be considered "lean" both at entry into and upon graduation from recruit training. Female recruits would be considered "average" at entrance and "lean" at graduation.

Comparison of Recruits with Active Duty Personnel

In general, recruits at graduation from recruit training were found to be as fit or more fit than their active duty counterparts. In areas where the active duty personnel appeared to be less fit than the recruit sample, it will be important to determine the factors associated with the shift toward poorer fitness in the fleet. If remediation is to be effected, variables such as physical work load, exercise habits and other lifestyle behaviors will need to be evaluated for their influence on fitness so that methods for improving physical readiness in fleet personnel can be developed.

CONCLUSIONS

Comparisons of the fitness of recruits entering the Navy with national norms for similar age groups were hampered by a lack of adequate normative data and procedural constraints which did not allow collection of exactly comparable fitness measures. When all the comparative findings are considered, there was nothing to indicate that people entering the Navy had markedly different fitness levels than people outside the Navy. However, there is a need to locate or collect a more appropriate set of normative data and replicate this finding.

It is quite clear from the data presented here that recruit training enhances fitness as measured by the current PRT. An item for future concern is the finding that male recruits did not develop upper torso strength (indicated by pull-up scores) during training. Such strength has been identified by Robertson (1983) as being necessary for the performance of many Navy job tasks. This finding suggests a need to increase the amount of strength training provided during recruit training.

Using the Navy PRT standards as fitness indicators, graduating recruits showed somewhat better overall fitness than similarly aged active duty personnel. For men, the biggest difference was seen in the 1.5-mile run time, with recruits meeting higher standards than fleet personnel. Graduating male recruits also had lower %BF than their counterparts in the fleet. However, there were essentially no differences between these groups on the sit-up and sit-reach tests.

For women, the greatest difference between graduating recruits and active duty personnel was seen in %BF, again with recruits meeting higher standards. Graduating female recruits also had better ratings on the 1.5-mile run and sit-up test, but did not differ in sit-reach performance.

In general, our results indicate incoming recruits tend to be less fit overall than their active duty counterparts. However, the fitness gains achieved during recruit training allow them to enter the fleet generally more fit than active duty sailors. The reasons for the differences in fitness between graduating recruits and active duty personnel should be a target for future research so that steps can be taken to prevent deconditioning and enhance physical readiness in the fleet.

REFERENCES

AAHPER Youth Fitness Test Manual. The American Alliance for Health, Physical Education, and Recreation. Washington, D.C.: AAPHER, 1976.

AAHPERD Health Related Physical Fitness Test Manual. The American Alliance for Health, Physical Education, Recreation, and Dance. Reston, VA, 1980.

AAHPERD Technical Manual, Health Related Physical Fitness. The American Alliance for Health, Physical Education, Recreation, and Dance. Reston, VA, 1984.

Cooper, K.H. The Aerobics Way. New York: Bantam Books, 1977.

Hodgdon, J.A. and M.B. Beckett. Prediction of percent body fat for U.S. Navy men from body circumferences and height. Naval Health Research Center Report #84-11. Naval Health Research Center, San Diego, CA 92138-9174, 1984.

Hodgdon, J.A. and M.B. Beckett. Prediction of percent body fat for U.S. Navy women from body circumferences and height. Naval Health Research Center Report #84-29. Naval Health Research Center, San Diego, CA 92138-9174, 1984.

Nice, D.S., L. Dutton, and G.E. Seymour. An analysis of baseline Navy health and physical readiness data from local shore facilities. Naval Health Research Center Report #84-1. Naval Health Research Center, San Diego, CA, 92138-9174, 1984.

Robertson, D.W. Relationship of dynamic strength, static strength, and body weight to mental and muscular tasks. Proceedings of the 24th DRG Seminar on the Human as a Limiting Element in Military Systems. Vol 1. NATO Defense Research Group Report DS/A/DR(83)170, Toronto, Canada; 369-389; 1983.

SPSS Inc. SPSS^X Users Guide. New York: McGraw-Hill, 1983.

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(U) Physical fitness was assessed for 302 male and 393 female recruits (RCT) upon entry into (T1) and at the completion (T2) of RCT training using the Navy's Physical Readiness Test (PRT) consisting of 1.5-mile run time (RUN), sit-ups in 2 minutes (SU2), sit-reach distance (SRD), and percent body fat (%BF) estimation. Sit-ups performed in the first minute of the 2-minute test (SU2), and triceps skinfold thickness (SKNFLD) were also measured. Maximum number of pull-ups (PU) was measured for male, and flexed-arm hang time (FHT)

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for female RCTs. RCT fitness was compared to AAHPERD/national norms for 17-year-old high school students (AAHPERD) where possible, as well as to PRT scores from a sample of active duty Navy personnel (AD). Significant ($p<0.05$) results are as follows: Compared to AAHPERD, male RCTs both at T1 and at T2 did RUN faster, did fewer SU1, and fewer PU. SRD was less at T1 but did not differ at T2. SKNFLD did not differ at T1 or at T2. Female RCTs did RUN faster both at T1 and at T2. SRD and SU1 were less at T1, but did not differ at T2. SKNFLD and FHT did not differ from AAHPERD either at T1 or at T2. With training, RCT fitness generally improved significantly, but two measures, SKNFLD for male and female RCTs, and SU1 by male RCTs showed no change; and PU decreased over the course of training. Compared to AD, male RCTs were faster on RUN at both T1 and T2. They did fewer SU1 and had shorter SRDs at T1, but by T2 were comparable to AD. At T1, male RCTs had the same average %BF as AD males, but they were significantly leaner at T2. Female RCTs were leaner both at T1 and T2, did RUN more slowly at T1 but faster at T2, did not differ on SU2 at T1 but did significantly more at T2, and had shorter SRDs at T1 but did not differ at T2. It was concluded that inadequate normative data on civilian populations, and technical constraints in study administration make interpretation of the comparisons with civilians difficult. It was clear that RCT training improved the physical fitness of RCTs. Finally, it appears that RCT training graduates enter the fleet somewhat more fit than fleet sailors.

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