The Fitness Training Unit in U.S. Army Basic Combat Training: Physical Fitness, Training Outcomes, and Injuries

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This study involved a retrospective examination of physical fitness, training outcomes, and injury rates among personnel in the Fitness Training Unit (FTU). Personnel were assigned to the FTU based on low performance on push-ups, sit-ups, and/or a 2-mile run (N = 44 men, 95 women) and received an augmented physical fitness program before basic combat training (BCT). They were compared with 712 men and 379 women who took the same test but were not assigned to the FTU and went directly to BCT. FTU and non-FTU personnel trained in the same battalions. Army Physical Fitness Test scores of FTU personnel were compared with those of trainees discharged or completed BCT in 8 weeks were obtained from unit training records. Injuries during BCT were documented from a review of the medical records. On entry to BCT, FTU women had similar 2-mile run times compared with non-FTU women (21.6 vs. 21.5 minutes, respectively; p = 0.88); FTU men were considerably slower on the 2-mile run than non-FTU men (20.3 vs. 17.3 minutes; p < 0.01). FTU women and non-FTU women had similar graduation success (60% vs. 68%, respectively; p = 0.14) and time-loss injury rates (1.3 vs. 1.4 people injured/100 person-days, respectively; p = 0.90). FTU men were less likely to graduate than non-FTU men (55% vs. 62%; p < 0.01) and more likely to suffer a time-loss injury (1.2 vs. 0.7 people injured/100 person-days; p < 0.01). Efforts should be directed toward providing a sufficient training stimulus to improve the aerobic fitness level of men (as well as women) in the FTU.

Introduction

The Fitness Training Unit (FTU) is a specialized training element with the mission of improving the fitness level of new recruits before basic combat training (BCT). Individuals are assigned to the FTU if they do not pass a special Reception Station Physical Fitness Test administered within 1 or 2 days of arrival. If trainees pass the test, they go on directly to BCT. Test criteria at Fort Jackson, South Carolina, during the summer of 1998 are listed in Table 1. The goals of the FTU are to better prepare new trainees for the physical demands of BCT and to reduce injuries during BCT.

Trainees who enter the FTU perform a specific physical training program, which includes running, weight training, push-up and sit-up improvement, road marching, and developmental stretching. They also participate in military training, such as customs and courtesies, drill and ceremony, wearing of the uniform, Uniformed Code of Military Justice, and Army values. Criteria to exit the FTU and go on to BCT differ from the initial test and are also listed in Table I (summer 1998). If a trainee was sent to the FTU for a push-up or sit-up failure, he or she could go on to BCT after passing the exit criteria for that event; tests are given three times per week. If the trainee was a run failure in the summer of 1998, he or she had to stay in the FTU for a mandatory 3-week period and pass the exit criteria before entry to BCT.

Few studies have examined the effectiveness of the FTU in reaching its stated goals. One investigation found that FTU personnel had higher sick call rates and lower end-of-cycle fitness measures but had similar discharge rates compared with non-FTU personnel. However, when that study was conducted, the only criterion to enter BCT was 1 or more push-ups for women and 12 or more push-ups for men; the test given in the summer of 1998 involved three events (Table I). An investigation conducted when the three-event test was in place was limited by a very small sample size. Data from this latter study suggested that the injury incidence for FTU and non-FTU women was identical. Male FTU participants had a higher injury incidence than men not in the FTU, but this was not statistically significant because of the small sample of FTU men (N = 7).

Because of changes in the fitness criteria and the limited data on the effectiveness of the FTU, further investigation was clearly warranted. The purposes of the present study were to compare and contrast physical fitness, training outcomes, and injury rates between personnel entering BCT from the FTU and those entering BCT directly without attending the FTU.

Methods

Study Design and Subjects

This study involved a retrospective review of training data and medical records on two battalions of basic trainees with a total of 1240 individuals. There were 756 men, 474 women, and 10 trainees excluded from the analysis because their gender was not present in their medical records. There were 44 men and 95 women who trained in the FTU and then entered one of these 2 battalions. There were 712 men and 379 women who entered BCT without training in the FTU. The BCT training cycle was 8 weeks in length. One battalion began training on 8 May 1998 and graduated 1 July 1998 while the other began training on 15 May 1998 and graduated 9 July 1998. The training location was Fort Jackson, South Carolina.
This information was typically available on one of three forms: more injuries (numerator) divided by the total number of days in
DA Form 518, body part injured, disposition, and any days of limited duty. Injury incidence rates were calculated as subjects with one or
3444-6). This information included the date of the visit, diagno-
were used for analysis of most of the injury data. Person-time
the trainee's medical record (Department of the Army [DA]
in Epilnfo (version 6.04b, Centers for Disease Control
trajectory, person-time injury incidence rates and survival analysis
behaviors that existed prior to service (EPTS discharge) or in-
APFT scores between FTI and non-FTU groups were made us-
were on-time graduates if they were included on the training
was usually granted.

Training Outcomes

Two types of training outcomes were examined: (1) on-time
completion of BCT (i.e., after 8 weeks), and (2) discharges. Train-
ees were on-time graduates if they were included on the training
roster on the first day of battalion training and were not dis-
charged, removed from training for injuries, or sent to another
battalion to complete training (i.e., newstarted or recycled).

Discharge data were obtained by reviewing discharge packets
at the Fort Jackson Transition Point Headquarters, where the
records of all discharged personnel were processed. The reasons
for discharge as well as medical record data (described below)
were recorded. Discharge data were cross-checked with sum-
mary rosters provided by the training battalion S-1 (Personnel
Section) to ensure that the data were complete and accurate.

There were numerous reasons for which a trainee could be
discharged, but most fell into two major categories: medical
conditions that existed prior to service (EPTS discharge) or in-
adequate entry-level performance. The latter category was often
called an entry-level separation (ELS) or Chapter 11 discharge.
ELS discharges were most often the result of trainees' inability
to adapt to the military environment because of lack of ability
(could not adequately perform critical military tasks) or psycho-
logical reasons (inability to follow orders, personality problems,
etc.).

Injury Data

For each trainee in the two battalions under study, we ex-
tracted information for each visit to a medical care provider from
the trainee's medical record (Department of the Army [DA] Form
3444-6). This information included the date of the visit, diagno-
sis, body part injured, disposition, and any days of limited duty.
This information was typically available on one of three forms:
(1) DA Form 5181-R (Screening Note of Acute Medical Care), (2)
Standard Form 600 (Chronological Record of Medical Care), or
(3) Standard Form 558 (Emergency Care and Treatment Form).

An injury case was defined as an event that resulted in physi-
cal damage to the body for which the trainee visited a medical
care provider and the encounter was recorded in the medical
record. Injuries could be caused by overuse (cumulative micro-
trauma) or acute trauma (sudden overload). Overuse injuries
included musculoskeletal pain (not otherwise specified), stress
fractures, stress reactions, tendinitis, bursitis, fasciitis, overuse
syndromes, and strains. Traumatic injuries included sprains,
dislocations, fractures, blisters, abrasions, lacerations, and
contusions. Environmental injuries (heat injuries, cold injuries,
and insect bites) were collected but not included in the analysis
(this category accounted for less than 3% of all injuries).

Three levels of injury were examined that involved progress-
ively increasing severity. The first level (any injury) included
visits to a health care provider for any type of injury. The second
level, a time-loss injury, involved one or more days of limited
duty (a profile). The third level was an injury that resulted in a
recommendation that the trainee be temporarily removed from
training and sent to the Physical Training and Rehabilitation
Program (PTRP). In general, a PTRP recommendation was made
by the Physical Therapy Clinic of the hospital if the trainee had
a physical limitation that would result in missing 1 week or
more of training or if the trainee had been given repeated short-
term profiles. In the PTRP, the trainee received modified training
while recovering from the injury, and then he or she returned to
BCT. Individuals who were recommended to the PTRP could
decline to be sent there and request an ELS discharge, which
was usually granted.

Physical Characteristics

Trainee physical characteristics were obtained from DA Form
88 (Report of Medical Examination) in the medical records.
These characteristics included gender, date of birth (for age),
stature, and body mass. These data were typically recorded in
the Military Entrance Processing Station and thus represent
information gathered before arrival at Fort Jackson. Body mass
index (BMI) was calculated as body mass/stature².⁵

Data Analysis

Comparisons of physical characteristics and first diagnostic
APFT scores between FTU and non-FTU groups were made us-
ing Student's t test for independent samples. Analyses of groups
on the first diagnostic and final APFT scores were conducted
using a two-way mixed-model analysis of variance (independent
groups, repeated measures on the diagnostic and final APFT).
Training outcomes and PTRP recommendations were compared
between groups using the χ² statistic; where expected cell sizes
were less than 5, the Fisher exact test was used. The Statistical
Package for the Social Sciences (version 10.0.5, SPSS, Chicago,
Illinois) and Epilnfo (version 6.04b, Centers for Disease Control
and Prevention, Atlanta, Georgia) were used for these analyses.

Because of subject attrition during the course of the investiga-
tion, person-time injury incidence rates and survival analysis
were used for analysis of most of the injury data. Person-time
injury incidence rates were calculated as subjects with one or
more injuries (numerator) divided by the total number of days in
BCT (denominator). To obtain people injured/100 person-days,
those not completing BCT had their times censored at the day had a higher BMI, performed fewer push-ups, and ran the 2 APNr data were not available, the training personnel had deleted cursed in both FTU and non-FTU personnel. However, there was data were available on 619 men and 319 women. Where initial for men or women, indicating that similar improvements oc-
sample) and 393 women (83% of the female sample). Final APFT there were no significant interactions in the analysis of variance

Table II shows a comparison of the physical characteristics and first diagnostic APFT scores of the FTU and non-FTU trainees. Remember that the physical characteristics were obtained from medical records and reflect values before entry into the FTU or BCT; the APFT scores reflect fitness on entry into BCT (after completion of the FTU). Male FTUs were older, heavier, had a higher BMI, performed fewer push-ups, and ran the 2 miles slower than their non-FTU counterparts. Female FTUs were heavier, had a higher BMI, and performed fewer push-ups and sit-ups than non-FTU women. The average 2-mile run times of the FTU and non-FTU women were almost identical.

Table III shows a comparison of FTU and non-FTU groups on the first diagnostic and final APFT. Both FTU and non-FTU groups improved significantly on all events from the first diagnostic test to the final test. The non-FTU group demonstrated higher performance than the FTU group on all APFT events except on the women’s 2-mile run. On push-ups and sit-ups, there were no significant interactions in the analysis of variance for men or women, indicating that similar improvements occurred in both FTU and non-FTU personnel. However, there was

### Table II

<table>
<thead>
<tr>
<th>Gender</th>
<th>Group</th>
<th>Age (years)</th>
<th>Stature (cm)</th>
<th>Body Mass (kg)</th>
<th>BMI (kg/m²)</th>
<th>Push-ups (repetitions)</th>
<th>Sit-Ups (repetitions)</th>
<th>2-Mile Run (minutes)</th>
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</thead>
<tbody>
<tr>
<td>Men</td>
<td>FTU</td>
<td>23.1 ± 4.7</td>
<td>175.3 ± 11.1</td>
<td>81.5 ± 16.7</td>
<td>26.4 ± 4.5</td>
<td>23 ± 13</td>
<td>21.2 ± 2.5</td>
<td>17.7 ± 1.5</td>
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<td>Non-FTU</td>
<td>21.4 ± 3.4</td>
<td>176.1 ± 7.2</td>
<td>74.9 ± 13.0</td>
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<td>33 ± 14</td>
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* From independent-samples t test.

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* From two-way mixed-model analysis of variance.

### Table III

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<tr>
<th>Gender</th>
<th>Event</th>
<th>Group</th>
<th>N</th>
<th>Diagnostic APFT (mean ± SD)</th>
<th>Final APFT (mean ± SD)</th>
<th>Diagnostics vs. Final APFT Main Effect</th>
<th>FTU vs. Non-FTU Main Effect</th>
<th>APFT by FTU/Non-FTU Interaction</th>
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<td>Push-ups</td>
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<td>24 ± 13</td>
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<td>Sit-ups</td>
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* From two-way mixed-model analysis of variance.

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TABLE IV
TRAINING OUTCOMES AMONG FTU AND NON-FTU TRAINEES

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Group</th>
<th>Proportion in Outcome Category (%)</th>
<th>p Valuea</th>
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<th>Group</th>
<th>Proportion in Outcome Category (%)</th>
<th>p Valuea</th>
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<tr>
<td>Completed BCT in 8 weeks</td>
<td>FTU</td>
<td>54.5</td>
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<td>60.0</td>
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<td>Discharged</td>
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<td>FTU</td>
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<td>FTU</td>
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<td></td>
</tr>
<tr>
<td>Discharged (declined PTRP and EPTS)</td>
<td>FTU</td>
<td>11.4</td>
<td>0.07</td>
<td>FTU</td>
<td>13.7</td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-FTU</td>
<td>4.8</td>
<td></td>
<td></td>
<td>12.4</td>
<td>0.73</td>
<td></td>
</tr>
</tbody>
</table>

a From $\chi^2$ statistic or Fisher exact test.

b ELS, entry level separation (Chapter 11).
c PTRP, Physical Training and Rehabilitation Program.
d EPTS, medical condition that existed prior to service.

A significant interaction for the run among both men and women. For the men, the interaction indicated that the FTU group improved relatively more than the non-FTU group. For the women, the interaction indicated the opposite, that the FTU women did not improve as much as non-FTU women.

Training Outcomes

Table IV shows a comparison of training outcomes between FTU trainees and non-FTU trainees. Men coming from the FTU were less likely to graduate and more likely to be discharged. When specific reasons for discharge were examined, FTU men were more likely to be an ELS discharge (Chapter 11) or discharged for medically related reasons (declined PTRP and EPTS combined). FTU men were 2.5 times more likely to be discharged for declining PTRP than non-FTU men, but this was not statistically significant. Likewise, FTU men were 2.3 times more likely to be discharged for a medical condition that existed prior to service than non-FTU men, but this too was not statistically significant.

Table IV shows that FTU women had considerably more favorable training outcomes than FTU men. Both FTU and non-FTU women had a similar likelihood of completing the cycle and of being discharged for any reason. Even when specific reasons for discharge were examined, there was no difference between FTU and non-FTU women.

Injuries

Medical records were reviewed on a total of 733 men (97% of the male sample) and 452 women (95% of the female sample); this included 44 FTU men (100% of the male FTU sample) and 89 FTU women (94% of the female FTU sample).

Table V shows the person-time injury incidence rate analysis. Overall, the injury rate among FTU men was 1.7 and 2.0 times higher than among non-FTU men (any injury and time-loss injury, respectively). The injury rates among men who completed BCT were 1.7 times higher among the FTU men than among the non-FTU men (both any injury and time-loss injury).

Table V shows that FTU women had considerably more favorable training outcomes than FTU men. Both FTU and non-FTU women had a similar likelihood of completing the cycle and of being discharged for any reason. Even when specific reasons for discharge were examined, there was no difference between FTU and non-FTU women.

Injury rates were similar among FTU and non-FTU men who did not complete BCT. The injury incidence rate among FTU women did not differ from that among non-FTU women.

Although FTU men were twice as likely to be recommended to the PTRP compared with non-FTU men (9.1% vs. 4.5%), the difference was not statistically significant ($p = 0.17$). Similarly, FTU women were about 1.6 times more likely than non-FTU women to be recommended to the PTRP (16.9% vs. 10.7%), and, like the men, this difference was not statistically significant ($p = 0.11$).

Figure 1 shows the survival curves from the Kaplan-Meier analysis for the men. The log-rank test indicated that the survival distributions differed for the FIU and non-FTU men ($p < 0.01$); the FTU men demonstrated less cumulative survival (i.e., fewer men without injuries) over time. The mean survival time was 36 days (95% confidence interval [CI] = 30–42 days) for the FTU men and 42 days (95% CI = 40–43 days) for the non-FTU men. Figure 2 shows the survival curves for the women. The log-rank test indicated that the survival distributions were similar for the FTU and non-FTU women ($p = 0.63$). The mean

TABLE V
PERSON-TIME INJURY INCIDENCE RATES (PEOPLE INJURED/100 PERSON-DAYS) FOR FTU AND NON-FTU TRAINEES

<table>
<thead>
<tr>
<th>Group or Subgroup</th>
<th>Men Any Injury</th>
<th>Time-Loss Injury</th>
<th>Women Any Injury</th>
<th>Time-Loss Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTU</td>
<td>1.20*</td>
<td>1.05*</td>
<td>1.32</td>
<td>1.15</td>
</tr>
<tr>
<td>Completed BCT</td>
<td>0.93b</td>
<td>0.69*</td>
<td>1.09</td>
<td>0.93</td>
</tr>
<tr>
<td>Did not complete BCT</td>
<td>1.69</td>
<td>1.69</td>
<td>1.93</td>
<td>1.76</td>
</tr>
<tr>
<td>Non-FTU</td>
<td>0.70</td>
<td>0.53</td>
<td>1.35</td>
<td>1.16</td>
</tr>
<tr>
<td>Completed BCT</td>
<td>0.56</td>
<td>0.40</td>
<td>1.07</td>
<td>0.89</td>
</tr>
<tr>
<td>Did not complete BCT</td>
<td>2.04</td>
<td>1.79</td>
<td>2.54</td>
<td>2.31</td>
</tr>
</tbody>
</table>

* $p < 0.01$ compared with respective non-FTU group.

b $p < 0.10$ compared with respective non-FTU group.
survival time was 32 days (95% CI = 28–36 days) for the FTU women and 30 days (95% CI = 28–32 days) for the non-FTU women.

Discussion

At the start of this investigation, we assumed that FTU personnel would have less favorable training outcomes and/or a higher injury incidence compared with non-FTU personnel for at least two reasons. First, FTU personnel are selected for their low fitness level. It is known that lower fitness levels are associated with a higher incidence of injury²,⁶,⁹ and discharge.¹⁰ Because the FTU is designed to increase fitness only minimally, FTU individuals may still be at higher risk of injury and discharge than their more fit counterparts. The second reason to expect higher injury rates in FTU personnel was the additional exposure time. Individuals who enter the FTU perform physical training for a longer period than individuals who go directly to BCT. This additional time may increase exposure to injury-producing events.¹¹,¹²

Despite these expectations, FTU women completed BCT with outcomes very similar to non-FTU women. FTU and non-FTU women had similar graduation success, similar discharge incidence, similar injury rates, and similar injury survival curves. On the other hand, FTU men did not fare as well. When FTU and non-FTU men were compared, the FTU men were less likely to graduate, were more likely to be discharged, and had higher injury rates. These data suggest that the FTU (as structured in the summer of 1998) was considerably more effective for women than for men.

One possible reason the FTU women had injury rates and training outcomes similar to non-FTU women may be related to their aerobic fitness level on arrival at BCT. Although FTU women performed fewer push-ups and sit-ups than non-FTU women, the two groups had equal aerobic fitness, as indicated by performance on the diagnostic 2-mile run. Because past studies have indicated that aerobic fitness is strongly associated with injury rates in BCT,²,⁶,⁸ it is reasonable to expect that the FTU and non-FTU women with similar aerobic fitness would experience similar injury risk. This suggests that emphasis should be placed on this component of physical fitness while individuals are training in the FTU.

We do not know the specific APFT events that sent subjects to the FTU or the length of time they were in the FTU, because these data were not available. The FTU orderly room provided us with global data on 30,636 recruits who took the Reception Station Physical Fitness Test from January to August 1998. These data are presented in Table VI. If the sample from the present study is representative of the FTU in general, then men were about equally likely to be sent to the FTU for failing push-ups or the run, whereas women were more likely to be sent for failing push-ups alone. A proportionally smaller number of women were sent to the FTU for low running performance.

Table VI also shows that the Reception Station Physical Fitness Test sent an uneven proportion of men and women to the FTU. Only 7% of male recruits were sent and women to the FTU. Only 7% of male recruits were sent to the FTU, whereas 24% of female recruits were sent. The average FTU man was in a much lower gender-specific fitness percentile than the average FTU woman. One may argue that it was more difficult for this group of men to improve their fitness because they may have had genetically less trainability.¹¹,¹⁴ However, this does not appear to have been the case. On the push-ups or sit-ups, FTU personnel who did take the final (record) APFT improved at a rate similar to non-FTU personnel. On the 2-mile run, FTU men actually showed more improvement than their non-FTU counterparts (Table III). This suggests that the FTU men actually had more aerobic trainability¹⁵ and that this trainability was not fully exploited while the men were in the FTU.

The situation was somewhat different for FTU women. Like the men, FTU and non-FTU women showed similar improvement on push-ups and sit-ups during BCT. Unlike the men, FTU women showed less improvement in BCT on the 2-mile run compared with non-FTU women. This suggests that the FTU women had less aerobic trainability¹⁵ in BCT, possibly attributable to aerobic fitness improvements made in the FTU. Supporting this idea is the similar 2-mile run times of the female FTU and non-FTU trainees on arrival at BCT. One weakness with this evaluation (and that of the men) is that many FTU and non-FTU personnel did not take the final APFT because they dropped out.

<table>
<thead>
<tr>
<th>Event</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-ups</td>
<td>3.6%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Sit-ups</td>
<td>1.7%</td>
<td>7.7%</td>
</tr>
<tr>
<td>One-mile run</td>
<td>3.1%</td>
<td>6.8%</td>
</tr>
<tr>
<td>Any test</td>
<td>6.9%</td>
<td>23.9%</td>
</tr>
</tbody>
</table>

TABLE VI

PROPORTION OF RECEPTEES FAILING THE RECEPTION STATION PHYSICAL FITNESS TEST (JANUARY TO AUGUST 1998)
of training before it was administered. How these dropouts responded to training in BCT is not known.

For administrative reasons (i.e., lack of training cadre), all personnel in the FTU ran as a single group during physical training while this study was being conducted. Ability group runs (i.e., running in smaller groups that include individuals of similar aerobic fitness) could increase the exercise intensity of men and women who are more aerobically fit because they would be able to run faster. Because men, on average, have more aerobic fitness than women, one would expect that more men would be in the faster ability groups. The faster running speeds presumably would allow the men to increase their aerobic fitness to a greater extent compared with the situation in which ability groups were not present.

One may argue that FTU ability group exercise may result in a short-term increase in injury rates because some studies have suggested that faster running speeds are associated with a higher likelihood of injury. However, this may not be the case, because the total training distance (rather than the frequency, duration, or intensity of training) seems to be the training variable most strongly associated with injury incidence. Thus, if the total training distance remains the same while the training intensity is increased, injury rates may not change. Furthermore, because more rest time is allowed between training events in the FTU and the overall schedule is less physically demanding, fewer injuries would be expected in the FTU compared with BCT. Once the trainee enters BCT, physical activity is almost continuous and less recovery time is available.

Conclusions

FTU women had similar aerobic fitness, graduation success, and injury rates compared with women directly entering BCT without the FTU. However, FTU men were less aerobically fit, were less likely to graduate, and had higher injury rates compared with men going directly to BCT without the FTU. Higher aerobic fitness may be achieved by instituting ability group runs in the FTU, which can increase the training intensity for both women and men without necessarily increasing injury rates in the FTU. Besides running, alternative forms of exercise that can improve aerobic fitness and are suitable for training large groups of individuals (e.g., aerobic dance, upper body aerobic exercise) also should be considered. This would distribute training stress to other anatomic locations, allowing previously stressed parts of the body more time for recovery. Improved aerobic fitness before BCT is likely to decrease injury rates and improve graduation success.

Acknowledgments

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