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The Impact of Non-Mandated Physical Training on Physiological Measures and Performance in Army Officers

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COLUMBUS STATE UNIVERSITY

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ABSTRACT

The purpose of this study was to observe the physiological changes in body composition and fitness assessments in US Army Officers after 5 months of non-mandated exercise. Twenty-two captains stationed at Fort Benning, Georgia volunteered to participate (age; 26.9±1.2 years, height; 1.76±0.6m, and weight; 83.1±11.1kg). Eleven participants remained in active units with mandated training (MT) while 11 participants were in positions where training was not mandated (NMT). Anthropometrics, body composition, cardiorespiratory fitness, anaerobic power, and muscular strength were measured in both groups before and after the intervention period (18±2 weeks). At pre-intervention, MT and NMT were not different in body composition, cardiorespiratory fitness, anaerobic power, or muscular strength ($P>0.05$). Post-intervention, there were no significant time x group interactions observed in anthropometrics, body composition, cardiorespiratory fitness, anaerobic power, and muscular strength between groups ($P>0.05$). However, a main effect of groups was attained in body fat, VO_2peak, and peak power ($P<0.05$) and main effect of time was observed across all participants in VO_2peak and push-up performance ($P<0.05$). Plausible explanations can be due to the observed rank and limitations of the Army Physical Readiness Training (APRT). Further research is warranted investigating the effect of mandated exercise in officer ranks and physical performance.

KEY WORDS: exercise, military, fitness

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LIST OF ABBREVIATIONS

APRT	Army Physical Readiness Training
PT	Physical training
APFT	Army Physical Fitness Test
ROTC	Reserve Officer Training Corps
FM	Field Manual
AR	Army Regulation
MT	Mandated Training
NMT	Non-Mandated Training
RPE	Rating of Perceived Exertion

INTRODUCTION

U.S. Army soldiers are required to perform regular physical training to maintain peak physical condition required for occupational performance such as working in harsh environments, long duration marches, and maneuvering heavy equipment [1]. The Army Physical Readiness Training (APRT) program is a set of guidelines to optimize every soldiers' combat effectiveness through improving their physical condition with mandatory group-based training 5 days a week [2, 3]. The APRT program consists of one hour of activity that combines aerobic and resistance training exercises that focus on developing strength, endurance, and mobility. The exercises can be tailored to the specific occupational needs of the unit, especially in the Infantry where physical fitness is a vital component of job-specific operations [4-6]. Officers in leadership positions are tasked with the oversight of the APRT program in their soldiers [7, 8]. They often develop the exercise regimen and set goals without related experience or education in the field of exercise science.

The Army Physical Fitness Test (APFT) is an assessment tool used to measure how fit soldiers are at a given time during their service as well as the effectiveness of the APRT. The test consists of a maximal effort two-mile run, 2 minutes of push-ups and sit-ups and is administered at least every 6 months. Time to completion on the run is used to measure cardiorespiratory endurance while the number of repetitions achieved in both push-ups and sit-ups assess muscular strength and endurance. Each event is scored on a numerical scale relating to the soldiers age. For example, if a 25 years old male completed 70 push-ups, 70 sit-ups, and ran 2 miles in 14 minutes he would score 270 out of 300 based on scoring standards (Appendix C-E). Company level officers are responsible for their soldiers and themselves achieving a passing score of at least 200 out of

300 points [9]. If an APFT is failed, the soldier is required to report to their commander for a formal counseling. During the counseling a soldier is given an individualized fitness program to address the areas of weakness and a retest is administered within 90 days of the failed APFT. During this time period, a soldier may not be able to reenlist, receive awards, or promotions. If a soldier passes the second APFT then they may return to unit PT, however, if they fail, the commander may start the process to chapter out the soldier [10].

During combat deployments, special operations units do not perform mandated physical training, yet are expected to maintain physical fitness in order to pass an APFT at all times [2]. Farina et al. (2017) found elite special operations soldiers increased total training time, lean body mass, and grip strength after returning from 3-6 month tours [11]. Lester et al. (2010) demonstrated power (from measuring bench throw and squat jump) increased, but aerobic performance decreased after returning from a 13-month deployment in combat arms soldiers [12]. Although these studies observed combative units, the participants were a mixed sample of officers and enlisted soldiers. Because of different positions in leadership and occupational expectations, those enlisted soldiers and officers may maintain different levels and types of fitness. Previous research has applied different fitness assessments to measure various physical attributes that may or may not relate to the bench mark APFT tests [12, 13]. Both tests and training have been inconsistent during and after mandated unit physical training (PT). Little research has been published on officer specific programming and physiological outcomes during times of independent training [14].

For successful completion of military operations, high levels of physical exertion are required from soldiers [15]. Up to 27% of potential army recruits do not qualify for enlistment for being overweight, which is associated with predicted physical fitness according to Army Regulation 600-9 [8]. The recruits that pass body composition regulations have to attend basic

training courses before they are eligible for job placement. The introductory courses familiarize the incoming soldiers to exhaustive physical training to prepare them for demanding military operations. Previous studies have reported cardiovascular improvements after basic training courses that emphasized mandated group exercise. Training typically includes 4 hours of running and resistance exercise with 8 hours of marching every week. After 8 weeks, VO_2max improved by 12% and distance ran increased 7% [16, 17]. ROTC cadets (Reserve Officer Training Corps, college students who become officers after graduation) have reported increases in VO_2max, strength measures, and favorable body composition results compared to their civilian student counterparts while completing APRT for 9 months [18, 19]. These studies observed soldiers before official unit assignments and suggest the implementation of mandated exercise improves physical fitness.

ROTC cadets are required to participate in mandated group exercise during the academic school year (9 months), but not over the summer (3 months). When tested before and after 12 weeks of non-mandated training, aerobic fitness decreased, where VO_2max decreased by 4.3% [20]. Prolonged periods (4+ weeks) of inactivity have been associated with decreased VO_2max, cardiac output, and endurance performance and increased heart rate, recovery heart rate, and blood pressure [21]. Hansen et al. (2004) found a significant decrease in heart rate reserve and VO_2max in British sailors after one month of inactivity [5]. These studies suggest soldiers may not exercise to the same extent when they are not required and exhibit unfavorable outcomes. Without required exercise soldiers are subject to cardiorespiratory effects on sedentary behavior. Few studies have examined markers of musculoskeletal detraining which represents 2 out of the 3 fitness tests in the APFT. With job specific duty emphasizing muscular strength and endurance, detraining

information would be beneficial to better maintain soldier's health as they enter times of non-mandated PT throughout their career.

Whether officers alter physical fitness during periods of non-mandated exercise remains unclear. The primary aim of this study is to investigate the physiological changes including body composition and cardiorespiratory fitness in officers over 5 months when PT is not required. In addition, this study will examine anaerobic power and grip strength, attributes that are emphasized in military training [22]. It was hypothesized that the officers without mandated exercise will display unfavorable signs of detraining including decreased aerobic and muscular fitness while increasing body fat and weight, and that the officers with mandated training will maintain body composition and fitness performance.

METHODS

Participants

Army combat arms captains stationed at Fort Benning, Georgia from December 2017 through June 2018 were recruited to participate in this study. Twenty-two (n=22) males completed pretesting which included measuring anthropometrics, body composition, grip strength, VO_2peak, anaerobic capacity, and muscular strength. Participants were assigned to groups based on their PT requirements for the next 5 months. The officers of the mandatory training (MT) group remained exercising during regulated PT hours and followed required programming from their respective units. The exercises varied from an hour of sprint intervals and resistance training to 3-hour ruck marches. Researchers were unable to influence or design exercise the MT group performed. The officers in the non-mandated training (NMT) group were not assigned to an active duty unit (due to

graduate school enrollment or prolonged time between army schools) and were therefor not required to perform exercises during specific time frames or follow predetermined programs enforced by the military. During NMT, officers are allowed to perform physical activity at their own will. After the 5-month period of non-mandated training, the NMT group returned to participating in APFT following post-testing.

All participants who were free from injury at the start of the study and answered "no" to all questions on the Physical Activity Readiness Questionnaire (PAR-Q) were included. Those taking regular medications or with any medical conditions deeming them unsafe to exercise by the investigators were excluded. All participants were given informed consent before any testing was administered. This study was approved by the Columbus State University Institutional Review Board.

Study protocol

Participants were asked to come into the CSU Exercise Science lab for testing. The first day of testing included gathering demographic information, anthropometrics, body composition, grip strength and performing a VO_2peak test (Figure 1). Subjects were asked to return after 48 hours for the second visit which included a Wingate test, 2 minutes of push-ups and sit-ups, and completing an International Physical Activity Questionnaire (IPAQ) [23, 24]. The push-ups and sit-ups were performed in accordance with Field Manuel (FM) 21-22 which specifies form expectations and time between events [7]. Previous research has found familiarization trials for VO_2peak and Wingate assessments did not elicit different results in a healthy population, therefore one was not administered [25]. Participants were asked to eat a small meal 2-3 hours before and avoid caffeine (>5hr) and exercise (>48hr) prior to testing. The researchers requested participants to arrive in an a

euhydrated state to prevent dehydration during the fitness assessments. At 5 months, participants returned to repeat testing in the same fashion.

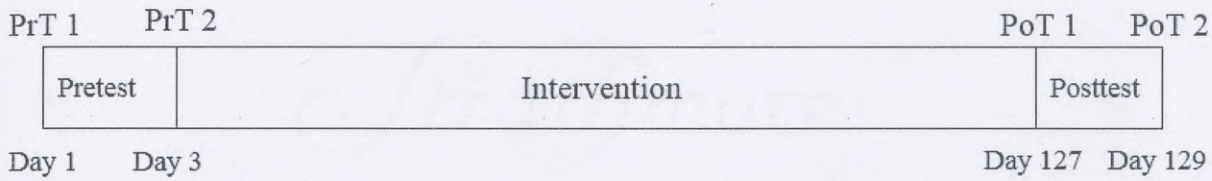

Figure 1. Timeline of participation. PrT 1 pre-testing consisting of the anthropometrics, body composition, and VO_2peak; PrT 2 consisting of a Wingate test, 2 minutes of push-ups, and 2 minutes of sit-ups; PoT 1 post-testing repeating PrT1, PoT 2 repeating PrT 2.

Study Outcomes

Anthropometrics

Body composition was assessed (% fat, % fat free, fat and fat free mass, and total body mass) using a BOD POD Composition System (Concord, CA) following manufacturer instructions. Height was measured in centimeters (cm) using a standometer. Neck and waist, circumference were taken at the closest cm using a Gulick tension rod tape measure following Army Regulation (AR) 600-9 protocol [26].

Cardiorespiratory Variables

Participants performed a modified incremental treadmill test to measure VO_2peak. Participants self-selected a running speed equivalent to their last recorded 2-mile time. The speed remained constant as the grade increased by 1% every minute until volitional exhaustion, a rating of perceived exertion greater than 17, a heart rate within 10 beats of their age predicted max (220 – age), a respiratory exchange ratio value greater than 1.15, or a plateau in oxygen consumption with increasing workload. Throughout the test, respiratory gases were measured with a calibrated metabolic cart (ParvoMedics Inc, Sandy UT). A Zephyr bioharness (Medtronic, Annapolis, MD) was worn to continuously monitor heart rate which was recorded every minute as well as RPE

using the Borg scale. Blood pressure was taken every 3 minutes as a safety measure, unless the participant was in their final minute of testing.

Anaerobic measures and Grip strength

To measure anaerobic power, each participant performed a Wingate Anaerobic Test [27] on a braked cycle ergometer (Lode Excalibur, Groningen, NL). Manufacturer recommendations were followed for calibration and seat adjustments. Subjects warmed up by pedaling at a self-selected pace for 4 minutes at 50 Watts (W). For the 5th minute, participants were directed to pedal at 60 rpms and then sprint as fast as possible for the final 10 seconds of the warm up. They were encouraged to keep pedaling as fast as possible once the 30 second test started. The resistance was set at 0.7 Nm/Kg which was calculated by the computer software associated with the cycle ergometer (Excalibur Sports, Lode B.V., Netherlands). Anaerobic power was determined as the peak power output (W) and anaerobic capacity as the average output (W) for the duration of the test. Fatigue index was measured to indicate the power lost over the course of the cycle test. The Wingate Test has been proven as a reliable measure of high intensity, short duration performance [28].

A calibrated hand grip dynamometer (JAMAR; Bolingbrook, IL) was used to measure grip strength. The highest measure of the three trials was recorded. Grip strength has been previously proven as a reliable measure of upper body strength and is utilized in many military specific tasks like firing weapons, climbing ropes, and carrying equipment [29].

Statistical Analysis

All data was analyzed using SPSS Statistics v 23 (IBM Corp, Chicago, IL). Descriptive statistics were used to calculate mean ± standard deviation (SD) of demographics and study outcome variables. Independent sample t-tests were used to analyze differences between baseline

values between groups (NMT vs. MT). A 2x2 (time x group) repeated measured ANOVA was used to assess changes in outcome variables after 5 months. Statistical significance was set at $p < 0.05$.

RESULTS

Participants

Twenty-two participants completed the pre-testing, however 6 participants did not complete post-testing (Figure 2). In addition, to maintain compliance participants began post-testing at 4.5 months due to changes to their training calendars and permanent change of station moves. The intervention period consisted of 18.1±1.9 weeks. The study maintained 73% compliance, with 8 participants in the MT and 8 participants in the NMT groups completing the study (Figure 2). Baseline information represents all participants tested (n=22), while intervention information represents only participants that completed the study (n=16). Overall, the groups combined had a mean age, height, and weight that were 26.9±1.2 years, 1.76±0.6m, and 83.1±11.1kg, respectively (Table 1). Table 2 represents physical fitness assessments after 4.5 months of intervention. The NMT and MT groups had a mean intervention length of 18.8±2 weeks and 17.4±1.2 weeks (P=0.14).

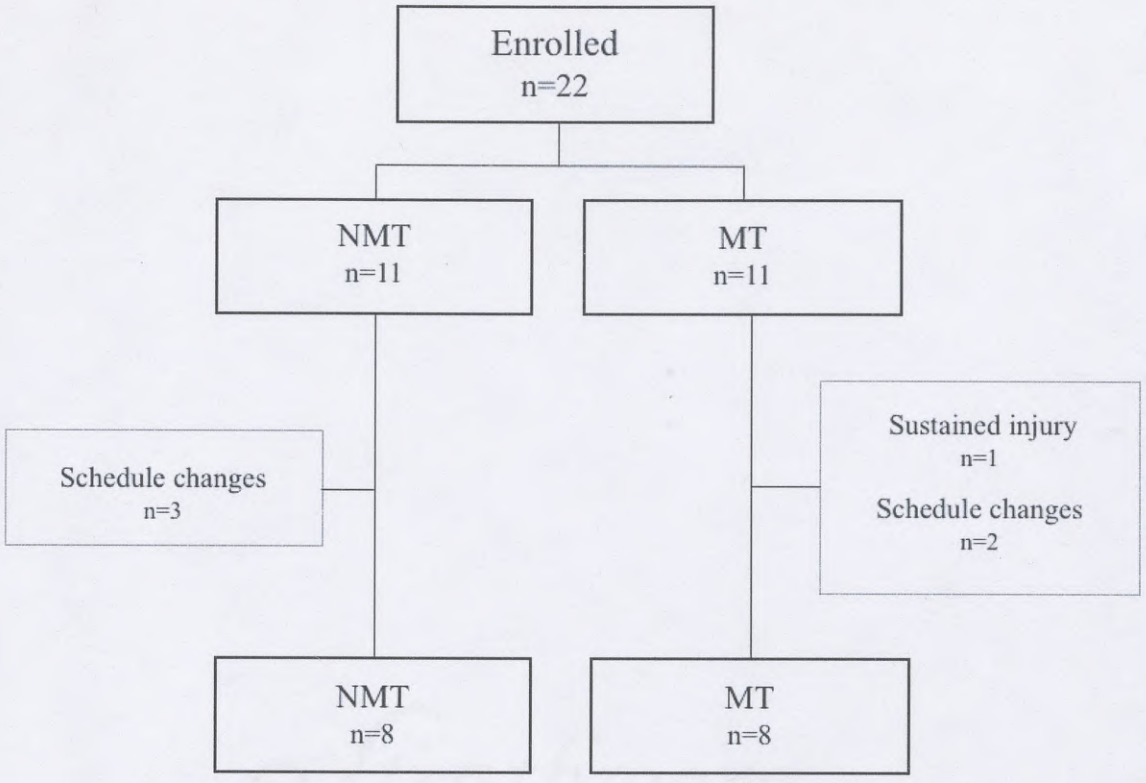

Figure 2. Study recruitment and compliance during the 5-month intervention. NMT non-mandated training; MT mandatory training.

Table 1. Demographic and physiological variables pre-intervention.

	NMT (n=11)	**MT** (n=11)	**All** (n=22)
Demographics			
Age (y)	27±1	27±0	26.9±1.2
Height (m)	1.75±0.78	1.76±0.62	1.76±0.61
Weight (kg)	82.8±11.8	83.1±0.9	83.1±11.1
Service time (years)	4±0	5±1	4.6±0.7
Airborne (n)	7	9	16
Air Assault (n)	7	6	15
Ranger Tab (n)	5	7	12
EIB (n)	2	6	8
Branch:			
Infantry (n)	5	8	13
Armor (n)	6	3	9
Body Composition			
BF (%)	21.5±6.4	17.1±6.5	19.3±6.7
FM (kg)	18.3±7.9	14.4±6.1	16.4±7.2
FFM (kg)	65.6±7.06	68.9±9.85	67.3±8.5
Neck (cm)	37.9±1.1	38.2±1.9	38.1±1.5
Waist (cm)	87.0±8.2	87.3±6.7	87.1±7.3
Cardiorespiratory			
VO_2Peak ($ml \cdot kg^{-1} \cdot min^{-1}$)	45.9±2.5	48.4±3.8	47.2±3.4
HR Max (bpm)	193±10	192±5	192.6±7.8
Resting HR (bpm)	69±11	64±8	66.8±9.5
Resting SBP (mmHg)	125±11	129±13	127±11.8
Resting DBP (mmHg)	79±6	78±9	78.4±7.39
Anaerobic			
Peak Power (W)	1081.3±222.6	980.5±212.4	1030.9±218.9
Mean Power (W)	548.6±68.0	560.0±83.0	554.3±74.3
Rate of Fatigue (%)	82.4±7.9	74.3±12.5	78.4±11.0
Muscular Strength			
Push-Ups	64±11	62±15	63.1±13.1
Sit-Ups	73±6	76±10	74.3±8.4
Grip Strength (kg)	50.3±4.9	51.1±5.0	50.8±4.9

MNT, non-mandated training; MT, mandatory training; EIB, expert infantry badge; BF, body fat; FM, fat mass; FFM, fat free mass; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; SBP, systolic blood pressure; DBP, diastolic blood pressure. No significant difference between groups ($P>0.05$).

Table 2. Differences in descriptive and physiological variables between pre- and post-testing

	NMT n=8		MT n=8	
	PrT	PoT	PrT	PoT
Body Composition				
Body Fat (%)	23.9±6.7	24.4±6.2	17.2±4.7	15.6±4.6
FM (kg)	21.2±8.5	21.7±8.5	14.3±4.6	12.8±4.2
FFM (kg)	66.7±7.7	64.9±6.0	68.0±11.0	69.7±9.1
Neck (cm)	38.2±1.1	37.2±2.9	38.4±2.1	38.1±1.7
Waist (cm)	88.7±9.3	90.6±8.0	85.7±6.7	85.2±5.3
Cardiorespiratory				
VO_2Peak ($ml \cdot kg^{-1} \cdot min^{-1}$)	45.7±2.4	48.3±3.9	48.9±3.8	53.4±4.3
HR Max (bpm)	193±10	190±8	191±8	188±8
Resting HR (bpm)	65±6	64±6	64±9	64±8
Resting SBP (mmHg)	122±9	124±10	132±13	131±10
Resting DBP (mmHg)	78±5	78±6	83±8	81±4
Anaerobic				
Peak Power (W)	1180±209	1184±243	901±139	1047±221
Mean Power (W)	566±48	538±43	542±91	547±107
Muscular Strength				
Push-Ups	59±6	62±6	60±15	67±12
Sit-Ups	72±5	73±9	78±11	80±14
Grip Strength (kg)	51.0±5.6	49.0±5.4	50.6±4.3	51.7±8.6

PrT, pre-test; PoT, post-tests, FM, fat mass; FFM, fat free mass; SBP, systolic blood pressure; DBP, diastolic blood pressure. No significant interaction between groups ($P>0.05$).

Body Composition and Anthropometrics

Neck and waist circumferences were maintained within NMT ($P=0.45$) and MT ($P=0.27$) following the intervention period. BMI was maintained in the NMT group (PoT: 28.0±1.1) while the MT group slightly decreased (26.1±2.9 to 25.7±2.3, $P=0.20$) due to a loss in body weight. Although there was not group by time interaction ($P=0.12$), the MT group than the NMT group (13.5±2.3kg vs 21.5±2.3kg; respectively, $P=0.03$). The NMT group decreased fat free mass by 2.3% while the MT group increased by 3.0% ($P=0.99$). Figure 3 represents the dependent variable (BF%) between the groups pre- and post-intervention. The NMT group had a significantly higher

percent fat than the MT group (24.2±1.9% vs 16.4±1.9%; respectively, P=0.01) however, a group by time interaction was not observed (P=0.12).

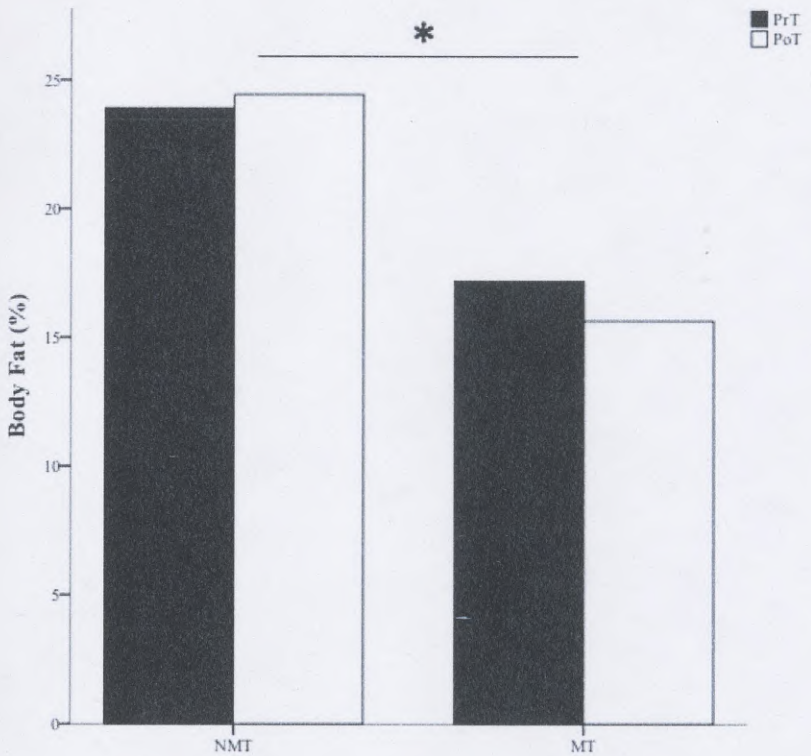

Figure 3. Body fat between groups pre- to post- intervention. MNT, non-mandated training; MT, mandatory training; PrT, pre-test; PoT, post-test. *Main effect of group P<0.05.

Cardiorespiratory Variables

Participants completed the pre- VO_2peak test in 8.6±1.3 minutes and post- in 9.4±1.5 minutes (P=0.02), ranging between 7-9 mph (P=0.07). Resting HR, SBP, and DBP did not change (P>0.05). Overall, both groups increased rating of perceived exertion (RPE) during the last stage of the VO_2peak test from 17±2 to 18±4 (P=0.04) after the intervention period, however no group differences were observed (P=0.57). Max HR decreased by 1.5% across groups (193±9bpm to 189±8bpm, P=0.04) but the group interaction was not significant (P=0.92). Figure 4 represents the differences between groups from pre- to post-testing. A significant main effect of time was present

indicating VO_2peak improved across all participants from pre- to post-testing (P<0.001). A main effect of group revealed that the MT group exhibited significantly greater VO_2peak compared to the NMT group (P=0.03), however no interaction was found (P=0.15).

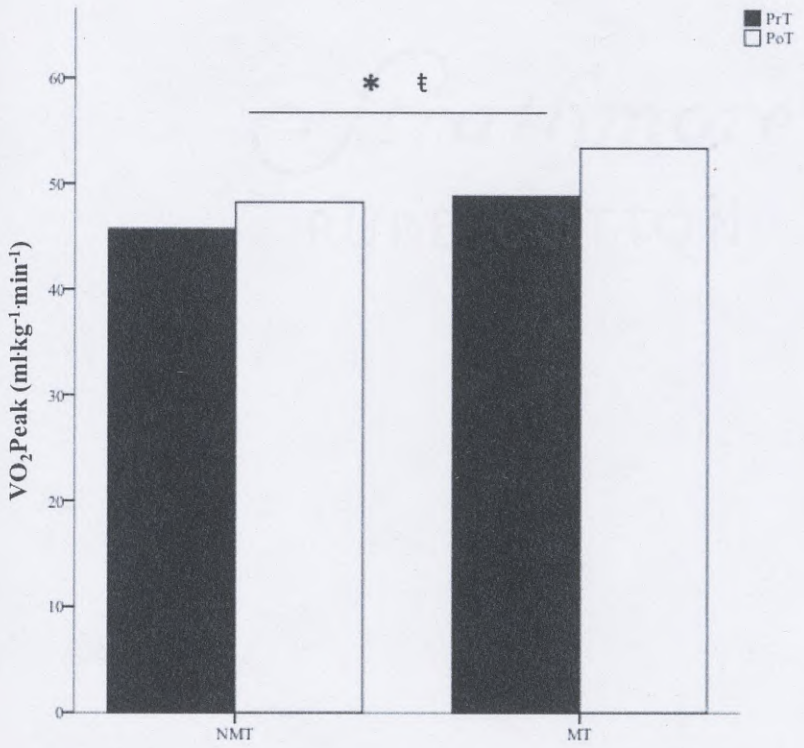

Figure 4. VO_2peak between groups pre- to post-intervention. MNT, non-mandated training; MT, mandatory training; PrT, pre-test; PoT, post-test. *MT significantly greater than NMT, P<0.05. ^{t}PoT significantly greater than PrT across both groups, P<0.05.

Anaerobic Measures and Muscular Strength

Rate of fatigue increased in both groups, across both groups (78.2±12.1% to 84.0±11.8%, P=0.06) however no significant interaction between time and group was observed (P=0.18). Figure 5 represents the differences in peak power between groups from pre- to post-testing. The NMT produced a significantly higher power output compared to the MT group (P=0.03). The MT group improved peak power by 17.7% (900.6±139.1W to 1046.8±220.7W, P=0.22) while the NMT group maintained (1179.9±208.9W to 1183±243.5W, P=0.22), but no interaction was observed (P=0.25).

Mean power output did not change across the intervention in both groups (P=0.17). Overall, the number of push-ups performed across both groups over the intervention period increased by 8.4% (59.4±11.1 to 64.4±9.3, P=0.01) however, no significant interaction between groups and time was observed (P=0.30). Sit-up performance (P=0.71) and grip strength did not change in either group from pre- to post-testing (P=0.51).

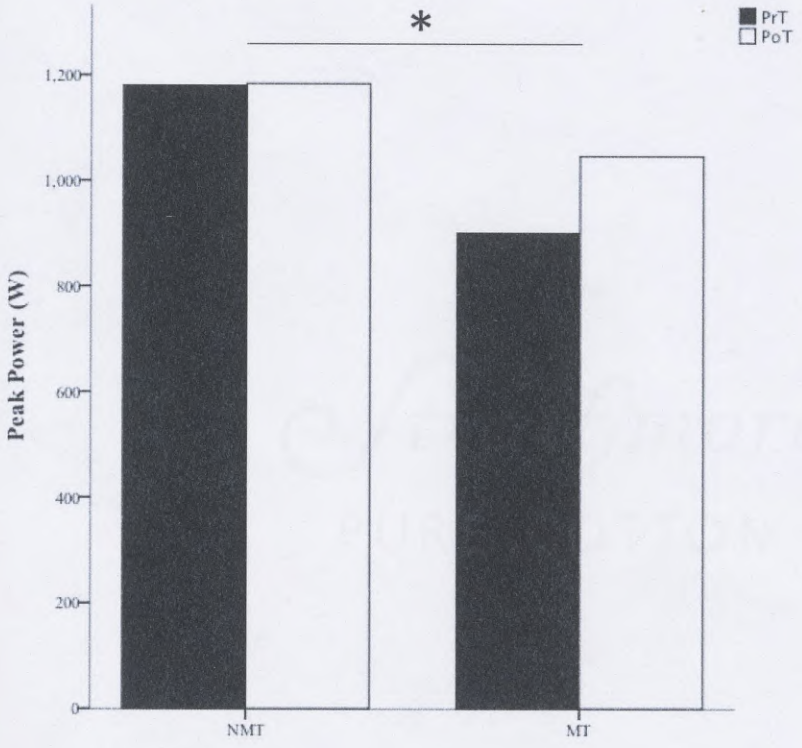

Figure 5. Peak power between groups pre- to post-intervention. MNT, non-mandated training; MT, mandatory training; PrT, pre-tests; PoT, post-tests. *Main effect of group P<0.05.

DISCUSSION

The primary purpose of this study was to investigate the changes in body composition, cardiorespiratory fitness and muscular fitness in army captains when PT is not mandatory. This is

the first study to investigate US Army Captains over an extended period of time. To date, there are no known publications comparing officer ranks and physical performance. There were no differences in the baseline fitness assessments between MT and NMT, suggesting the recruited participants were of the same level of fitness at the beginning of the study. There were no significant differences from pre- to post-testing between groups, suggesting both saw similar changes after 4.5 months. Thus, mandated exercise does not appear to affect fitness and performance in these subjects.

Body weight, neck, and waist circumferences were maintained during the intervention period. The NMT group increased percent change in body fat by 3.3% while the MT group decreased by 7.7%. The NMT group increased BMI by 0.50% while the MT group decreased by 1.1%. BMI and waist circumference are used to estimate body fat percentage according to AR 600-9. The soldiers in this study meet the current military standards in regards to AR 600-9 (Appendix F) however obesity and metabolic syndrome are major limiting factors for many potential army recruits [8]. This sample of participants are all assigned to Infantry or Armor units where maintaining top physical fitness is necessary to complete occupational tasks [18]. The differences between general army and infantry officer fitness standards are evident in the training manuals. The IBOLC (Infantry Basic Officer Leadership Course) preparation program is separated into two 4 week cycles. The training program involves Olympic lifts, long distance runs, and achieving almost perfect APFT scores [30]. The fitness manual for new recruits of all ranks involves low impact, body weight exercises designed for those with minimal exercise experience with the goal of simply passing the APFT [2]. Training adaptations like decreased body fat and increased fat free mass are imperative to achieving the optimal fitness state associated with successful infantry officers [4].

VO_2peak increased by 5.5% in the NMT group and 9.4% in the MT group, however, no interaction was observed (P=0.15), while heart rate max decreased by 1.5% across both groups. The current study examined the changes over 18±2 weeks and found increases in performance, suggesting both groups did participate in an adequate amount of aerobic training to improve cardiorespiratory measures (P>0.05). Previous research has reported soldiers prefer resistance training and do not perform aerobic exercise in their free time, yet this population improved VO_2peak performance, suggesting they participated in sufficient cardiorespiratory activity to elicit change [12]. A possible explanation for the imrpovement could be the rank observed. Combat arms captains have had to oversee APRT and ensure all soldiers in their platoon pass an APFT. They also have served for 4-5 years in which they have directly expirienced the need to stay physically fit to complete job requirements.

Peak power increased by 17.7% in the MT group while the NMT group maintained peak power output over the intervention period thus no interaction was present (P=0.25). Both groups maintained mean power from pre- to post-testing. The MT group increased rate of fatigue by 12% which implies they rapidly decreased the ability to sustain power output over the 30 second test. The NMT group did not change rate of fatigue before and after the intervention period, suggesting exercise was not related. The MT group improved push-ups by 13.5% compared to 6.1% in the NMT group (P=0.30) while sit-ups stayed the same for both groups (P=0.71). This implies that ARPT involves more push-up repetitions or upper body training than soldiers do during times of non-mandated exercise. However, both groups exceeded the 45 repetition minimum requirements according to pass an APFT [2]. Grip strength also remained unchanged before and after intervention in both groups. These findings suggest ARPT participation does not improve muscular endurance but does train to maintain or improve APFT events.

Rintamäki et al. (2012) found soldiers tested at the beginning and end of a 4-month deployment, where PT was not required, maintained performance on run time, push-ups, and grip strength while increasing repetitions of sit-ups. Leadership experience promotes adherence to regular physical activity even when it is not required or monitored [31]. Combat officers are required and trained to practice critical thinking therefor are capable of making thoughtful decisions on training time [32]. Smith et. al. (2002) conducted a review of injuries in light infantry soldiers and found officers had less occurrences of musculoskeletal injuries compared to the junior enlisted men observed [33]. This supports the current findings by suggesting service time and experience leads to better exercise habits and therefor reduced injury rates. Furthermore, ROTC cadets decreased VO_2max by 4.3% in 12 weeks without mandated exercise [20]. Which means the officer candidates lack the active duty experience associated with extreme working conditions where increased fitness levels are crucial to success [18, 34].

Anderson et al. (2017) surveyed 6290 male infantry soldiers and found participating in individual training positively impacted APFT scores. Among the soldiers that received the top third APFTP scores from the sample; 39% led unit PT, 46% ran more than 11 miles per week, and 41% performed resistance training more than 3 times per week. These sessions were all in addition to mandatory PT [35]. This suggests solely participating in the ARTP is not enough exercise to achieve competitive APFT scores and the ARPT is not challenging enough. Heinrich et. al. (2012) compared the ARTP to a novel program designed for mission essential fitness (MEF) that consisted of high intensity circuit training directly related to occupational tasks and found soldiers improved body composition and demonstrated increased physical fitness in 15 sessions over 8 weeks [6]. The proposed strength and conditioning program focused on swift, multidirectional movements that simulated combat situations. The MEF subjects also improved performance on APFTP components

(push-ups, sit-ups, and a 2-mile run) [6]. Together, these studies support the findings that the APRT has limited benefits in improving components of fitness but also military specific assessments [36].

A limitation for this study was compliance adherence. Although only 73% of the recruited subjects returned for post-test evaluations, no significant differences were examined in body composition, cardiorespiratory fitness, anaerobic power, or muscular strength. Also, the physical activity performed by the NMT group was not controlled during the intervention period. In an attempt to capture physical activity researchers requested activity logs be completed, however participants did not comply. The IPAQ was administered at PoT 2 when most subjects were either transitioning back to their units which required PT participation or in the process of moving to a new unit. These factors made diminished the credibility of utilizing the questionnaire for analysis.

CONCLUSION

Non-mandated PT does not elicit significant changes in Army Captains body composition, aerobic performance, muscular strength, or power output after 18±2 weeks. This suggests combat arms officers are capable of maintaining fitness without APRT participation. Both groups either maintained or improved key fitness components such as VO_2peak, heart rate max, peak power, mean power, push-ups, sit-ups, and grip strength ($P<0.05$). Further research is warranted to explore the relationship between officer ranks and physical performance.

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COLUMBUS STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD

Informed Consent Form

You are being asked to participate in a research project conducted by Emily Garrett, a Kate Early in the Exercise Science Lab at Columbus State University.

I. Purpose:

The purpose of this project is to examine physical and performance changes in soldiers over 5 months without required exercise.

II. Procedures:

You will come into the CSU Exercise Science Lab and be presented with an overview of the study and take a Physical Activity Readiness Questionnaire (PAR-Q). Once all questions have been addressed and compliance to protocol has been obtained by signing the consent you will have your body measurements, exercising oxygen uptake, and grip strength tested with well researched methods. At least two days later, you will be asked to return to have your intense exercise ability tested. The tests should take about an hour all together for the first testing day and 15 minutes for the short term, high intensity test. Heart rate, blood pressure, and perceived exertion rating will be monitored and recorded throughout all tests. 2.5 months after testing, you will be asked to complete a 7-day exercise log. 5 months after the initial testing, you will be asked to come in and repeat each test. The data can be used for future research and you will remain anonymous in publication.

III. Possible Risks or Discomforts:

The possible discomforts include exhaustive exercise side effects. They will be limited by ending the tests early if you are showing unfavorable signs like extremely heavy breathing, extra thirsty, or very tired. Water, carbohydrate beverages, and well-balanced snacks will be readily available and given upon immediate request.

IV. Potential Benefits:

You will gain knowledge of how physically fit you are which will help guide your exercise programming. The research and community will learn what impacts 5 months of decreased exercise does to someone's personal health and fitness.

V. Costs and Compensation:

There is no compensation for the participants.

VI. Confidentiality:

You will be randomly assigned a computer-generated number. The data will be kept in a

password protected file on a computer in the CSU Exercise Science Lab. Only the principal investigators will have access to the de identified data. It will be archived for future use of the data.

VII. Withdrawal:

Your participation in this research study is voluntary. You may withdraw from the study at any time, and your withdrawal will not involve penalty or loss of benefits.

For additional information about this research project, you may contact the Principal Investigator, Emily Garrett at 434-327-6613 or velez_emily@columbusstate.edu. If you have questions about your rights as a research participant, you may contact Columbus State University Institutional Review Board at irb@columbusstate.edu.

I have read this informed consent form. If I had any questions, they have been answered. By signing this form, I agree to participate in this research project. [If participation is dependent upon the participant being 18 years of age or older, you must include a statement here confirming the age.]

_____ _____

Signature of Participant Date

Appendix B. ANNOTATED BIBLIOGRAPHY

Abt, J. P., K. Perlsweig, T. Nagai, T. C. Sell, M. D. Wirt and S. M. Lephart (2016). "Effects of Age and Military Service on Strength and Physiological Characteristics of U.S. Army Soldiers." Military Medicine 181(2): 173-179.

This article sought out to compare age cohorts and physiological measures. The older and more experienced soldiers increased fat mass and decreased performance. Subsequently, this group also acquired the most service time. The most unfavorable physical performers were from groups 30-34 years old and with 11-15 years of service. This article validates the Wingate as an effective tool for assessing short term high intensity ability and also validates the Bod Pod for measuring body composition in military personnel.

Anderson, M. K., T. Grier, M. Canham-Chervak, T. T. Bushman, B. C. Nindl and B. H. Jones (2017). "Effect of mandatory unit and individual physical training on fitness in military men and women." American Journal of Health Promotion 31(5): 378-387.

Anderson et. al. (2017) examined 6290 males and 558 females across 3 different infantry brigades. The purpose of the study was to evaluate the effects of individualized training, in addition to mandatory PT and assess any associated risk factors. A self-administered questionnaire was used determine the top 33% PT test performers. Those that reported training in addition to unit PT were more likely to be in the top 33% and have more positive fitness components. This article quantifies and associates physical activity time with APFTP scores. These results support the current study by reinforcing the evidence that mandatory PT alone does not translate to greater PT scores.

Army, U. (2012). "Fm 7-22 Army physical readiness training." Washington, DC: Headquarters, Department of the Army.

The Field Manual (FM) 7-22 describes the Army's systematic approach to prepare all soldiers for the physical demands necessary for job assignments and combat situations through physical activity. The training sessions for units are mandatory and are at least one hour long, five days a week. These sessions usually include a mixture of cardiorespiratory activity and strength training but the specific exercise programming is at the commander's discretion. FM 7-22 also provides details of the APFT procedures used to assess fitness. Overall, the manual is very vague and does not provide any background rationale as to why the procedures were chosen.

Bar-Or, O. (1987). "The Wingate anaerobic test an update on methodology, reliability and validity." Sports medicine 4(6): 381-394.

The Wingate anaerobic test was originally developed in Israel in the 1970's as a simple means of measuring supramaximal exercise response. The article summarizes the methodology for test administration and an explanation of the measured variables. This is referenced as a validated means of assessing anaerobic fitness and performance. The protocol utilized was a 30 second Wingate test on a cycle ergometer.

Bartone, P. T., R. R. Roland, J. J. Picano and T. J. Williams (2008). "Psychological Hardiness Predicts Success in US Army Special Forces Candidates." International Journal of Selection & Assessment 16(1): 78-81.

Bartone et. al. (2008) set out to compare Special Forces candidates scores of the Dispositional Resilience Scale with successful course completion. The results indicated that psychological hardiness is highly related to graduation rates. This attributes to

characteristics needed for their occupation like stress tolerance and performance success. This psychological hardiness can be compared to combat arms due to the similarities in job expectation. This study supports the use of anaerobic power and grip strength for military specific tasks.

Bernstein, S. A., M. Lo and W. S. Davis (2017). "Proposing Using Waist-to-Height Ratio as the Initial Metric for Body Fat Assessment Standards in the U.S. Army." Military Medicine 182(S1): 304-309.

This study sought to identify a simpler and more straightforward manner in which AR 600-9, which sets out the body weight-to-height standards expected of soldiers in the U.S. Army, may be successfully met. It was proposed that using a waist-to-height ratio (WtHR) in place of the current AR 600-9 standard may be a more effective methodology. While on a one-year combat deployment to Iraq, 34 male and 8 female soldiers were evaluated for weight and body fat loss by battalion medical staff. Bernstein et al. observed the percentage of soldiers meeting body fat standards of WtHR $\leq$ 55% compared to those who had not. The researchers discovered that soldiers successfully attaining a WtHR $\leq$ 55% was an effective predictor of soldiers' achievement of both body fat standards in accordance with AR 600-9 and of achieving a professional military appearance. This study thoughtfully reviewed the procedures and standardized methods the Army uses for body composition assessment and also stated the commander's role in the process.

Farina, E. K., J. C. Taylor, G. E. Means, K. W. Williams, N. E. Murphy, L. M. Margolis, S. M. Pasiakos, H. R. Lieberman and J. P. McClung (2017). "Effects of Combat Deployment on

Anthropometrics and Physiological Status of U.S. Army Special Operations Forces Soldiers." Military Medicine 182(3/4): e1659-e1668.

Farina et. al. (2017) set out to determine the impact of combat deployments on the anthropometrics or the biochemical markers of physiological status in a population of U.S. Army Special Operations Forces soldiers with multiple prior deployments. While the majority of the soldiers did experience some adaptive changes (including grip strength, exercise time commitment, increased lean mass, and decreased levels of cortisol) Farina et. al. discovered that the physiological status of these soldiers was, in the absence of major unit casualties, minimally impacted by combat deployment. Levels of sex hormone–binding globulin were also observed. Farina et. al. concluded, in part, that future study may be necessary to more fully understand potential degradation and optimization of health and physiological status of U.S. Army Special Operations Forces soldiers, with an emphasis on in-theater metrics. This article supports the current study's claim that mandatory PT does not significantly increase physical performance.

Foster, C., C. V. Farland, F. Guidotti, M. Harbin, B. Roberts, J. Schuette, A. Tuuri, S. T. Doberstein and J. P. Porcari (2015). "The Effects of High Intensity Interval Training vs Steady State Training on Aerobic and Anaerobic Capacity." Journal of Sports Science & Medicine 14(4): 747-755.

In this study, Foster et. al. compared the effects of two different High Intensity Interval Training (HIIT) protocols with steady-state exercise training in terms of aerobic and anaerobic capacity over the course of 8 weeks of training. The study included 55 untrained college-aged subjects who were randomly assigned to one of three training groups; 24 training sessions (3 sessions per week) were completed during the 8-week

period. Foster et. al. noted increases in VO_2max and peak power output among all groups, with no significant difference between the groups. Decreased levels of satisfaction and enjoyment with the assigned protocols over the course of the study were also discovered with no significant difference between the groups. Overall the Tabata HIIT protocol was the ranked as the least enjoyable exercise program. Although HIIT protocols are time efficient, they do not surpass conventional exercise training in terms of measurable results in sedentary college-age individuals. The authors also found that familiarization trials in a young, healthy population do not elicit significant changes during testing.

Grier, T., M. Canham-Chervak, V. McNulty and B. H. Jones (2013). "Extreme Conditioning Programs and Injury Risk in a US Army Brigade Combat Team." U.S. Army Medical Department Journal: 36-47.

Grier et. al. sought to determine if two new training programs elicited an effect on injury rates and physical fitness in an infantry brigade. The first training program was developed by physical therapist that work closely with infantry units and focused on aquatic exercises, agility circuits, core conditioning, and speed interval training. This Advanced Tactical Athlete Conditioning (ATAC) program was designed to have more occupational and combat applications. The second training program was comprised of elements from the Ranger Athlete Warrior program and CrossFit. This Extreme Conditioning Program (ECP) was incorporated into mandatory unit PT sessions. Overuse injuries increased for both training programs and APRT participation. The risk for injury grew as the distance covered during PT runs and BMI increased. Injury risk was also associated with poor performance on the APFT runs. The lowest rates of injuries were in those that

participated in resistance training 1-3 sessions per week. This study provided extensive background information on the occupational demands of infantry soldiers.

Hansen, A. L., B. H. Johnsen, J. J. Sollers, 3rd, K. Stenvik and J. F. Thayer (2004). "Heart rate variability and its relation to prefrontal cognitive function: the effects of training and detraining." European Journal Of Applied Physiology 93(3): 263-272.

Hansen et. al. sought to determine the relationship between physical fitness, heart rate variability, and cognitive function in a population of 37 male sailors in the Royal Norwegian Navy. participants completed an 8-week long training regimen including an initial cognitive pre-test. The subjects were then assigned to either a trained group (which continued with training) or a detrained group (which was withdrawn from training for 4 weeks). Once the 4-week intervention period was completed, the sailors were given a cognitive retest (measured using a continuous performance task and a working memory test). Subjects were also tested on physical markers, including VO_2max and heart rate variability. No significant differences were examined between groups in the cognitive function test but the detrained group did elicit a significant drop in VO_2max and a resting heart rate variability compared to the trained group. This article was used as a major source of detraining information and was compared as a shorter intervention period compared to the current study.

Heinrich, K. M., V. Spencer, N. Fehl and W. S. Carlos Poston (2012). "Mission essential fitness: comparison of functional circuit training to traditional Army physical training for active duty military." Military medicine 177(10): 1125-1130.

Heinrich et. al. (2012) compared fitness, physiological, and body composition changes in army personnel when participating in a novel exercise program designed for occupational

success or the APRT after 8 weeks (15 sessions). The new program was developed with circuits of exercises that specifically pertain to combat movements. Significant improvements were observed in push-ups, bench press, and flexibility while run time performance decreased. This study supports the use of occupational specific exercises to improve fitness in soldiers.

Heir, T. (1998). "Musculoskeletal injuries in officer training: one-year follow-up." Military medicine 163(4): 229-233.

This study investigated the frequency and type of musculoskeletal injuries during one year of initial officer training. Overall, 60% of cadets reported injuries with most occurring in the first 6 weeks. Women and older cadets reported significantly more injuries than their counterparts. The results suggest a gradual introduction to military training is necessary to reduce the risk of injuries. This study strengthens additional references that state the unfavorable physical performance by officer cadets.

Hoffman, J. R. (1997). "The relationship between aerobic fitness and recovery from high-intensity exercise in infantry soldiers." Military medicine 162(7): 484-488.

Hoffman et. al. (1997) set out to analyze the relationship between aerobic fitness recovery and recovery from high intensity exercise in 197 infantry soldiers. The results indicated the top aerobic performers recovered to resting heart rates faster than their less fit peers. The primary purpose of this article, within the current study, is to serve as a resource for occupation specific information within infantry soldiers and to report the aerobic performance benefits of improved body composition.

Knapik, J. (1989). "The Army Physical Fitness Test (APFT): a review of the literature." Military medicine 154(6): 326-329.

This review analyzes the three events in the APFT; a 2-mile run, 2 minutes of push-ups, and 2 minutes of sit-ups. The authors reported a strong relationship between the 2-mile run and predictions of VO_2max as well as support for simultaneously assessing muscular strength and endurance with the push-ups and sit-ups. While the article cites supporting references to justify the usefulness of the APFT, there is a disconnect on the applications to physical fitness. The review was primarily utilized as a source explaining the APFT in a more reader friendly manner than the Army field manual.

Knapik, J. J., W. Rieger, F. Palkoska, S. Van Camp and S. Darakjy (2009). "United States Army physical readiness training: rationale and evaluation of the physical training doctrine." The Journal of Strength & Conditioning Research 23(4): 1353-1362.

The purpose of the review was to provide rationale and evaluations of the APRT. The doctrine states the guidelines are provided to improve soldiers' physical capabilities for military operations by improving physical fitness, preventing injuries, ensure progressive training, and develop self-confidence and instilling discipline. The review claims adherence to the APRT increases APFT scores and improves performance in military specific tasks like weighted runs and obstacle courses. The authors also reported fewer incidences of injury after following the APRT for 8 weeks. While the review provided applicable information, the main findings were reported in an ambiguous manner.

Lester, M. E., J. J. Knapik, D. Catrambone, A. Antczak, M. A. Sharp, L. Burrell and S. Darakjy (2010). "Effect of a 13-month deployment to Iraq on physical fitness and body composition." Military medicine 175(6): 417-423.

The purpose of this study was to evaluate the changes in body composition, strength, aerobic endurance, and power in 73 combat arms soldiers before and after a 13-month deployment. While aerobic endurance decreased and fat mass increased, upper and lower body strength significantly improved as well as upper body power. An activity questionnaire also provided insight as the type of exercise soldiers prefer when PT is not mandated. Aerobic performance and sport activities are not performed when not required. A major limitation to the current study is the lack of information obtained on types of physical activity over the intervention period.

Liguori, G., K. Krebsbach and J. Schuna Jr (2012). "Decreases in maximal oxygen uptake among army reserve officers' training corps cadets following three months without mandatory physical training." International Journal of Exercise Science 5(4): 354.

Given that Army ROTC cadets are held to a standard of mandatory physical training during the academic year, and are not held to such a standard during the summer, this study sought to determine whether there is any significant changes in cadet VO_2max at the end of the summer. Graded exercise treadmill tests were administered to participants in the late spring and early fall of 2010. Liguori et. al. (2012) discovered that there was a significant decrease in VO_2max among ROTC cadets of both genders after 12 weeks of non-mandated PT.

Lyons, G. M. and J. W. Masland (2015). Education and Military Leadership. A Study of the ROTC. Princeton, New Jersey, Princeton University Press.

This book outlines the development and implementation of the ROTC program in colleges and universities. While leadership expectations have adjusted to meet the demands of the military, the cadets are commissioning undertrained and unprepared. The reference is primarily cited to bolster the argument regarding ROTC cadets and the need for more relatable career experience.

Mikkola, I., S. Keinänen-Kiukaanniemi, J. Jokelainen, A. Peitso, P. Härkönen, M. Timonen and T. Ikäheimo (2012). "Aerobic performance and body composition changes during military service." Scandinavian journal of primary health care 30(2): 95-100.

The aim of this study was to determine the association of aerobic performance with body composition changes during military service. BMI was used as the determining factor for the 945 men. The researchers discovered that favorable changes in BMI are associated with improved aerobic performance. This was especially true for overweight and obese men. This study provides background information on training adaptations seen in soldiers that have recently enlisted.

Mujika, I. and S. Padilla (2000). "Detraining: Loss of Training-Induced Physiological and Performance Adaptations. Part II: Long Term Insufficient Training Stimulus." Sports Medicine 30(3): 145-154.

Mujika et. al. (2000) compiled a review consisting of a multitude of physiological and performance variables impacted by 4-8 weeks of detraining. While the authors described detraining adaptations from the mitochondrial and enzymatic levels to muscle performance, the primary focus was placed on reviewing maximal oxygen consumption, heart rate, cardiac output, endurance performance, heart rate, recovery heart rate, and

blood pressure. The measurements are more applicable to current study and relevance in the target audience.

Nindl, B. C., J. W. Castellani, B. J. Warr, M. A. Sharp, P. C. Henning, B. A. Spiering and D. E. Scofield (2013). "Physiological Employment Standards III: physiological challenges and consequences encountered during international military deployments." European Journal Of Applied Physiology 113(11): 2655-2672.

Nindl et. al. (2013) examined the effects of physiological demands on soldiers in harsh environment deployments. Aerobic capacity, load carriage, musculoskeletal injuries, environmental exposure hazards, traumatic brain injury, and post-traumatic stress disorder were observed. The results indicated that aerobic capacity decreased, the most prevalent injuries were musculoskeletal, and post-deployment concerns still exist for both traumatic brain injury and post-traumatic stress disorder. This study provides occupational specific information regarding unfavorable conditions and physical activity expectations while deployed.

Oliver, J. M., J. D. Stone, C. Holt, S. C. Jenke, A. R. Jagim and M. T. Jones (2017). "The Effect of Physical Readiness Training on Reserve Officers' Training Corps Freshmen Cadets." Military Medicine 182(11): e1981-e1986.

The purpose of this study was to examine the training effects of the APRT in ROTC cadets over their freshmen year of college. Body composition, aerobic fitness, and muscular strength were measured before, midway, and after the academic year. The largest improvements were seen in the APFTP scores with minor changes in the laboratory tests. The results support current research trends stating the APRT alone does

not significantly improve physical fitness. This article provides useful background information regarding ROTC cadets and training habits.

Proctor, S. P. (2008). The Military Health Issues in Occupational and Environmental Health, ARMY RESEARCH INST OF ENVIRONMENTAL MEDICINE NATICK MA.

Regulation, A. (2006). "600-9: The Army Weight Control Program." Washington, DC: US Dept of the Army: 15-38.

Proctor describes occupational and environmental health issues that are unique to military personnel. Garrison, peacetime, mission mobilization, and deployment activities with associated health hazards were explained in great detail. Long term military service and health concerns were also expressed. The primary function of this resource is to note the lack of officer specific information currently published.

Rintamäki, H., H. Kyröläinen, M. Santtila, M. Mäntysaari, R. Simonen, H. Torpo, T. Mäkinen, S. Rissanen and H. Lindholm (2012). "From the subarctic to the tropics: effects of 4-month deployment on soldiers' heat stress, heat strain, and physical performance." The Journal of Strength & Conditioning Research 26: S45-S52.

Rintamäki et. al. (2012) sought to determine the effects of heat stress on male Finish soldiers moving from Finland to Chad, thus undergoing a significant associated increase in atmospheric temperature. The results indicated the soldiers were able to maintain or improve their levels of physical performance during the deployment despite the heat stress. This study enforces the positive relationship between service time and fitness maintained.

Santtila, M., H. Keijo, K. Laura and K. Heikki (2008). "Changes in cardiovascular performance during an 8-week military basic training period combined with added endurance or strength training." Military medicine 173(12): 1173-1179.

This study sought to determine if there were any changes in maximal strength development or cardiovascular performance (VO_2max) over the course of an 8-week basic training program paired with either strength training or emphasized endurance training. The results of 72 basic trainees determined that endurance training improved VO_2max by 12.0% and strength training improved VO_2max by 8.5%. The control group's increase was 13.4%; thus, it was determined that there were no additional improvements in VO_2max generated by the addition of endurance training 3 times a week. Furthermore, Santtila et. al. discovered that basic training positively influenced body composition because body fat and waist circumference decreased in all groups.

Shadrick, S. B. and J. E. Fite (2009). Assessment of the Captains in Command training program for adaptive thinking skills, ARMY RESEARCH INST FOR THE BEHAVIORAL AND SOCIAL SCIENCES FORT KNOX KY.

Shadrick et. al. (2009) examined the effects a novel adaptive thinking training program, Captains in Command, that required students to learn battle command competency of U.S. company-grade officers without an instructor. Thirty-six company-grade officers enrolled in the Maneuver Captain's Career Course (MCCC) at Fort Knox, Kentucky were included in the study. Adaptive thinking training is generally completed under the purview of a live instructor; as such, this was the first evaluation of the Captains in Command program. During the program, the students were instructed in adaptive

thinking techniques, as well as various themes of battlefield thinking. They were then presented with a number of scenarios run by three-dimensional animated characters, which provided the students with pertinent information on the subject, and were asked to respond to the scenarios as if they were company commanders. The results suggested that although the Captains in Command training students demonstrated some improvements in their ability to identify more— and more critical— information than untrained students, irrespective of prior deployment experience, there was no significant difference between the results of this program and those of a comparable instructor-led program on students' performance of adaptive thinking related tasks.

Smith, T. A. and T. M. Cashman (2002). "The incidence of injury in light infantry soldiers." Military medicine 167(2): 104-108.

Smith et. al. (2002) performed a randomized, retrospective review of 339 medical records from a total of 3,195 light infantry soldiers over the course of 13 months. They discovered that U.S. Army soldiers suffer notable loss of training hours due to musculoskeletal injuries. In examining the medical records, the authors sought to determine what specific activities were most associated with injury occurrence in operational infantry soldiers. The results indicated that physical training was responsible for causing 50% of all reported injuries; 30% of these were associated with running. The researchers concluded that physical training is associated with high numbers of injuries in infantry soldiers. However, officers reported the lowest injury occurrences. This reference is one of the few publications to report any statistics on officers.

Appendix C. APFT push-up standards

PUSH-UP STANDARDS

Age group	17-21		22-26		27-31		32-36		37-41		Age group	42-46		47-51		52-56		57-61		62+		Age group
Repetitions	M	F	M	F	M	F	M	F	M	F	Repetitions	M	F	M	F	M	F	M	F	M	F	Repetitions
77					100						77											77
76					99						76											76
75			100		98		100				75											75
74			99		97		99				74											74
73			98		96		98		100		73											73
72			97		95		97		99		72											72
71	100		95		94		96		98		71											71
70	99		94		93		95		97		70											70
69	97		93		92		94		96		69											69
68	96		92		91		93		95		68											68
67	94		91		89		92		94		67											67
66	93		90		88		91		93		66	100										66
65	92		89		87		90		92		65	99										65
64	90		87		86		89		91		64	98										64
63	89		86		85		88		90		63	97										63
62	88		85		84		87		89		62	96										62
61	86		84		83		86		88		61	94										61
60	85		83		82		85		87		60	93										60
59	83		82		81		84		86		59	92		100								59
58	82		81		80		83		85		58	91		99								58
57	81		79		79		82		84		57	90		98								57
56	79		78		78		81		83		56	89		96		100						56
55	78		77		77		79		82		55	88		95		99						55
54	77		76		76		78		81		54	87		94		98						54
53	75		75		75		77		79		53	86		93		97		100				53
52	74		74		74		76		78		52	84		92		96		99				52
51	72		73		73		75		77		51	83		91		94		98				51
50	71		71		72	100	74		76		50	82		89		93		97		100		50
49	70		70		71	99	73		75		49	81		88		92		95		99		49
48	68		69		69	98	72		74		48	80		87		91		94		98		48
47	67		68		68	96	71		73		47	79		86		90		93		96		47
46	66		67	100	67	95	70		72		46	78		85		89		92		95		46
45	64		66	99	66	94	69	100	71		45	77		84		88		91		94		45
44	63		65	97	65	93	68	99	70		44	76		82		87		90		93		44
43	61		63	96	64	92	67	97	69		43	74		81		86		89		92		43
42	60	100	62	94	63	90	66	96	68		42	73		80		84		87		91		42
41	59	98	61	93	62	89	65	95	67		41	72		79		83		86		89		41
40	57	97	60	92	61	88	64	93	66	100	40	71		78		82		85		88		40
39	56	95	59	90	60	87	63	92	65	99	39	70		76		81		84		87		39
38	54	93	58	89	59	85	62	91	64	97	38	69		75		80		83		86		38
37	53	91	57	88	58	84	61	89	63	96	37	68	100	74		79		82		85		37
36	52	90	55	86	57	83	60	88	62	94	36	67	99	73		78		81		84		36
35	50	88	54	85	56	82	59	87	61	93	35	66	97	72		77		79		82		35
34	49	86	53	83	55	81	58	85	60	91	34	64	95	71	100	76		78		81		34
33	48	84	52	82	54	79	57	84	59	90	33	63	94	69	98	74		77		80		33
32	46	83	51	81	53	78	56	83	58	88	32	62	92	68	97	73		76		79		32
31	45	81	50	79	52	77	55	81	57	87	31	61	90	67	95	72	100	75		78		31
30	43	79	49	78	50	75	54	80	56	85	30	60	89	66	93	71	98	74		76		30
29	42	77	47	77	49	75	53	79	55	84	29	59	87	65	92	70	96	73		75		29
28	41	76	46	75	48	73	52	77	54	82	28	58	86	64	90	69	95	71	100	74		28
27	39	74	45	74	47	72	51	76	53	81	27	57	84	62	88	68	93	70	98	73		27
26	38	72	44	72	46	71	50	75	52	79	26	56	82	61	87	67	91	69	96	72		26
25	37	70	43	71	45	70	49	73	51	78	25	54	81	60	85	66	89	68	94	71	100	25
24	35	69	42	70	44	68	48	72	50	76	24	53	79	59	83	64	87	67	92	69	98	24
23	34	67	41	68	43	67	47	71	49	75	23	52	78	58	82	63	85	66	90	68	96	23
22	32	65	39	67	42	66	46	69	48	73	22	51	76	56	80	62	84	65	88	67	93	22
21	31	63	38	66	41	65	45	68	47	72	21	50	74	55	78	61	82	63	86	66	91	21
20	30	62	37	64	40	64	44	67	46	70	20	49	73	54	77	60	80	62	84	65	89	20
19	28	60	36	63	39	62	43	65	45	69	19	48	71	53	75	59	78	61	82	64	87	19
18	27	58	35	61	38	61	42	64	44	67	18	47	70	52	73	58	76	60	80	62	84	18
17	26	57	34	60	37	60	41	63	43	66	17	46	68	51	72	57	75	59	78	61	82	17
16	24	55	33	59	36	59	39	61	42	64	16	44	66	49	70	56	73	58	76	60	80	16
15	23	53	31	57	35	58	38	60	41	63	15	43	65	48	68	54	71	57	74	59	78	15
14	21	51	30	56	34	56	37	59	39	61	14	42	63	47	67	53	69	55	72	58	76	14
13	20	50	29	54	33	55	36	58	38	60	13	41	62	46	65	52	67	54	70	56	73	13
12	19	48	28	52	32	54	35	56	37	59	12	40	60	45	63	51	65	53	68	55	71	12
11	17	46	27	50	31	52	34	54	36	57	11	39	58	44	62	50	64	52	66	54	69	11
10	16	44	26	49	29	50	33	52	35	56	10	38	57	42	60	49	62	51	64	53	67	10
9	14	43	25	49	28	49	32	50	34	54	9	37	55	41	58	48	60	50	62	52	64	9
8	13	41	23	48	27	49	31	49	33	53	8	36	54	40	57	47	58	49	60	51	62	8
7	12	39	22	46	26	48	30	49	32	51	7	34	52	39	55	46	56	47	58	49	60	7
6	10	37	21	45	25	47	29	48	31	50	6	33	50	38	53	44	55	46	56	48	58	6
5	9	36	20	43	24	45	28	47	30	48	5	32	49	36	52	43	53	45	54	47	56	5
4	8	34	19	42	23	44	27	45	29	47												
3	6	32	18	41	22	43	26	44	28	45												
2	5	30	17	39	21	42	25	43	27	44												
1	3	29	15	38	20	41	24	41	26	42												
Repetitions	M	F	M	F	M	F	M	F	M	F	Repetitions	M	F	M	F	M	F	M	F	M	F	Repetitions
Age group	17-21		22-26		27-31		32-36		37-41		Age group	42-46		47-51		52-56		57-61		62+		Age group

Scoring standards are used to convert raw scores to point scores after test events are completed. Male point scores are indicated by the M at the top and bottom of the shaded column. Female point scores are indicated by the F at the top and bottom of the unshaded column. To convert raw scores to point scores, find the number of repetitions performed in the left-hand column. Next, move right along that row and locate the intersection of the soldier's appropriate age column. Record that number in the Push-Up points block on the front of the scorecard.

[2]

Appendix D. APFT sit-up standards

SIT-UP STANDARDS

AGE GROUP	17-21	22-26	27-31	32-36	37-41	AGE GROUP	42-46	47-51	52-56	57-61	62+	AGE GROUP
Repetitions	M/F	M/F	M/F	M/F	M/F	Repetitions	M/F	M/F	M/F	M/F	M/F	Repetitions
82			100			82						82
81			99			81						81
80		100	98			80						80
79		99	97			79						79
78	100	97	96			78						78
77	98	96	95			77						77
76	97	95	94	100	100	76						76
75	95	93	92	99	99	75						75
74	94	92	91	98	98	74						74
73	92	91	90	96	97	73						73
72	90	89	89	95	96	72	100					72
71	89	88	88	94	95	71	99					71
70	87	87	87	93	94	70	98					70
69	86	85	86	92	93	69	97					69
68	84	84	85	91	92	68	96					68
67	82	83	84	89	91	67	95					67
66	81	81	83	88	89	66	94	100	100			66
65	79	80	82	87	88	65	93	99	99			65
64	78	79	81	86	87	64	92	98	98	100		64
63	76	77	79	85	86	63	91	97	97	99	100	63
62	74	76	78	84	85	62	90	96	96	98	99	62
61	73	75	77	82	84	61	89	94	95	97	98	61
60	71	73	76	81	83	60	88	93	94	96	97	60
59	70	72	75	80	82	59	87	92	93	95	96	59
58	68	71	74	79	81	58	86	91	92	94	95	58
57	66	69	73	78	80	57	85	90	91	92	94	57
56	65	68	72	76	79	56	84	89	89	91	92	56
55	63	67	71	75	78	55	83	88	88	90	91	55
54	62	65	70	74	77	54	82	87	87	89	90	54
53	60	64	69	73	76	53	81	86	86	88	89	53
52	58	63	68	72	75	52	80	84	85	87	88	52
51	57	61	66	71	74	51	79	83	84	86	87	51
50	55	60	65	69	73	50	78	82	83	85	86	50
49	54	59	64	68	72	49	77	81	82	84	85	49
48	52	57	63	67	71	48	76	80	81	83	84	48
47	50	56	62	66	69	47	75	79	80	82	83	47
46	49	55	61	65	68	46	74	78	79	81	82	46
45	47	53	60	64	67	45	73	77	78	79	81	45
44	46	52	59	62	66	44	72	76	77	78	79	44
43	44	50	58	61	65	43	71	74	76	77	78	43
42	42	49	57	60	64	42	70	73	75	76	77	42
41	41	48	56	59	63	41	69	72	74	75	76	41
40	39	47	55	58	62	40	68	71	73	74	75	40
39	38	45	54	56	61	39	67	70	72	73	74	39
38	36	44	52	55	60	38	66	69	71	72	73	38
37	34	43	51	54	59	37	65	68	69	71	72	37
36	33	41	50	53	58	36	64	67	68	70	71	36
35	31	40	49	52	57	35	63	66	67	69	70	35
34	30	39	48	50	56	34	62	64	66	68	69	34
33	28	37	47	49	55	33	61	63	65	66	68	33
32	26	36	46	48	54	32	60	62	64	65	66	32
31	25	35	45	47	53	31	59	61	63	64	65	31
30	23	33	44	46	52	30	58	60	62	63	64	30
29	22	32	43	45	50	29	57	59	61	62	63	29
28	20	31	42	44	49	28	56	58	60	61	62	28
27	18	29	41	42	48	27	55	57	59	60	61	27
26	17	28	39	41	47	26	54	56	58	59	60	26
25	15	27	38	40	46	25	53	54	57	58	59	25
24	14	25	37	39	45	24	52	53	56	57	58	24
23	12	24	36	38	44	23	51	52	55	56	57	23
22	10	23	35	36	43	22	50	51	54	55	56	22
21	9	21	34	35	42	21	49	50	53	54	55	21
Repetitions	M/F	M/F	M/F	M/F	M/F	Repetitions	M/F	M/F	M/F	M/F	M/F	Repetitions
AGE GROUP	17-21	22-26	27-31	32-36	37-41	AGE GROUP	42-46	47-51	52-56	57-61	62+	AGE GROUP

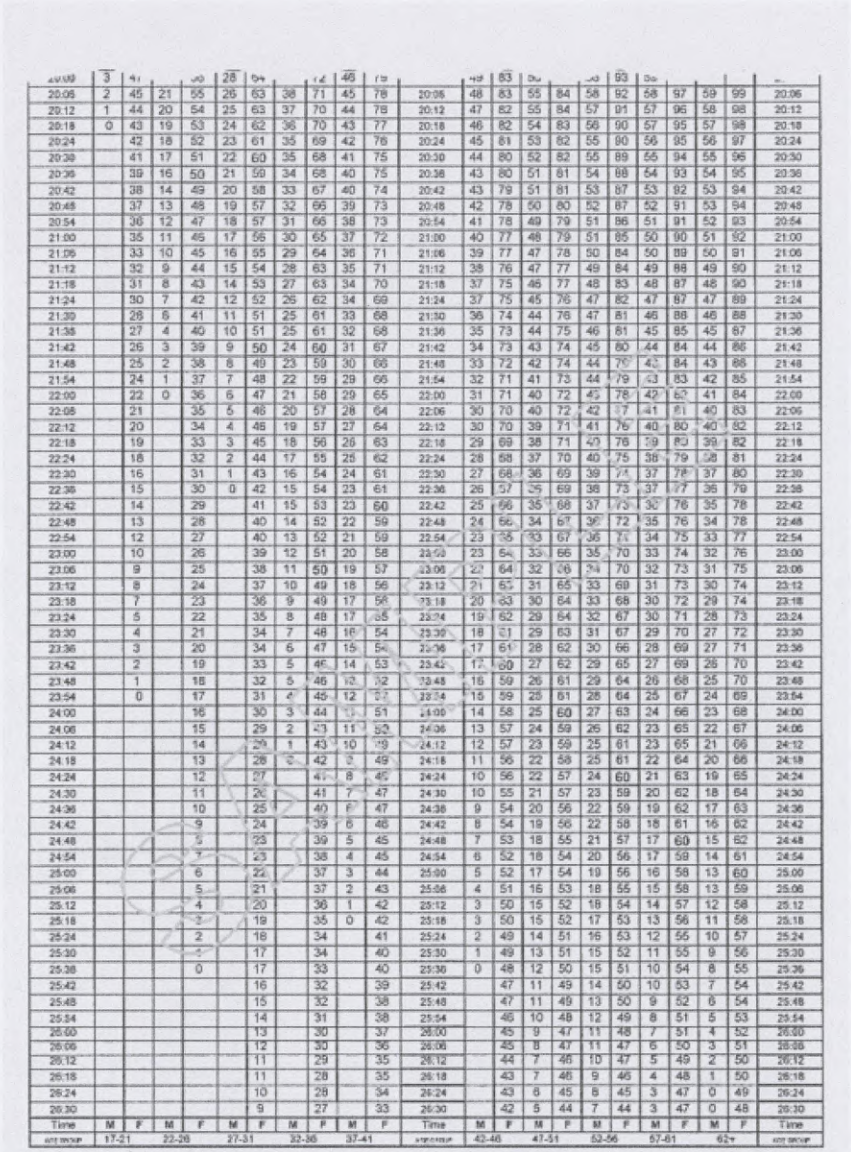
Scoring standards are used to convert raw scores to point scores after test events are completed. To convert raw scores to point scores, find the number of repetitions performed in the left-hand column. Next, move right along that row and locate the intersection of the soldier's appropriate age column. Record that number in the Sit-Up points block on the front of the scorecard.

[2]

Appendix E. APFT 2-mile run standards

2-MILE RUN STANDARDS

AGE GROUP	17-21		22-26		27-31		32-36		37-41		AGE GROUP	42-46		47-51		52-56		57-61		62+		AGE GROUP
Time	M	F	M	F	M	F	M	F	M	F	Time	M	F	M	F	M	F	M	F	M	F	Time
12:54											12:54											12:54
13:00	100		100								13:00											13:00
13:06	99		99								13:06											13:06
13:12	97		98								13:12											13:12
13:18	96		97		100		100				13:18											13:18
13:24	94		96		99		99				13:24											13:24
13:30	93		94		98		98				13:30											13:30
13:36	92		93		97		97		100		13:36											13:36
13:42	90		92		96		96		99		13:42											13:42
13:48	89		91		95		95		98		13:48											13:48
13:54	88		90		94		95		97		13:54											13:54
14:00	86		89		92		94		97		14:00											14:00
14:06	85		88		91		93		96		14:06	100										14:06
14:12	83		87		90		92		95		14:12	99										14:12
14:18	82		86		89		91		94		14:18	98										14:18
14:24	81		84		88		90		93		14:24	97		100								14:24
14:30	79		83		87		89		92		14:30	97		99								14:30
14:36	78		82		86		88		91		14:36	96		98								14:36
14:42	77		81		85		87		91		14:42	95		98		100						14:42
14:48	75		80		84		86		90		14:48	94		97		99						14:48
14:54	74		79		83		85		89		14:54	93		96		98						14:54
15:00	72		78		82		86		88		15:00	92		95		98						15:00
15:06	71		77		81		84		87		15:06	91		95		97						15:06
15:12	70		76		79		83		86		15:12	90		94		96						15:12
15:18	68		74		78		82		86		15:18	90		93		95		100				15:18
15:24	67		73		77		81		85		15:24	89		92		95		99				15:24
15:30	66		72		76		80		84		15:30	88		91		94		98				15:30
15:36	64	100	71	100	75		79		83		15:36	87		91		93		97				15:36
15:42	63	99	70	99	74		78		82		15:42	86		90		92		97		100		15:42
15:48	61	98	69	98	73	100	77		81		15:48	85		89		91		96		99		15:48
15:54	60	96	68	97	72	99	76	100	80		15:54	84		88		91		95		98		15:54
16:00	59	95	67	96	71	98	75	99	80		16:00	83		87		90		94		97		16:00
16:06	57	94	66	95	70	97	75	99	79		16:06	83		87		89		93		96		16:06
16:12	56	93	64	94	69	97	74	98	78		16:12	82		86		88		92		95		16:12
16:18	54	92	63	93	68	96	73	97	77		16:18	81		85		87		91		94		16:18
16:24	53	90	62	92	66	95	72	97	76		16:24	80		84		87		90		93		16:24
16:30	52	89	61	91	65	94	71	96	75		16:30	79		84		86		90		93		16:30
16:36	50	88	60	90	64	93	70	96	74		16:36	78		83		85		89		92		16:36
16:42	49	87	59	89	63	92	69	94	74		16:42	77		82		84		88		91		16:42
16:48	48	85	58	88	62	91	68	94	73		16:48	77		81		84		87		90		16:48
16:54	46	84	57	87	61	91	67	93	72		16:54	76		80		83		86		89		16:54
17:00	45	83	56	86	60	90	66	92	71	100	17:00	75		80		82		85		88		17:00
17:06	43	82	54	85	59	89	65	92	70	99	17:06	74		79		81		84		87		17:06
17:12	42	81	53	84	58	88	65	91	69	98	17:12	73		78		80		83		86		17:12
17:18	41	79	52	83	57	87	64	90	68	98	17:18	72		77		80		83		85		17:18
17:24	39	78	51	82	56	86	63	90	68	97	17:24	71	100	76		79		82		84		17:24
17:30	38	77	50	81	55	86	62	89	67	96	17:30	70	99	76		78		81		83		17:30
17:36	37	76	49	80	54	85	61	88	66	96	17:36	70	99	75	100	77		80		82		17:36
17:42	35	75	48	79	53	84	60	88	65	95	17:42	69	98	74	99	76		79		81		17:42
17:48	34	73	47	78	51	83	59	87	64	94	17:48	68	97	73	99	76		78		80		17:48
17:54	32	72	46	77	50	82	58	86	63	94	17:54	67	97	73	98	75		77		80		17:54
18:00	31	71	44	76	49	81	57	86	63	93	18:00	66	96	72	97	74		77		79		18:00
18:06	30	70	43	75	48	80	56	85	62	92	18:06	65	96	71	97	73		76		78		18:06
18:12	28	68	42	74	47	80	55	84	61	92	18:12	64	95	70	96	73		75		77		18:12
18:18	27	67	41	73	46	79	55	83	60	91	18:18	63	94	69	96	72		74		76		18:18
18:24	26	66	40	72	45	78	54	83	59	90	18:24	63	94	69	95	71		73		75		18:24
18:30	24	65	39	71	44	77	53	82	58	89	18:30	62	93	68	94	70		72		74		18:30
18:36	23	64	38	70	43	76	52	81	57	89	18:36	61	92	67	94	69		71		73		18:36
18:42	21	62	37	69	42	75	51	81	57	88	18:42	60	92	66	93	69		70		72		18:42
18:48	20	61	36	68	41	74	50	80	56	87	18:48	59	91	65	92	68		70		71		18:48
18:54	19	60	34	67	39	74	49	79	55	87	18:54	58	90	65	92	67		69		70		18:54
19:00	17	59	33	66	38	73	48	79	54	86	19:00	57	90	64	91	66	100	68		69		19:00
19:06	16	58	32	65	37	72	47	78	53	85	19:06	57	89	63	91	65	99	67		68		19:06
19:12	14	56	31	64	36	71	46	77	52	85	19:12	56	89	62	90	65	99	66		67		19:12
19:18	13	55	30	63	35	70	45	77	51	84	19:18	55	88	62	89	64	98	65		67		19:18
19:24	12	54	29	62	34	69	45	76	51	83	19:24	54	87	61	89	63	97	64		66		19:24
19:30	10	53	28	61	33	69	44	75	50	82	19:30	53	87	60	88	62	96	63		65		19:30
19:36	9	52	27	60	32	68	43	74	49	82	19:36	52	86	59	87	62	96	63		64		19:36
19:42	8	50	26	59	31	67	42	74	48	81	19:42	51	85	58	87	61	95	62	100	63		19:42
19:48	6	49	24	58	30	66	41	73	47	80	19:48	50	85	58	86	60	94	61	99	62		19:48
19:54	5	48	23	57	29	65	40	72	46	80	19:54	50	84	57	86	59	93	60	98	61		19:54
20:00	3	47	22	56	28	64	39	72	46	79	20:00	49	83	56	85	58	93	59	98	60	100	20:00
20:06		45	21	55		63	38	71		78	20:06	48		55	84	58		58	97	59		20:06



Time	M	F	M	F	M	F	M	F	M	F	Time	M	F	M	F	M	F	M	F	M	F	Time
AGE GROUP	17-21		22-26		27-31		32-36		37-41		AGE GROUP	42-46		47-51		52-56		57-61		62+		AGE GROUP
20:06	2	45	21	55	25	63	38	71	45	78	20:06	48	83	55	84	58	92	58	97	59	99	20:06
20:12	1	44	20	54	25	63	37	70	44	78	20:12	47	82	55	84	57	91	57	96	58	98	20:12
20:18	0	43	19	53	24	62	36	70	43	77	20:18	46	82	54	83	56	90	57	95	57	98	20:18
20:24		42	18	52	23	61	35	69	42	76	20:24	45	81	53	82	55	90	56	95	56	97	20:24
20:30		41	17	51	22	60	35	68	41	75	20:30	44	80	52	82	55	89	55	94	55	96	20:30
20:36		39	16	50	21	59	34	68	40	75	20:36	43	80	51	81	54	88	54	93	54	95	20:36
20:42		38	14	49	20	58	33	67	40	74	20:42	43	79	51	81	53	87	53	92	53	94	20:42
20:48		37	13	48	19	57	32	66	39	73	20:48	42	78	50	80	52	87	52	91	53	94	20:48
20:54		36	12	47	18	57	31	66	38	73	20:54	41	78	49	79	51	86	51	91	52	93	20:54
21:00		35	11	46	17	56	30	65	37	72	21:00	40	77	48	79	51	85	50	90	51	92	21:00
21:06		33	10	45	16	55	29	64	36	71	21:06	39	77	47	78	50	84	50	89	50	91	21:06
21:12		32	9	44	15	54	28	63	35	71	21:12	38	76	47	77	49	84	49	88	49	90	21:12
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21:24		30	7	42	12	52	26	62	34	69	21:24	37	75	45	76	47	82	47	87	47	89	21:24
21:30		28	6	41	11	51	25	61	33	68	21:30	36	74	44	76	47	81	46	86	46	88	21:30
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21:48		25	2	38	8	49	23	59	30	66	21:48	33	72	42	74	44	79	43	84	43	86	21:48
21:54		24	1	37	7	48	22	59	29	66	21:54	32	71	41	73	44	79	43	83	42	85	21:54
22:00		22	0	36	6	47	21	58	29	65	22:00	31	71	40	72	43	78	42	82	41	84	22:00
22:06		21		35	5	46	20	57	28	64	22:06	30	70	40	72	42	77	41	81	40	83	22:06
22:12		20		34	4	46	19	57	27	64	22:12	30	70	39	71	41	76	40	80	40	82	22:12
22:18		19		33	3	45	18	56	26	63	22:18	29	69	38	71	40	76	39	80	39	82	22:18
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22:36		15		30	0	42	15	54	23	61	22:36	26	67	35	69	38	73	37	77	36	79	22:36
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23:00		10		26		39	12	51	20	58	23:00	23	64	33	66	35	70	33	74	32	76	23:00
23:06		9		25		38	11	50	19	57	23:06	22	64	32	66	34	70	32	73	31	75	23:06
23:12		8		24		37	10	49	18	56	23:12	21	63	31	65	33	69	31	73	30	74	23:12
23:18		7		23		36	9	49	17	56	23:18	20	63	30	64	33	68	30	72	29	74	23:18
23:24		5		22		35	8	48	17	55	23:24	19	62	29	64	32	67	30	71	28	73	23:24
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23:42		2		19		33	5	46	14	53	23:42	17	60	27	62	29	65	27	69	26	70	23:42
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25:12				4		20		36	1	42	25:12	3	50	15	52	18	54	14	57	12	58	25:12
25:18				3		19		35	0	42	25:18	3	50	15	52	17	53	13	56	11	58	25:18
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25:30				1		17		34		40	25:30	1	49	13	51	15	52	11	55	9	56	25:30
25:36				0		17		33		40	25:36	0	48	12	50	15	51	10	54	8	55	25:36
25:42						16		32		39	25:42		47	11	49	14	50	10	53	7	54	25:42
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25:54						14		31		38	25:54		46	10	48	12	49	8	51	5	53	25:54
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26:06						12		30		36	26:06		45	8	47	11	47	6	50	3	51	26:06
26:12						11		29		35	26:12		44	7	46	10	47	5	49	2	50	26:12
26:18						11		28		35	26:18		43	7	46	9	46	4	48	1	50	26:18
26:24						10		28		34	26:24		43	6	45	8	45	3	47	0	49	26:24
26:30						9		27		33	26:30		42	5	44	7	44	3	47	0	48	26:30

Scoring standards are used to convert raw scores to point scores after test events are completed. Male point scores are indicated by the M at the top and bottom of the shaded column. Female point scores are indicated by the F at the top and bottom of the unshaded column. To convert raw scores to point scores, find the number of repetitions performed in the left hand column. Next, move right along that row and locate the intersection of the soldier's appropriate age column. **In all cases, when a time falls between two point values, the lower point value is used.** Record that number in the 2MR points block on the front of the scorecard.

[2]

Appendix F. AR 600-9 height and weight standards

Table 3–1
Weight for height table (screening table weight)

Height (in inches)	Minimum weight (in pounds)*	Male weight in pounds, by age				Female weight in pounds, by age			
		17–20	21–27	28–39	40+	17–20	21–27	28–39	40+
58	91	—	—	—	—	119	121	122	124
59	94	—	—	—	—	124	125	126	128
60	97	132	136	139	141	128	129	131	133
61	100	136	140	144	146	132	134	135	137
62	104	141	144	148	150	136	138	140	142
63	107	145	149	153	155	141	143	144	146
64	110	150	154	158	160	145	147	149	151
65	114	155	159	163	165	150	152	154	156
66	117	160	163	168	170	155	156	158	161
67	121	165	169	174	176	159	161	163	166
68	125	170	174	179	181	164	166	168	171
69	128	175	179	184	186	169	171	173	176
70	132	180	185	189	192	174	176	178	181
71	136	185	189	194	197	179	181	183	186
72	140	190	195	200	203	184	186	188	191
73	144	195	200	205	208	189	191	194	197
74	148	201	206	211	214	194	197	199	202
75	152	206	212	217	220	200	202	204	208
76	156	212	217	223	226	205	207	210	213
77	160	218	223	229	232	210	213	215	219
78	164	223	229	235	238	216	218	221	225
79	168	229	235	241	244	221	224	227	230
80	173	234	240	247	250	227	230	233	236

Notes:

* Male and female Soldiers who fall below the minimum weights shown in table 3–1 will be referred for immediate medical evaluation.

[1] Height will be measured in stocking feet (without shoes), standing on a flat surface with the chin parallel to the floor. The body will be straight but not rigid, similar to the position of attention. The measurement will be rounded to the nearest inch with the following guidelines: If the height fraction is less than 1/2 inch, round down to the nearest whole number in inches. If the height fraction is 1/2 inch or greater, round up to the next highest whole number in inches.

[2] Weight will be measured and recorded to the nearest pound within the following guidelines: If the weight fraction is less than 1/2 pound, round down to the nearest pound. If the weight fraction is 1/2 pound or greater, round up to the next highest pound.

[3] All measurements will be in a standard PT uniform (gym shorts and T-shirt, without shoes).

[4] If the circumstances preclude weighing Soldiers during the APFT, they will be weighed within 30 days of the APFT.

[5] Add 6 pounds per inch for males over 80 inches and 5 pounds for females for each inch over 80 inches.

[26]

HOW DOES FIVE MONTHS WITHOUT MANDATED EXERCISE EFFECT PERFORMANCE AND PHYSIOLOGICAL MEASURES IN ARMY OFFICERS?

A thesis submitted to the College of Education and Health Professions in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

DEPARTMENT OF HEALTH, PHYSICAL EDUCATION, AND EXERCISE SCIENCE

by

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2018

Kate A Early
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7-18-18
Date

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7-18-2018
Date

Dr. Clayton Nicks, Member

July 18, 2018
Date