

Effects of a Pre-Training Conditioning Programme on Basic Military Training Attrition Rates

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Abstract

The medical attrition rates of 4 cohorts of recruits undergoing basic military training (BMT) were studied. They were grouped as follows: Group A ($n = 3475$), a mixture of fit and unfit recruits; Group B ($n = 2081$), consisting only of fit recruits; Group C ($n = 940$) comprising only unfit recruits who underwent a 4 to 6 weeks conditioning programme prior to being subjected to a similar 3-month BMT for all 3 groups and Group D ($n = 2613$) comprising unfit recruits who underwent an extended 4-month BMT. It was found that Group B [Relative risk (RR) = 0.26 95% confidence interval (CI) = 0.21, 0.33] and Group C (RR = 0.45 95% CI = 0.38, 0.62) had significantly lower medical attrition rates compared with Group A (RR = 1). Group D, however, did not show significantly lower attrition rates in spite of a more gradual training pace. When the unfit cohorts were compared, Group C (RR = 0.52 95% CI = 0.40, 0.67) had significantly lower attrition rates than Group D (RR = 1). The major cause of medical attrition in all groups was musculo-skeletal injuries sustained during training. Our results showed that a formal pre-training conditioning programme resulted in lower attrition during BMT and this reduction was more effective than training the recruits at a slower pace by extending the BMT by one month.

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Introduction

In the Singapore Armed Forces (SAF), about 15% of recruits eventually dropped out during basic military training (BMT) for medical reasons. This results in a high training and manpower cost. The attrition is primarily due to injuries sustained during training. Other causes include aggravation of pre-existing conditions as a result of training. Various preventive strategies were developed to minimise this attrition. One strategy was to segregate the recruits by fitness levels. All those who failed to pass a pre-training fitness test had the duration of BMT extended by an extra one month from a standard 3-month programme. It was felt that by allocating more training time, a more gradual pace was made possible. This method was found to be effective, with a 7.3% incidence of attrition in the segregated (by fitness levels) training companies, compared to a rate of 14.2% in the non-segregated training companies [Relative risk (RR) = 0.52 95% confidence interval (CI) 0.48, 0.56].¹

However, it was felt that merely extending the training by one month was not as effective as designing a Pre-training Conditioning Programme (PTP) with the intent of preparing the recruits adequately for BMT. We re-

port here the effects of this PTP on attrition rates of recruits during BMT.

Subjects and Methods

All male recruits from four training cohorts of an Army Infantry Basic Military Training Centre were selected into this study as follows:

Group A, comprising 3475 trainees not segregated by fitness. They were trained under a standard combat BMT programme.

Group B, comprising 2081 trainees who passed the pre-BMT fitness minimum entry criteria of 4 chin-ups, 28 sit-ups (in one minute), 207 cm in the standing broad jump, 10.9 sec or less in the 4 × 10 metres shuttle run and 13:00 (min:sec) or less in the 2.4 km run. All 5 fitness test items were administered at one sitting with the run as the last item. This cohort then underwent a 3-month BMT programme similar to Group A.

Group C, comprising 940 trainees who failed to achieve the minimum pass criteria in one or more of the 5 fitness test items. They underwent a PTP varying from 4 to 6 weeks, followed by a 3 month BMT programme similar to Groups A and B. Other than the PTP, the amount of

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time allocated to physical training including callisthenics, weight training, endurance runs, forced marches and other strenuous activities in Groups A, B and C were the same.

Group D, comprising 2613 trainees who similarly failed the entry fitness test. They were trained under a 4-month BMT programme which allowed a more gradual pace. They had 54 more hours of physical training (52% more) than the standard 3 months BMT programme of the above two groups. Thirty of these hours were made up of a specific weight training programme to develop muscular strength. All military lessons, passing standards and expectations of the BMT remained the same as the 3-month programme.

The median age of all four groups was similar at 18 years. All trainees were medically screened to be fit to undergo BMT. They had no known medical (including orthopaedic) conditions to contraindicate combat duties.

The authors designed the PTP with emphasis on cardiovascular endurance, muscular strength and endurance, flexibility and motor skills (Table I). There were 25 one-hour sessions for endurance runs which were conducted in the cool periods of the morning. Strength training (ST) comprised several work stations incorporating a mixture of stacked weights equipment and free-weights, conducted in a circuit format with buddy assistance. Altogether there were 22 half-hour sessions. Another 11 two-hour sessions for ST involved use of medicine ball and partner-resisted exercises. Flexibility exercises involved formal stretching routines prior to any prescribed training. For motor skill development, field games, dodge-step-and-run drills and swimming were employed. A total of 17 two-hour swimming sessions were conducted. At the end of the fourth and fifth week, the pre-BMT fitness tests were conducted. All recruits who passed the test were given

one to two weeks disruption from training. These recruits then joined the remainder of the group, after the sixth week, in a standard BMT programme.

Some injuries or illnesses resulted in attrition. Every case of attrition was recommended by a medical board comprising three army physicians who assessed that the severity of the condition disqualified the recruit from further training or that continuation of training would seriously impair healing. Apart from a specific condition, any recruit who accumulated medical leave in excess of 14 days would be similarly disqualified. Individual medical records of each case of attrition were studied and grouped under the following categories:

1. Musculo-skeletal injuries sustained during training e.g. stress fractures.
2. Acute illness or medical conditions which surfaced during training e.g. pneumonia.
3. Aggravation of a pre-existing but minor orthopaedic condition e.g. pes planus.
4. Aggravation of a pre-existing but minor medical condition e.g. mild bronchial asthma
5. Accumulation of excessive medical leave due to a variety of minor medical complaints which by themselves do not justify attrition.

Incidence of attrition was calculated for total attrition and also for 5 categories of causes for each of the groups. Univariate analysis was performed with use of the relative risk computation between the various attrition causes using the incidences found in Group A as index group. Chi-squares were employed to test contrasts between the index group and the risk groups. The significance level for all statistics was $P < 0.05$. Statistical calculations were made using Epi-Info 5 software.²

Results

Table II provides the incidences of different categories of medical attrition during BMT. The relative risks of attrition of the three groups, using the attrition of Group A as the index group, are given in Table III. All 3 groups B, C and D had lower attrition rates than Group A, who trained under the old system of a standard BMT, regardless of fitness on entry. However, despite extending the BMT by 1 month the attrition rate of Group D was not significantly lower than Group A (RR = 0.94 95% CI 0.83, 1.07). Recruits who passed the entry fitness test, Group B, had the lowest attrition rate at 3.7% and when compared to their less fit counterparts in Group D, there was 80% less attrition (RR = 0.20 95% CI 0.19, 0.36). Of the two groups who failed the entry fitness test, Group C (RR = 0.52 95% CI 0.40, 0.67) had less attrition (6.9%) than Group D (13.4%).

Of note was the reduction in the attrition due to severe musculo-skeletal injuries, which dropped from 5.6% in Group A to 1.2% in Group B and 2.3% in Group C. The attrition rate in this category for Group D (4.7%)

TABLE I: THE PRE-TRAINING CONDITIONING PROGRAMME

Day Time (hours)	Mon, Wed, Fri	Tues. Thurs	Sat
0630-0730	Endurance runs		Remedial training
0730-0830	Breakfast		
0830- 1030	Weight training	Calisthenics	Remedial training
1030- 1200	Lectures	Fatigue duties	Footdrill
1200- 1400	Lunch and afternoon rest		
1400-1500	Administration periods		Dismiss for weekend
1500- 1700	Swim	Games	
1700- 1900	Rest and dinner		
1900-2100	Motor skills training	Rest	

TABLE II: ATTRITION DUE TO DIFFERENT MEDICAL REASONS IN THE BMT PROGRAMMES OF THE SINGAPORE ARMED FORCES

Causes of attrition	Number of medical attrition from Basic Military Training			
	Group A Not segregated 3 mo BMT (n = 3475)	Group B Fit recruits 3 mo BMT (n = 2081)	Group C Unfit recruits PTP-3 mo BMT (n = 940)	Group D Unfit recruits 4 mo BMT (n = 2613)
Musculo-skeletal injuries	196 (5.6)	25 (1.2)	22 (2.3)	124 (4.7)
Medical conditions	132 (3.8)	17 (0.8)	8 (0.9)	54 (2.1)
Aggravation of pre-existing orthopaedic conditions	55 (1.6)	13 (0.6)	16 (1.7)	63 (2.4)
Aggravation of pre-existing medical conditions	82 (2.4)	17 (0.8)	15 (1.6)	75 (2.9)
Attrition due to excessive medical leave from training	30 (0.9)	6 (0.3)	4 (0.4)	34 (1.3)
Total attrition	495 (14.2)	78 (3.7)	65 (6.9)	350 (13.4)

Percentages are in parenthesis; BMT: basic military training

TABLE III: RELATIVE RISKS OF MEDICAL ATTRITION FROM VARIOUS CAUSES USING GROUP A AS INDEX

Causes of attrition	Relative Risk			
	Group A Not segregated 3 mo BMT	Group B Fit recruits 3 mo BMT	Group C Unfit recruits PTP-3 mo BMT	Group D Unfit recruits 4 mo BMT
Musculo-skeletal injuries	1	0.21 (0.14, 0.32)***	0.41 (0.27, 0.64)***	0.84 (0.68, 1.05)
Medical conditions	1	0.22 (0.13, 0.36)***	0.22 (0.11, 0.46)***	0.54 (0.40, 0.74)***
Aggravation of pre-existing orthopaedic conditions	1	0.39 (0.22, 0.72)**	1.08 (0.62, 1.87)	1.02 (0.74, 1.41)
Aggravation of pre-existing medical conditions	1	0.35 (0.21, 0.58)***	0.68 (0.39, 1.17)	1.22 (0.89, 1.66)
Attrition due to excessive medical leave from training	1	0.33 (0.14, 0.80)**	0.49 (0.17, 1.46)	1.51 (0.92, 2.46)
Total attrition	1	0.26 (0.21, 0.33)***	0.45 (0.38, 0.62)***	0.94 (0.83, 1.07)

95% confidence intervals are in parenthesis; BMT: basic military training

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

was not significantly lower than Group A. The major drop in attrition in Group C came from the musculo-skeletal injuries and the new medical condition categories (Table III).

Discussion

Among athletes and coaches it is generally well accepted that a pre-training conditioning programme can result in a reduction of injuries during training and competition seasons. It would be difficult, however, to provide objective and concrete evidence of this injury prevention effect. Empirically, proper conditioning by strengthening muscles and ligaments should provide sufficient protection to the musculo-skeletal tissues when they are subjected to rigorous training, particularly military training.^{3,4} Work among industrial workers showed that company fitness programmes reduce use of medi-

cal services, risk of industrial injury and lowered absenteeism.⁵ Among US Army recruits, better fitness prior to training reduces the risk of musculo-skeletal injury during BMT.^{6,7} One can expect that a recruit who begins training at a superior level of fitness is better able to withstand the physical demands better and is less likely to be injured. A major reason is that a fit individual upon entry into the training system is more likely to be a physically active individual and has better psychomotor skills.

In a previous study we reported the effectiveness of segregating trainees into fit and unfit groupings and training them separately.¹ However, it was felt that simply extending the training duration by another month to allow for a more gradual training pace, while effective, may not be the best solution. Alternatively, a formal PTP directed specifically at improving the

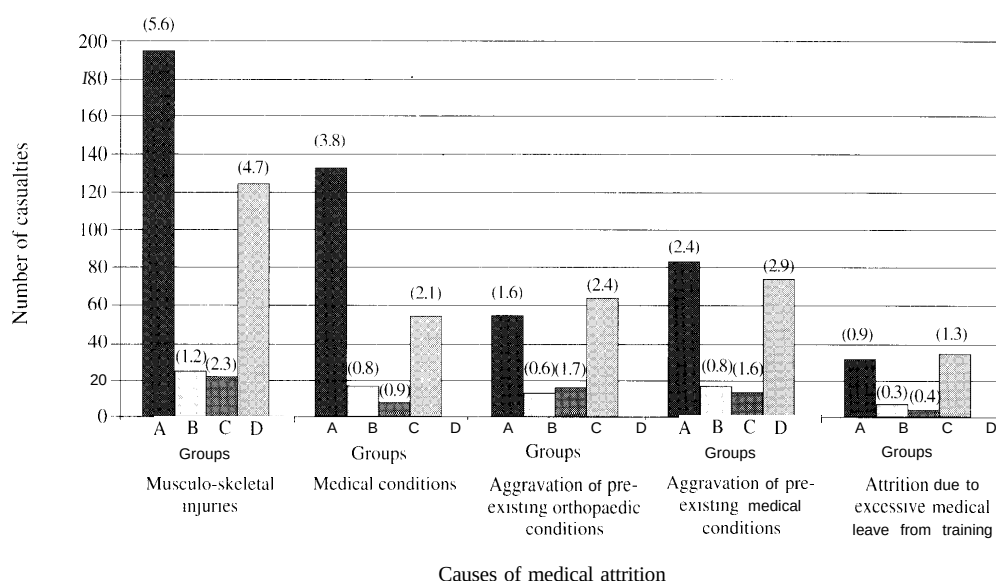


Fig. 1. Attrition due to different medical reasons in the BMT programmes of the Singapore Armed Forces.

stamina, strength and co-ordination of the recruits was introduced prior to military training. Physical conditioning induces several favourable changes in the body which helps prevent injuries and reduce the risk of attrition. These include an increase in maximum oxygen transport, strengthening of muscles, tendons and bones and a decrease in body fat. All of these are useful changes for a soldier undergoing rigorous training. It was also felt that with a formal PTP the soldier can be better prepared psychologically and this may have an indirect effect on injury prevention.⁸

Our results showed that the attrition rate for those who underwent PTP was 6.9% compared with the attrition rate of 14.2% for a standard 3-month BMT comprising a mixed group of fit and unfit individuals. This clearly shows the effectiveness of the PTP in reducing attrition rates. This formal conditioning programme was also found to be more effective than simply extending the BMT by an additional month with the hope of achieving a more gradual pace of training.

Furthermore, once the recruits had improved their fitness with the PTP, their attrition rate was not significantly different from their counterparts who entered BMT with an acceptable level of fitness (Table IV, comparison of Groups B and C). One can argue that attrition of the 20 recruits in Group B, had already taken place at the PTP phase. Nonetheless, the cohort of 920 recruits who benefited from the PTP was able to withstand the standard BMT without any more attrition compared to those who were originally fit.

It must be noted, however, that the reported cohorts did not all undergo their training over the same period of time. Groups A and D trained over the same period but 6 months earlier than Groups B and C. All cohorts,

TABLE IV: RELATIVE RISK OF MEDICAL ATTRITION DURING THE STANDARD 3-MONTH BMT AFTER PRE-TRAINING CONDITIONING (GROUP C) USING GROUP B AS INDEX

	Group C after PTP	Group B
Musculo-skeletal injuries	1.63 (0.89, 2.97)	1
Medical conditions	0.93 (0.39, 2.24)	1
Aggravation of pre-existing orthopaedic conditions	1.22 (0.49, 3.04)	1
Aggravation of pre-existing medical conditions	1.20 (0.54, 2.68)	1
Attrition due to excessive medical leave from training	1.51 (0.43, 5.33)	1
Total attrition	1.30 (0.91, 1.87)	1

95% confidence intervals are in parenthesis

however, were trained at the same school. Since the decision to attrite soldiers from training was made by a separate panel of doctors and not by the trainers themselves, it was felt that these results merited reporting.

The attrition rates due to medical reasons constituted a small proportion of the training injury rates. We considered it appropriate to use the attrition rates rather than the injury rates as an index. This is because every case of attrition is decided by a separate panel of 3 military doctors constituting a medical board. Hence, the attrition rate is less subjected to physician variation. Furthermore, while injuries per se do occur frequently, minor injuries are not significant. Most subjects recover sufficiently to resume training. In contrast, attrition from training represents an absolute deficit, necessitating repeat training or in some instances a permanent loss to the combat strength of the army.

Conclusions

From our findings we conclude that a formal pre-training conditioning programme which physically and mentally prepares unfit recruits for forthcoming military training is an effective way of reducing the attrition rate from injury and medical causes.

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