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AUSTRALIAN ARMY

LAND WARFARE PROCEDURES - GENERAL

LWP-G 7-7-4

COMBAT FITNESS HANDBOOK

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CHAPTER 1

ARMY PHYSICAL TRAINING

SECTION 1-1. INTRODUCTION

1.1 Successful performance in combat is the driving force behind all military training; physical training is no exception. It is an inherent responsibility of commanders at every level to ensure their soldiers are physically capable of meeting the physical demands of the land battle.

1.2 War places a premium on the physical capabilities of soldiers, making physically capable soldiers a 'force multiplier', as it enhances existing capabilities without additional resources. A high level of physical condition not only permits the efficient execution of tasks over extended periods of time, but increases confidence, discipline and esprit de corps, while reducing susceptibility to injury and mental and physical stress. Physically fit and mentally tough soldiers have prevailed over weaker and physically unprepared soldiers, even when they were greatly outnumbered. Strong soldiers who can continue to perform their duties under the physical and mental stress of combat, without a decrease in performance, have a greater probability of victory than those with lower physical capabilities. Conversely, unfit soldiers are more susceptible to injury and subject to fatigue, precursors to making excuses and accepting defeat.

1.3 In modern times, the necessity and value of creating and maintaining a highly fit and skilled military is often lost behind the technology of modern weaponry. However, it is the soldier on the ground who ultimately decides the outcome of battle. A sound physical training program can make a unit both physically and mentally tough. Prudent commanders recognise this reality and make physical training the cornerstone of unit training programs.

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1.4 This chapter provides an overview of physical training. It outlines the components and principles of fitness, and discusses various types of fitness programs.

Definition of Combat Fitness

1.5 Combat fitness is defined as the physical capacity to perform the physical demands of routine and mission specific duties effectively, and still have enough energy left over to handle any contingencies that may arise. This includes possessing high levels of the physical fitness parameters of strength, endurance and aerobic capacity, and the motor skill parameters of agility, balance and coordination.

Aim of Combat Fitness Training

1.6 The aim of combat fitness training is to physically and mentally prepare soldiers for battle, including:

a. preparing the soldier in the task specific fitness requirement of their role;

b. preparing the soldier in the task specific motor skill requirement of their role, including those skills required for all forms of service sports, minor team games and other unit competitions (many injuries result from soldiers who lack motor skills while playing unit sport and minor team games); and

c. physically conditioning and maintaining a high standard of fitness for both regular and reserve soldiers, regardless of corps, rank and gender, throughout their careers.

Command Responsibilities

1.7 Physical training (PT) is a function of leadership and; therefore, all commanders should actively enforce its conduct. Without the full support of the chain of command, there is little chance that a successful PT program can be implemented to improve soldiers' physical abilities.

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1.8 Leaders should be visible and active participants in PT programs. Their example will emphasise the importance of physical fitness training and highlight it as a key element of the unit's training program for operations. Leaders need to emphasise the value of PT and clearly explain the objectives and benefits of the program for it to be effective.

1.9 The sole responsibility for effective physical conditioning programs rests with leaders at every level. Leaders should not use PT to punish soldiers who fail to perform to a standard. Punishment, especially excessive repetitions or additional PT, is counterproductive. The aim of PT is to ultimately foster a positive and an enthusiastic attitude, and not to discourage soldiers from participating in PT. Leaders should plan special training to help soldiers who require it. The application of sound leadership techniques is especially important in bringing physically deficient soldiers up to standard.

Command Functions

1.10 To ensure that PT is focused to the unit's operational role (or mission), commanders need to evaluate the effectiveness of their unit's PT program. They can monitor the fitness of their personnel and evaluate the PT by doing the following:

a. participating in and observing training, relating their fitness program to the unit's operational role; and

b. analysing individual basic fitness assessment (BFA) and unit combat fitness assessment performances.

1.11 Commanders should provide adequate facilities and funds to support a program that will improve each soldier's level of physical fitness and motor skills. Commanders should also be sure that everyone capable participates, since all individuals, regardless of rank, age or gender, benefit from regular exercise. Commanders should also make special efforts to provide the correct PT for soldiers who are medically restricted. Those who have been away from the conditioning process because of leave, sickness or injury will also need special consideration.

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1.12 It is important that commanders ensure their junior leaders are familiar with approved techniques, directives and publications for PT and that they comply with them. The objective of every commander should be to incorporate the most effective methods of PT into a balanced program. This program should result in the improved physical fitness and motor skills of their soldiers and an enhanced ability to perform mission related tasks.

1.13 Commanders are advised to consult and direct physical training instructors (PTIs) and/or combat fitness leaders (CFLs) to formulate, supervise and conduct sound programs that will attain their unit's physical training and role/mission specific goals.

SECTION 1-2. THE COMPONENTS OF PHYSICAL TRAINING

1.14 There are two main components of physical training; physical fitness and motor skill.

1.15 The components of physical fitness are as follows:

a. *Aerobic Endurance.* Aerobic endurance is the ability of the body to deliver the oxygen and nutrients needed for muscular activity and also to transport waste products from the cells. It is usually trained by continuous or interval work/rest running or exercising. Advance to contact and quick attacks are examples of the aerobic endurance components.

b. *Muscular Strength.* Muscular strength is the ability of the muscular system to lift or move heavy loads with maximal force. It is usually trained by forcing muscles to work against varying loads in an isotonic, isometric or eccentric contraction (depending on the training requirement). Moving defence stores onto trucks and pushing and pulling large objects (such as artillery pieces) around the battlefield are examples of muscular strength.

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c. *Muscular Endurance.* Muscular endurance is the ability of the muscular system to perform repeated movements with a sub-maximal force for extended periods of time. It is usually trained by lifting light loads in the same mode as strength training with high repetition. Repetitive lifting of defence stores and digging are examples of muscular endurance.

d. *Flexibility.* Flexibility is the range of motion at a joint or series of joints. It is usually trained by doing stretching exercises specific to the soldier's role. Moving under or through barbed wire, climbing and digging pits are examples of flexibility.

1.16 The components of motor skill are as follows:

a. *Agility.* Agility is the ability to change the position of the body quickly and efficiently. It is usually trained by precise pattern activities such as vaulting, jumping, landing, cutting, turning, acceleration, deceleration, scaling and climbing. Activities such as fire and movement, reaction to alerts, and movement in and out of confined spaces (command bunkers and rifle pits) are all examples of agility.

b. *Balance.* Balance is the ability to maintain efficient stability and equilibrium. It is usually trained by balancing on 'wobble boards', balance beams, walking or running on undulating terrain, obstacle courses and lifting off-balance loads. Some job specific examples include patrolling in rough terrain, rock hopping in creek beds, and climbing onto and down from vehicles.

c. *Coordination.* Coordination is the ability to produce a smooth pattern of movement. It is usually trained by vaulting activities, obstacle courses and minor team games. Some job specific examples include fire and movement, manually moving stores and building structures.

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1.17 In most military tasks, more than one fitness and motor component is activated. For example, a single lift of a 30 kilograms (kg) pack onto the back requires strength, balance and coordination. If the activity is loading 10 kg containers onto a truck and is continuous, it will activate the muscular endurance component and, if sufficiently prolonged, will initiate the aerobic component. Further examples of components of fitness exercised while performing combat roles are detailed in Table 1–1.

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Table 1–1: Activation of the Components of Fitness

Task	*Average Duration of Task*	*Related Components of Fitness*
Casualty evacuation 100 m	47 sec	Muscular endurance, muscular strength, flexibility, agility, balance and coordination.
Ammunition box lift 48 boxes of 20.9 kg, height 1.3 m	2 min, 44 sec	Muscular strength, aerobic endurance, balance, coordination.
Maximal effort carrying 3 jerry cans of 21 L a distance 3 x 35 m with pack and 3 x 35 m without pack	4 min, 2 sec	Muscular strength, balance and coordination.
Maximal effort digging 0.5 m3	4 min, 22 sec	Muscular strength, aerobic endurance, flexibility, balance and coordination.
Weight load march 5.3 km/h, load 24.5 kg for 14.5 km	2 hr, 44 min	Aerobic endurance, muscular endurance and balance.
Note: The component of coordination is activated to varying levels in the performance of most military tasks.		

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Principles of Training

1.18 The primary objective of PT is to cause biological adaptations within the body to improve the capacity to perform physical activities and specific tasks. PT in the Army can result in improved performance and combat readiness through systematic, repeated, general and task specific physical activity. This requires adherence to carefully planned and executed training activities. The principles of training apply to personnel at all levels of physical training and are as follows:

a. *Overload.* The load or the intensity of training must be greater than what the body is accustomed to in order to stimulate the body to adapt and show a positive gain in capacity.

b. *Specificity.* Specificity refers to the fact that training must be focused on the specific muscles that are to be developed, and on the specific coordinated movements or tasks to be carried out.

c. *Individuality.* The level of response to regular physical training will vary due to the genetic difference and experience between individuals.

d. *Recovery.* A hard day of training for a given component of fitness should be followed by an easier training day or rest day for that component and/or muscle group to help recovery. Another way to allow recovery is to alternate the muscle groups exercised every other day, especially when training for strength or muscular endurance. It is important for commanders and CFLs to take the whole work day and week into account when determining recovery, not just the PT session.

e. *Reversibility.* The beneficial effects of training are reversible when a soldier stops exercising on a regular basis. When regular exercise ceases, detraining or loss of training state occurs rapidly and after only 1 to 3 weeks the body suffers significant reversibility in performance.

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1.19 The principles of training and exercise are detailed in Chapter 3.

Frequency, Intensity, Time and Type Factors

1.20 With insight into the principles of training, a rule that must be followed when designing a successful training program are the factors of frequency, intensity, time and type (FITT).

Frequency

1.21 Frequency refers to how often PT is to be conducted. A minimum of three days a week is recommended but, for optimal results commanders must strive to conduct physical training five days a week.

Intensity

1.22 Intensity refers to how hard an individual or group PT session is to be conducted. The intensity of group PT sessions will be influenced by varying levels of individual fitness within the group, the type of activity being conducted and the unit's stage of training.

1.23 Intensity levels for aerobic training such as running, swimming and cycling, can be determined in a number of ways to varying levels of accuracy. The most common method is heart rate (HR). The target HR zone is between 60 and 90 per cent of the maximum HR (generally 220 minus age).

1.24 Another common method to measure intensity through the talk test. Being able to talk while exercising reflects low intensity. Just being able to talk with a breath required every two or three words is medium intensity. Being able to say only one word without taking a breath is medium to high intensity. Not being able to talk at all is high intensity.

1.25 Intensity levels for muscular strength are measured as a percentage of the maximum amount of weight that can be lifted once by a muscle group through the full range of movement (ROM). This is covered in detail in Chapter 9.

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Time

1.26 Time refers to the length of time that the training exercise is applied during any training session. At least 15 to 45 minutes of continuous exercise must be performed in order to improve aerobic fitness. For muscular endurance and strength, exercise time equates to the number of repetitions done.

Type

1.27 Type refers to the types of exercise performed. The principle of specificity is particularly important in this phase.

Frequency, Intensity, Time and Type Factors Applied to a General Physical Conditioning Program

1.28 At least three exercise sessions for aerobic fitness, muscular endurance, muscular strength and flexibility should be performed each week to improve fitness levels. Thus, to obtain maximum gains in muscular strength, soldiers should conduct at least three strength training sessions per week.

1.29 Performing a single session per week on each of the components will result in only a moderate increase in fitness and unnecessary post-exercise soreness may occur. With planning, a training program for the average soldier can be developed to provide a reasonable balance of all the components of physical fitness.

1.30 Table 1–2 is an example of a generic PT program. In the first week, Monday, Wednesday and Friday are dedicated to aerobic fitness, and Tuesday and Thursday are devoted to muscular endurance and strength. During the second week, the training days are reversed; muscular endurance and strength are trained on Monday, Wednesday and Friday. As a result aerobic fitness is trained on Tuesday and Thursday. Stretching exercises are done in every training session to enhance flexibility. By complying with the principle of recovery, a unit can train continuously in this manner. Equal emphasis can be devoted to developing muscular endurance, strength and aerobic fitness while training five days per week.

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Table 1–2: Frequency, Intensity, Time and Type Factor Application to a Physical Training Program

Factor	*Aerobic Fitness*	*Muscular Strength*	*Muscular Endurance*	*Muscular Strength and Muscular Endurance*	*Flexibility*
Frequency	Three sessions and usually combined with endurance.	Three sessions per week and can be combined with ABC.	Three sessions per week and combined with endurance.	1 to 2 sessions per week.	As required – ROM during warm-ups to every session
Intensity	One session at 60 to 70 %, HRR, one at 70 to 80 %, and one at 80 to 90 % (interval trg)	3 to 7 RM, each session low, medium, high.	12 + Repetitions	4 to 12 Repetitions of jumping, other agility types governed by time	Slight discomfort no pain

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Factor	*Aerobic Fitness*	*Muscular Strength*	*Muscular Endurance*	*Muscular Strength and Muscular Endurance*	*Flexibility*
Time	15 to 40 mins			15 to 40 mins group	
Type	Load carriage, running, swimming	Game form, logs, obstacle course, circuits, free weights		Game form, vaulting, ground work	Stretching

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1.31 The mission specific requirements for each unit will vary. Engineers, for example, may place a greater emphasis on muscular strength training in lieu of aerobic fitness training; however, the principle of recovery cannot be revoked, and hard and easy days must be observed.

1.32 Depending on the time available for each session and the way training sessions are conducted, all components of fitness can be developed using a three-day per week program. However, a five-day per week program is much better. Numerous approaches can be taken when tailoring a fitness program to meet a unit's role/mission, as long as the principles of exercise are not violated. Such programs, when coupled with good nutrition, will help keep soldiers fit to win.

Benefits of Regular Combat Fitness Training

1.33 **Direct Benefits.** All the components of fitness are improved and maintained when soldiers undergo regular fitness training. In relation to physical performance in a combat role, commanders should appreciate the significance a high standard of fitness provides in achieving the mission. A fit soldier is less prone to fatigue and will consume less of the body's energy stores at a lower rate than a less fit soldier, if both are working at the same absolute workload. As a result, the fit soldier, working alongside the unfit soldier at the same absolute workload, may be able to work up to four or five times (or more) as long as the unfit soldier before fatigue occurs.

1.34 **Indirect Benefits.** The indirect benefits of exercise are less obvious but have a long-term impact on an individual's wellbeing. They are as follows:

a. an enhanced quality of life;

b. physical activity extends longevity and protects against the development of:

(1) coronary heart disease,

(2) hypertension or high blood pressure,

(3) obesity,

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(4) non-insulin dependent diabetes mellitus,

(5) osteoporosis,

(6) colon cancer, and

(7) depression; and

c. physical training preserves and maintains function and independence among the elderly.

Types of Military Fitness Programs

1.35 The majority of PT conducted in the Army is performed in lessons in a group environment. The group lesson may be performed as a single activity such as a unit run or it may comprise up to three or more modules of varying duration and intensity. Table 1–3 details most of the PT modules Army conduct (interpretations may vary) and the components of fitness activated while performing the modules.

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Table 1–3: Army Physical Training Modules and Components of Fitness Activated

Activity	*Aerobic Training*	*Muscular Endurance*	*Strength*	*Coordination*	*Flexibility*
Ability Group Run	x				
Above Pool Obstacle Course		x		x	
Assessment	x	x	x	x	x
Aerobic Class	x	x			
Aerobic Circuit	x	x		x	
Game Form Exercise		x	x	x	
Core Stability and Prehabilitation		x		x	
Climbing and Scaling		x		x	
Cross-country Run	x				
Deep Water Running	x	x			
Flexibility					x

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Activity	*Aerobic Training*	*Muscular Endurance*	*Strength*	*Coordination*	*Flexibility*
Heaving and Abdominal		x	x		
Individual Run	x				
Indoor Obstacle Course		x		x	
Interval Running	x	x			
Lift and Carry		x	x	x	
Log Exercises		x		x	
Long Slow Distance	x				
Medicine Ball Exercises		x		x	
Military Skills Activity	x	x	x	x	
Minor Team Game				x	
Muscular Endurance Circuit		x			
Obstacle Course Training		x		x	
Orienteering	x				

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Activity	*Aerobic Training*	*Muscular Endurance*	*Strength*	*Coordination*	*Flexibility*
Pump		x			
Push and Pull		x	x	x	
Rifle Exercises		x		x	
Relays	x				
Ropes and Balance		x	x	x	
Shell Exercises		x			
Stick Exercises		x		x	
Strength Circuit			x		
Stretcher Carry	x	x			
Unit Run	x				
Vaulting Agility				x	
Weight Training			x		

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1.36 Conducting up to three modules in a PT lesson has the following advantages:

a. all the components of fitness can receive a training effect, particularly in a three days per week training program; and

b. the activities performed in many of the modules simulate functional task specific roles, and variety.

1.37 The general content of Army PT modules are discussed in later chapters. Specifically, the instructional procedures for teaching the modules are detailed in Chapter 13.

Physical Training Programs

1.38 **Group Training.** The unit PT program is designed in accordance with the systematic approach as detailed in Chapter 3; however, the lessons that may make up the group program are as follows:

a. *General Group Lessons.* Soldiers perform PT in a group environment at a predetermined level of intensity. The progressive unit program imposes the level of intensity for each lesson; soldiers who have participated on a regular basis receive the prescribed training effect required to facilitate improvement. In some cases, fitter soldiers may not be challenged if group lessons are conducted rigidly, and less fit soldiers may incur injuries attempting to keep up. Therefore, the introduction of ability groups within lessons is essential to ensure all soldiers receive a training effect.

b. *Ability Groups.* Soldiers within units have varying levels of fitness. The organised unit PT program will adopt the strategy of ability groups, within lessons, to cater for the variables in fitness levels of members of the unit. To receive a training effect from a session, all soldiers must comply with the overload principle of fitness. Soldiers who have trouble sustaining the lowest level should be considered for an individual remedial program.

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c. *Battle Physical Training Lessons.* The battle focused approach to combat fitness training requires a prerequisite amount of physical fitness. Battle PT lessons enhance the physiological systems and coordination skills that directly support demanding work performance tasks. The lessons are normally conducted in modified and varying levels of combat dress to suit the type of lesson, and are conducted during the task specific and maintenance phase.

1.39 Individual Training. The alternate types of programs conducted in the Army are individual programs. Individual programs may be the only form of training or an adjunct to the unit program for individuals; however, they are designed exclusively for the soldier and are defined as follows:

a. *Personal Development.* Soldiers may elect to undertake a personal training program to seek improvement in physical performance for certain activities or for self-esteem. Senior ranks without the time, soldiers serving in small detachments or, in particular, reserve soldiers may not have the opportunity to participate in group sessions; therefore, a personal training program is essential for them to maintain their capability. It is highly recommended that all soldiers undertake personal training programs to receive the indirect benefits of a regular training program. A personal program significantly improves a soldier's performance in a selected component of fitness, and the benefits may compensate for any shortfall not obtained in group sessions. Soldiers are advised to consult PTIs or CFLs on the correct exercise prescription to suit their individual requirements. The exercise prescription permits the individual to train alone; however, enlisting the aid of a training partner is recommended. Training partners provide physical assistance, motivation and commitment to maintain the regularity of a training program.

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b. *Remedial.* Soldiers not up to standard or incapable of performing their mission specific duties are required to undertake a corrective training program in accordance with current Army policy. Following counselling, the identified soldier should consult medical staff for a diagnosis to establish a solution for the problem. It is vital they are not ridiculed or vilified by their peers or leaders for their deficiency. The aim is to address the problem to enable the soldier to develop a positive self-help attitude towards PT. The remedial program should be closely monitored to guarantee the soldier improves progressively without injury. It should also be educational to ensure the soldier understands and appreciates their improvements. Failing to educate the soldier may lead to reversibility once the program has concluded.

c. *Rehabilitation.* A major component of the recovery process from surgery or injury for soldiers involves undergoing individual rehabilitation programs. Medical officers, physiotherapists and PTIs strictly supervise rehabilitation programs for soldiers. Commanders should note that the conclusion of rehabilitation programs does not necessarily mean the soldier is fit for full duty. A remedial program may be required to fine tune the member's fitness back to the pre-trauma level. A soldier rushed back to full unit training may sustain a recurrence of the original injury.

SECTION 1-3. EMPLOYMENT OF PHYSICAL TRAINING INSTRUCTORS AND COMBAT FITNESS LEADERS WITHIN UNITS AND FORMATIONS

Physical Training Instructors

1.40 Primary Function. PTIs are primarily involved in the physical conditioning of personnel, advising commanders on injury prevention and assisting with the rehabilitation of injured

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personnel. This function is performed equally in barracks and while on operations.

1.41 Physical Conditioning. PTIs are qualified to design, conduct, evaluate and review the unit's physical training programs to develop physically conditioned personnel to support commanders in executing their operational tasks. PTIs are best placed to provide unit PT risk management programs and appropriate advice for progressive sessions applicable to the unit's roles and level of fitness. PTIs are responsible for the safe and effective conduct of military self-defence training and the conduct of military self-defence exponent and instructor courses. They are responsible for the ongoing development of soldier's skills in this area, and for ensuring that training is conducted in accordance with doctrine and the skills taught on the military self-defence course.

1.42 Injury Prevention. In support of the physical conditioning task, PTIs are responsible for the provision of advice to commanders and personnel conducting PT sessions to ensure compliance with safety standards to prevent injury. While injury prevention analysis and advice is predominantly by PTIs in relation to physical conditioning programs, commanders may call upon PTI advice regarding injury prevention in the workplace.

1.43 Rehabilitation. PTIs, along with physiotherapists and health care workers, provide rehabilitation services to injured personnel. On operations PTIs provide a critical rehabilitation role in support of medical staff to ensure that correct methods of rehabilitation treatment and training are provided to the member maximising the opportunity for the individual to remain within the AO, thus preserving operational manpower. They are responsible for the tailored exercise prescription for injured members and provision of timely and accurate feedback to the Medical Officer.

1.44 Secondary Function. A secondary, yet important, function provided by PTIs is their contribution to unit morale while on operations and in barracks through the organisation of sporting and social activities with Australian and coalition forces.

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Combat Fitness Leaders

1.45 **Role.** The CFLs are soldiers authorised to conduct combat fitness training. When not conducting PT, they perform their routine mission specific duties. Their skill set places them in the primary position to contribute to the development of their units' PT programs. They are key contributors to their units' injury prevention strategies.

1.46 **Tasks.** The core tasks of a CFL are as follows:

a. under PTI supervision, determine the fitness goals and current fitness of the unit;

b. under PTI supervision, develop a fitness program for the sub-unit;

c. conduct combat fitness training sessions;

d. conduct Army fitness minor team games;

e. conduct competitive minor team games;

f. operate in accordance with the legal and ethical responsibilities of an instructor;

g. promote health and fitness in the Army; and

h. employ injury prevention in combat fitness training.

Risk Management of Physical Training

1.47 Military operations and training are hazardous and will rarely be free of risk. Despite this, Army has a moral and legal obligation to minimise risks and to train within a level of risk that meets government and community expectations.

1.48 The focus of risk management within the Army is force preservation. The objective of force preservation of combat power is achieved through identification, assessment, control and monitoring of risk within all aspects of Army activity, including the operational and training environment.

1.49 Commanders at all levels should strive to achieve the best possible levels of fitness for their soldiers but, in doing so, they should consider the risks involved with this training. They

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should ensure that all risks are reduced to a manageable level in order to reduce the likelihood of injury, thereby preserving the force. Some form of risk will be present in all aspects of PT; however, the risk of injury can be dramatically reduced with the employment of qualified, competent personnel to plan and conduct PT. PTIs and CFLs should be used to plan and conduct PT wherever possible.

1.50 Further information on PT safety aspects can be found in the *Defence Safety Manual (SAFETYMAN),* 2002 or on the Defence Safety Management Agency website located at http://dsma.dcb.defence.gov.au.[1]

Conclusion

1.51 Physical fitness is equally as important as other elementary soldier skills. History has proven a high standard of physical fitness is a force multiplier; therefore, commanders are strongly encouraged to foster a commitment to regular participation in structured physical training programs.

1. Department of Defence 2004, Defence Safety Management Agency, Canberra, viewed October 22, 2004, <http://dsma.dcb.defence.gov.au>

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CHAPTER 3

PRINCIPLES OF PHYSICAL TRAINING

SECTION 3-1. OVERVIEW

3.1 A combat fitness training program and its individual sessions will vary depending on the roles and tasks dictated by the commander's intent. The activities contained within a single session can be further broken down into repetitions of a specific activity, that is, jumping a 2 m ditch. These activities are usually repeated to a point whereby the soldier is 'overloaded'. That overloading, if managed correctly, stimulates a training response which will enhance the physical capability of the soldier. As each soldier will vary in experience and ability, the individual effects of training sessions will also vary. Although there will be individual variance to training activities, the form in which training adaptation occurs is similar.

3.2 The factors which affect this training response include the following:

a. *Tolerance Capacity.* A trained soldier will normally be able to tolerate the demand of a training stimulus for a period of time. The level of tolerance is related to the level of pre-existing fitness as well as the experience of each individual. The ability to continue demonstrating a high level of performance will be dictated by the onset of fatigue.

b. *Fatigue.* Fatigue develops when the soldier can no longer perform the tasks in the manner required within the lesson. The onset of fatigue depends on the training intensity. In the presence of fatigue, the soldier will not perform actions correctly and may reinforce the actions the training session desires to rectify. Injuries may occur at this point of the training session unless preventive actions have been included to take fatigue into account; for example, landing mats or protective equipment. In

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the presence of fatigue, a soldier will revert to an untrained state of performance.

c. *Recovery.* After each training stimulus or repetition is completed, the body attempts to recover. The length of time that a soldier spends in the recovery stage depends on the potential of each individual, and the intensity and duration of the training stimulus. Recovery involves the replenishment of the body's systems to return to full function. Effective recovery will produce the desired outcome or training effect.

d. *Training Effect.* During recovery the body will undergo a period of reorganisation of the structural and functional systems. If recovery is effective and adaptation has occurred, the body when subjected to the same training load again will perform differently. This improvement is called the training effect. Having achieved a training effect, the maintenance of it is depends on continued exposure to training stimuli.

e. *Decay.* Due to the temporary nature of a training effect, the body will return to the pre-trained state if no further training is applied. Therefore, to enhance performance further, training stimulus is required until the desired outcome is achieved. Once the desired training outcome has been achieved, the effective maintenance of it should be the next focus of the training program.

f. *Fitness Training Principles.* The basic fitness principles on which a training program should be based are overload of training, specificity of training effects, individual performance considerations, recovery and the reversibility of training adaptations.

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SECTION 3-2. PRINCIPLES

3.3 The principles of physical training are as follows:

a. overload,

b. specificity,

c. individuality,

d. recovery, and

e. reversibility.

Overload Principle

3.4 The training load must be greater than what the body is accustomed to in order to induce the body to adapt and foster physical improvement. Overload causes a variety of training adaptations that enable the body to function more efficiently. The appropriate overload for each soldier can be achieved by manipulating combinations of training frequency, duration and intensity.

3.5 The body responds to overloading by improving efficiency and capacity. Training load must continue to be gradually increased in order to maintain the overload. Progression of loading can be applied as increased frequency, higher intensity, longer duration or a combination of these. Loading must be based on the soldier's current physical fitness and training history. The recommended progression is as follows:

a. raise frequency of training; for example, from 3 to 5 days per week;

b. increase the duration/time of each training session while keeping frequency constant; and

c. raise intensity of loading over training sessions.

3.6 As a rule, it is not acceptable to bring about these three stages simultaneously. This would increase the risk of incurring a training injury, and it provides insufficient time for optimal physical adaptations to occur. The first priority is to achieve

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optimum frequency of training, with the last priority to increase load by intensity.

3.7 The training load required to produce an effect increases as fitness level improves during the course of training. The required training load depends, therefore, on the level of fitness of the soldier. The more fit the soldier, a greater load or stimulus will be required to improve that fitness. The overload principle dictates that as adaptation to a given load occurs, training load must be increased in order to achieve further improvement. At a certain point, positive training outcomes are not attained regardless of further increases in the training load. This is often referred to as 'The Law of Diminishing Returns'.

Specificity Principle

3.8 The principle of specificity revolves around the training effect being specific to the overall objective. The body adapts according to the type of overload imposed and the specific method training being delivered. Weight training performed exclusively induces specific strength adaptations with little or no increase in aerobic fitness. Aerobic fitness training, in contrast, elicits specific endurance training adaptations with essentially no improvement in strength.

3.9 Development of aerobic fitness for marching, traversing an obstacle course or running is most effectively achieved when the exercise trains the specific muscle groups involved for the desired performance. While swimming and cycling help to develop aerobic fitness, they do not improve the running performance as much as a running program does. Specific exercise modes, therefore, elicit specific training adaptations in the involved muscle groups.

3.10 Therefore, to enhance combat fitness performance, training must consist of exercises that use muscle groups in a way that imitates the movement patterns most often used during the actual performance of the activity. To improve load carriage capabilities, you must practise load carriage marching. Other aerobic activities add variety to the program and enhance the

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soldier's aerobic capabilities in preparation for load carriage work performance.

3.11 Consideration of the principle of specificity is vital when planning a training program. A task analysis is required to identify the specific demands and, hence, to allow the training objectives to be clearly defined. Task specific physical training, and specific skill and technique training in combination with general physical fitness training appear to be the optimal method to enhance military task performance.

Individuality Principle

3.12 The focus for combat fitness training is on team performance; however, the team in its entirety is made up of individuals of different genetics, experience, lifestyles and tolerance to training intensities. The main aim of a preparatory combat fitness program is to identify shortfalls in the performance of individuals and prescribe training to enhance performance accordingly. The use of ability groups and personal training programs is essential to optimise performance improvements.

3.13 Individual performance is determined by genetic factors such as the onset of puberty, body composition and specific muscle fibre type. Those individuals with a higher proportion of FT muscle fibres will have a greater potential for strength activities and reduced aerobic capacity, whereas those inheriting predominantly more ST muscle fibres will have the situation reversed. However, regular specific training will induce a training effect in any component of fitness regardless of the individual genetic constraints.

3.14 The capacity to respond to training is related to the initial level of fitness and the physiological characteristics of the individual. The potential for improvement is greatest when the initial level of fitness is lowest. As an untrained soldier starts to train, the gains in fitness are greatest, because of the large potential to be realised. As training proceeds, gains diminish as one approaches genetic potential. When the soldier is fit, performance improvements will be small and relatively infrequent. Once maximum fitness has been achieved, it

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requires much less training to maintain performance than it took to obtain in the first place. Individuals will achieve more stable adaptation and, ultimately, a greater improvement in performance if loading progression is raised cautiously and loading progression is achieved via more extensive training. It is important to note that gradual adaptation over a number of years is essential for absorbing heavy training loads.

Recovery Principle

3.15 A soldier's physical improvement depends on the provision of adequate recovery to ensure that training effects can be maximised. To train without adequate recovery from previous fatiguing work does not produce any benefit to soldiers from a fitness perspective; they merely learn to cope with fatigue rather than improving in specific aspects of performance. A comprehensive training regime must expose soldiers to arduous simulations to develop the coping mechanisms to deal with fatigue and a range of adverse environmental conditions. The point at which this training occurs must be incremental to reduce the likelihood of injury from overuse or ill-timed training loads.

3.16 As a rule, 24 to 48 hours is required to allow the highly vascularised (that is, high blood flow, more healing nutrients) tissues of the aerobic and muscular systems to recover from intense training. However, recovery from combat fitness training activities such as load carriage marching and obstacle training carried out in field dress may take longer.

3.17 The repetitive action of marching, jumping and landing places a great deal of stress on the skeletal system, connecting tissues and tendons of the body, in particular the lower limbs and back. If impact activities are programmed too frequently small lesions develop, and if training continues without adequate recovery the lesions accumulate. The accumulated lesions may culminate in stress fractures and tendon overuse injuries. The tendons and connective tissues are poorly vascularised (eg. less blood flow, less healing nutrients) and, as a consequence, the regeneration capacity is less than that of muscles. As a rule, 48 to 72 hours are required to allow for

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recovery from a high impact strain, especially in the first phase of training.

3.18 Longer recovery phases should, therefore, be planned in the form of rest and low intensity training. Another option is to plan other modes of activities that do not strain the same tissues. For example, between runs with high impact stress to the lower extremities on Monday and Wednesday, activities like swimming, deep water running or resistance training should be planned for the alternate days.

Reversibility Principle

3.19 The beneficial effects of training are reversible when a soldier stops exercising on a regular basis, causing a noticeable lack of fitness. Detraining or loss of training state occurs rapidly. After only 1 to 3 weeks of physical inactivity, significant reductions in working capacity can be measured. Many of the training improvements are lost within several months, which has a negative impact on performance.

3.20 The time for the loss of training adaptations and performance appears to be related to the individual's training level. The magnitude of performance decay is variable, and probably influenced by the exercise mode and the duration of detraining. The more recently the fitness level has been achieved, the more quickly it will be affected by reduced training. Long periods of gradual development are, therefore, desirable. Lengthy transitional periods without training should be avoided, while on leave soldiers should be educated and encouraged to maintain their base level fitness. If injured, alternative physical activities should be conducted to ensure the base level is preserved.

3.21 In all cases, regular training is important. It generally takes several months to develop a reasonable level of aerobic fitness, muscular strength or muscular endurance, but it requires less effort to maintain the level once it has been achieved.

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Overtraining

3.22 Overtraining can be defined as an induced state of fatigue caused by a prolonged period of high intensity and/or frequency of training with inadequate recovery for adaptation. Continued training in this state will cause a decline in performance, a loss of muscle mass and a decrease in the immune system, possibly resulting in the soldier being more susceptible to infection and illness.

3.23 **Overtraining Indicator.** General fatigue is a desired and an acceptable consequence of training; however, a soldier indicating a prolonged state of fatigue that lasts for at least a week is considered to be suffering from overtraining. By applying the principles of training, overtraining should be avoided.

Diagram of Adaptation to Training

3.24 With insight to the principles which underpin the development of fitness, the next step is to apply the training load for the subsequent session at the desired time to promote optimal gains. There is an initial decrease in performance as the body is subject to a training overload. During the recovery phase the body undergoes regeneration. It does not stop at its former level, but will super-compensate to a higher level to protect the body against a repeat of a similar training load. If no further training load is applied, the training effect is lost (see to Figure 3–1); applying the training load too late will result in negligible improvement (Figure 3–2). Ideally, the aim is to apply the next training load at the peak of the super-compensation phase to facilitate maximum gains (Figure 3–3), while applying it too soon will result in overtraining (Figure 3–4).

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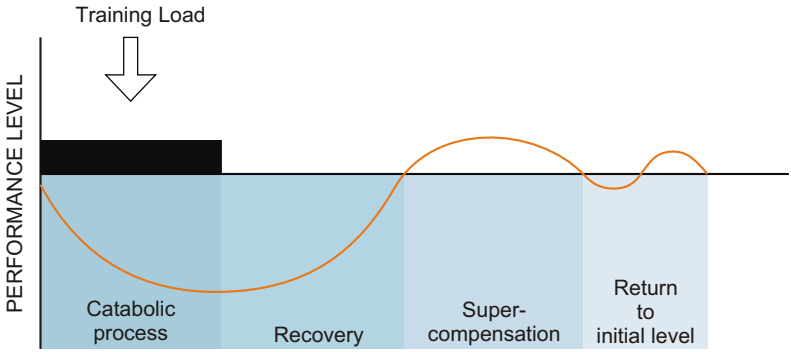


Figure 3–1: Diagram of Adaptation to Training, No Further Training

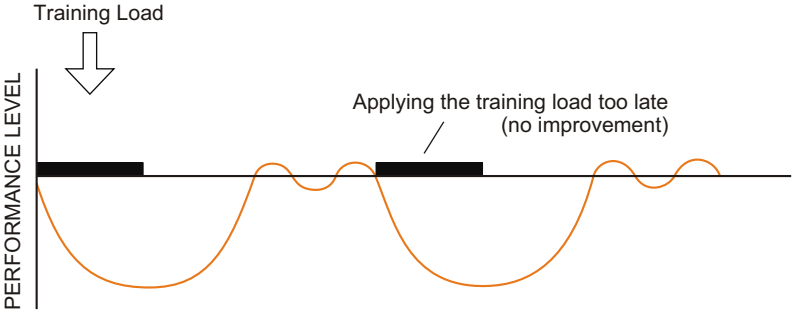


Figure 3–2: Diagram of Adaptation to Training, Applying the Training Load Too Late

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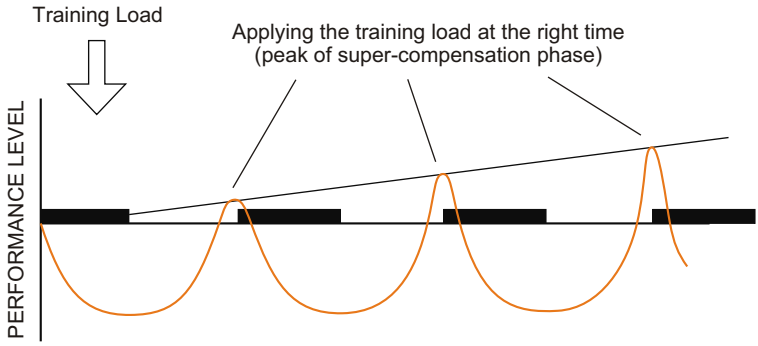


Figure 3–3: Diagram of Adaptation to Training, Applying the Training Load at the Right Time

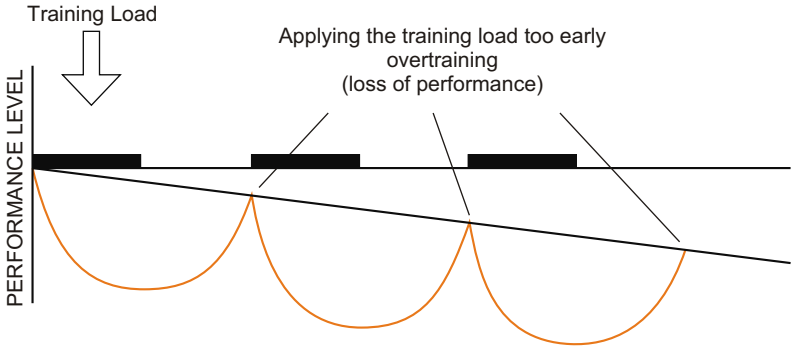


Figure 3–4: Diagram of Adaptation to Training, Applying the Training Load Too Early

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CHAPTER 4

DEVELOPING A PHYSICAL CONDITIONING PROGRAM

SECTION 4-1. INTRODUCTION

4.1 Development of military physical conditioning programs should be driven by the unit combat mission and follow the basic principles of physical training. The physical conditioning program in any unit is to enhance the physical ability of the soldier to complete the combat mission. The outcome will be a soldier who is able to complete the combat mission skilfully, without suffering undue fatigue and free of injury. The adoption of a graduated step planning process is recommended.

4.2 **Steps in Planning.** A six step planning method is recommended as a systematic and practical approach for developing unit level training programs. The six steps include:

a. defining training objectives,

b. analysing individual and unit fitness,

c. developing a training plan,

d. conducting training,

e. re-evaluating individual and unit fitness, and

f. revising training objectives.

4.3 This approach integrates both general physical training activities for improving overall physical capacity and military specific physical activities to enhance task performance.

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SECTION 4-2. DEFINE TRAINING OBJECTIVES – STEP 1

4.4 The unit is required to conduct a task analysis to identify the physical demands required to fulfil their mission. The overall program and individual training session objectives should be clearly identified and driven by the results of the analysis. There are many types of units with different mission requirements. Commanders should tailor the physical training objectives to meet the needs of their particular unit when deployed on the battlefield. Items to consider when defining training objectives are as follows:

a. type of unit and missions;

b. higher commander's and/or headquarters' training guidance;

c. unit and individual fitness level;

d. time and resources available;

e. any identified shortfalls from previous physical training programs;

f. rate, type and occurrence of injury within the unit;

g. specific physical requirements;

h. technical physical requirements; and

i. skill requirements.

4.5 It is not sufficient to simply state that the objective of unit physical training is to improve fitness. The program as a whole should have an identifiable objective related to the unit's mission and specific goals that may be quantified. This permits the establishing physical performance standards that soldiers would need to achieve for the unit's mission to succeed.

4.6 The key to developing useful performance standards is to make them challenging, yet realistic. If the program objective is not mission related, then the chance of injury will be greater in the performance of the job/role.

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4.7 For example, the objective of a transport company's physical training program may be to develop a level of strength, aerobic capacity and skill that permits the safe operation of transport vehicles for periods extending up to 12 hours, including the loading and unloading of cargo by hand. The performance standard would be that each individual will have the upper body strength to lift 60 per cent of their body weight overhead, 75 per cent of their body weight to waist height twice in 30 seconds, and the aerobic fitness to complete a 2.4 kilometre (km) run in 11 minutes. Further, personnel should demonstrate the skill sets of good lifting form, coordination and balance in order to complete the task without injury.

4.8 Each individual physical training session within the program should have a training objective tied to one or two of the major components of physical fitness. For every training session, soldiers should understand how the activities selected would help improve specific components of fitness and skill. If an activity is not effective in improving the component to be trained it should be eliminated or the session's training objective changed.

SECTION 4-3. ANALYSE UNIT AND INDIVIDUAL FITNESS – STEP 2

4.9 Before training can be effectively planned, the current level of unit and individual fitness and skill sets must be determined to establish the correct training start point. The analysis can be accomplished through key personnel conducting the following tasks:

a. *General Fitness Tests.* Authorised tests such as the BFA, multi stage fitness test or a combination of selected test components will identify the areas where training is needed and those where performance is already satisfactory. However, the test should be balanced and evaluate all components of physical fitness. The key point in any evaluation is to be sure the information it provides is accurate. Soldiers must give a maximum

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effort on fitness tests and the entire unit must participate, otherwise the basis on which training is planned may be invalid. Following a lengthy break in training, soldiers may require a week of light conditioning before the initial test to avoid unnecessary post-exercise trauma as a result of maximal effort. The test results will also identify personnel who require additional training to bring them up to the minimum or start standard.

b. *Skill Assessment.* The skill sets required of a unit are many and varied; however, the basic areas of jumping, landing, cutting, turning and stopping should be assessed. These areas have been identified as common precursors to injury. Other skill sets of specific units are lifting, carrying, climbing, scaling and putting down. Basic skills can be assessed though observation of a simple indoor obstacle course that contains the parameters described above. Quite often fitness training commences in earnest before the skill sets required are in place.

c. *Evaluation and Observation.* Mission related tasks will also provide information about unit and individual fitness. It may be appropriate to conduct mission specific events, such as a road march for a set distance with a prescribed load in a standard time, to obtain a complete picture of unit physical conditioning as it relates to military task performance.

4.10 Review of Training and Medical Data. An analysis of previous training programs and a review of medical statistical data may also assist in planning the unit's program. Historical patterns of failures and injuries may be identified and intervention strategies employed in the unit program to prevent further recurrences.

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SECTION 4-4. DEVELOP A TRAINING PLAN – STEP 3

4.11 From data collated from Steps 1 and 2, the unit program can be developed. At this stage, commanders are advised to employ PTIs and/or CFLs to formulate the progressive training plan and coordinate all administrative procedures relating to the successful conduct of the program. The purpose of the training plan is to organise fitness activities in such a way as to promote physiological adaptations that will result in improved physical ability. Emphasis should be placed on improving those components of physical fitness that are below standard.

4.12 In order to produce significant changes in physical ability, the schedule of lessons must comply with the principles of training and be conducted in accordance with the FITT principle. As a guide, it is recommended that programs be designed quarterly with three to five 40 to 60 minute periods per week allocated strictly for physical training while the unit is in barracks. Activities and events that will not result in the improvement of physical performance should not be made part of the physical training plan. However, to educate and add variety, sports and health promotion events can be an adjunct to the plan.

4.13 Other unit activities must be considered while planning the unit training program. For example, if the unit is programmed to conduct parade rehearsals for most of the day, it would be inappropriate to conduct endurance training on that day. Continual standing and marching is very fatiguing on the lower limbs and back. A therapeutic recovery session such as swimming or flexibility would be an ideal option following parade rehearsal.

SECTION 4-5. CONDUCT TRAINING – STEP 4

4.14 Once the physical training plan has been developed, training can begin. Every physical training session should begin with a short warm-up and end with a cool down. The body of the session should ensure soldiers receive a training effect. Two

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important considerations in the execution of every physical training program are as follows:

a. *Maximising Participation.* All members of the unit must actively participate in physical training to ensure the program succeeds. Physical capacity is improved by systematically exercising the body's systems in a progressive manner. It is erroneous to believe that soldiers can perform beyond their capacity by force of will alone. Individuals who do not participate will experience a decrease in performance over time. This makes physical training even more important for senior soldiers who hold less demanding physical positions than for new soldiers, who are in the prime of their physical abilities.

b. *Ability Group Training.* As stated in Chapter 1, the importance of ability group training within lessons is essential to ensure all soldiers are overloaded sufficiently to receive a training effect. The use of ability groups does not preclude the use of unit activities such as runs and route marches. These activities are excellent for building esprit and cohesion. However, a continual program of unit running will not maximise aerobic fitness and may result in unnecessary injury to poorly conditioned soldiers, and a lowering of aerobic fitness in highly fit soldiers.

SECTION 4-6. EVALUATE UNIT AND INDIVIDUAL FITNESS – STEP 5

4.15 At the conclusion of the training program, unit and individual fitness should be evaluated by performing the same activities carried out in Step 2. Results from physical training tests, and strong or weak performances on mission specific tactical training exercises, are excellent indicators of individual and unit fitness. Comparison of data will determine the effectiveness of the training program and, from the information derived, modifications to the program can be made.

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4.16 As a rule of thumb, significant changes in physical performance require a minimum of eight weeks of training and more often up to 12 weeks. Re-assessments conducted more frequently than quarterly may not be true indicators of the program's effectiveness and may risk alienating personnel.

SECTION 4-7. REVIEW/REVISE TRAINING OBJECTIVES AND PLAN – STEP 6

4.17 Based on the results, the objectives for the next phase of training can now be defined. However, caution should be taken. It is important not to elevate performance expectations and standards beyond mission requirements, even if unit and individual capabilities exceed what is required for superior mission performance. Avoidable injuries may result.

4.18 The long-term annual or pre-deployment unit physical training plan should be divided into phases. These phases or periods are more manageable and the program be can modified as required; this strategy is defined as the periodisation of training.

Periodisation

4.19 Periodisation involves the long-term planning of the training process so that peak performance is achieved at the most appropriate time. A physical training program should be designed in the following three definite phases:

a. preparatory fitness training,

b. task specific training, and

c. maintenance training.

4.20 The objective of each phase varies; however, the systematic steps in planning a fitness program are common to all three.

Training Guidelines

4.21 The six steps to planning can then be applied to the development of the three phases of training. The most important features of the training phases are summarised in Table 4–1.

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Table 4–1: Relevant Features of the Three Phases of Combat Fitness Training

	Preparatory (General) Fitness Training	*Task Specific Training*	*Maintenance Training*
Aim	Condition aerobic and muscular system	Enhanced task performance skills.	Keep up physical fitness and task performance.
Duration	8 to 12 weeks	6 to 12 weeks	Life time
Frequency	3 to 4 times per week	2 to 4 times per week	3 to 4 times per week
Mode	General conditioning exercises: major muscle groups	Task repetition specific.	Combination of general and task specific exercises

Note:

During the phase of task specific training, general fitness should be trained at least three times per week to maintain the desired level. Task specific training should be planned 1 to 2 times per week, depending on the complexity of the task.

The duration of each phase detailed in Table 4–1 is a guideline. Depending on the time available for training, each segment is given equal weighting. For example, if there are three months until deployment or a major exercise, then each segment should receive 1 month each. The point is that each segment is important and should not be omitted at the expense of another, particularly the preparatory phase.

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Preparatory (General) Fitness Training Phase

4.22 The aim of the preparatory phase is to develop the trainee or unfit soldier's personal level of fitness and skill. The duration of the phase is eight to 12 weeks and lays the foundation for more intense task specific training in the subsequent phase.

4.23 For unfit soldiers, the training load must be low in the beginning. In compliance with the principles of training, the training load should be increased gradually to facilitate a more stable adaptation and a greater improvement in performance. In particular, trainees are most vulnerable to high impact training injuries during the early stages (up to 12 months) of their careers. Adequate recovery periods are crucial, specifically for the lower limbs. An important part of the preparatory phase is teaching and/or reiterating the skill technique that is required for the job/role and those that may be required during physical training lessons. These could include jumping, landing, climbing, scaling, running, walking and stopping techniques.

Task Specific Training (Battle Training) Phase

4.24 At the conclusion of the preparatory phase, a good base level of fitness and skill should have been achieved, providing the soldier has participated in the entire program. Step 6, the validation of training, will determine whether the program progresses to the task specific phase or the preparatory phases continues until the shortfall in physical development is addressed. Task specific training can be quite arduous and the unfit may incur injuries. Therefore, it is essential that the base level of fitness be confirmed before commencing the phase.

4.25 Task specific training is aimed at enhancing the particular physiological systems and skills that directly support task performance. Gains in performance will be optimal when the program consists of activities which include the muscle groups that simulate the movement patterns most often used during the actual execution of that task. The training must include skill exercises. To improve the ability to lift and carry heavy objects, training exercises have to simulate lifting and carrying tasks.

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4.26 This phase can be conducted over a 6 to 12-week period and is considered a teaching phase. Task specific lessons should be scheduled at least 1 to 2 times per week, depending on the complexity of the task. Task specific lessons can be very physically demanding; therefore, they are not performed exclusively for the duration of the entire program. General physical training lessons must be incorporated for variety and to maintain the enhanced state of the soldier's components of fitness.

Maintenance Training Phase

4.27 If the commander is satisfied with the results of the task specific phase, the skills practice phase of maintenance training can commence. As a continuum, maintenance training is directed towards preserving physical fitness and task performance at the desired level. An effective maintenance program should include exercises to maintain the components of fitness and task specific skills. A minimum of three well-planned group sessions of 30 to 40 minutes a week are sufficient to maintain an acceptable level of fitness. Five sessions per week may be preferred or soldiers may be directed to conduct a personal program as a supplement to three sessions per week; however, maintenance training should become part of each soldier's training routine.

4.28 The principle of reversibility must be emphasised to soldiers. Soldiers will lose significant fitness within 1 to 3 weeks of the cessation of training and the physiological adaptations gained will deteriorate or be lost. It is more efficient and practical to maintain a level of fitness, rather than lose it and repeat a complete cycle of training to regain it.

4.29 As a guide, the best training is a combination of general training aimed at improving the components of fitness and task specific training for improving the specific skills that directly support the combat role.

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Training Programs in Detail

4.30 Within any of the three training phases, unit physical training programs must be performed in cycles to comply with the principles of overload and recovery. The graph in Figure 4–1 details the loading and unloading (recovery) intensities of a 12-week unit training program.

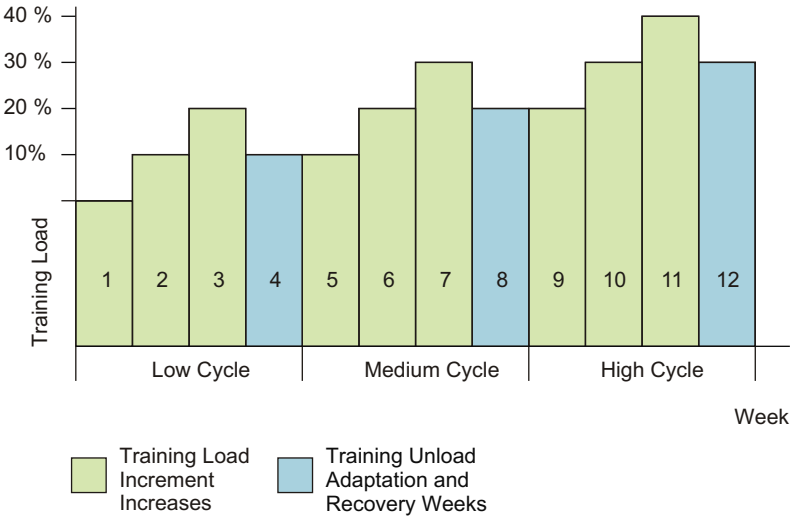


Figure 4–1: Cycle of Training

4.31 In the example, the program is divided into three cycles, each of four weeks in duration. The first three weeks of each cycle are devoted to the incremental overload in training, whereas the fourth week reduces the intensity to the second week standard to facilitate recovery. The first week of the subsequent stage maintains the recovery week level of intensity to confirm adaptation; however, the training content is altered.

4.32 Depending on the nature of the program, training cycles may vary; the same training load may be applied in two week increments before the intensity is raised. As a rule, two weeks for recovery and adaptation is sufficient.

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Training Program Planner Template

4.33 The training program planner template in Annex A may be used as an aid to plan the unit training program. Additional information such as timings, locations, dress and remarks may be included at the planner's discretion.

Sample Task Specific Program

4.34 The schedule for an eight week task specific fitness program for a rifle company is detailed in Annex B. The program is designed in accordance with all fitness training considerations, including the cycles of training, and delivered by functional fitness methods exclusive to Army. Most units in a barracks environment could perform the sample program. At the conclusion of the program, the unit should be capable of performing the required tasks.

4.35 The program is designed in accordance with the six steps of planning and proceeds as follows:

a. *Step 1– Define Training Objectives.* The unit is capable of a performing a 2 hour forced march in marching order. Sub-units are capable of breeching obstacles under simulated fire in both rural and urban terrain;

(1) *Training or Performance Standards.* Each soldier will be able to:

(a) as a unit, march 10 km in 2 hours in marching order, with a pack weight not to exceed 25 kg;

(b) as a section, dressed in patrol order, proficiently complete a military skills challenge including the obstacle course;

(c) complete 50 push-ups;

(d) squat 75 per cent of their body weight using the correct technique;

(e) complete 75 sit-ups; and

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(f) complete level 10 on the multi stage fitness test.

b. *Steps 2 to 5.* These are detailed in Annex B.

c. *Step 6.* This would be an enhanced task specific program or a maintenance program.

Program Policy

4.36 The lessons are preceded by a warm-up and concluded with a cool down. Lessons are 40 minutes in duration, excluding the route march and 60-minute assessment lessons. Most lessons are modulised to add variety to the program and to comply with the principles of training. The instructor is to allocate an additional five to 10 minutes at the beginning or conclusion of the lesson to educate the unit on factors relating to fitness. The educational package is to be instructed informally and the soldiers must assimilate the content delivered.

Program Outcome

4.37 For the sample program, the assessment results revealed that most soldiers could perform 50 push-ups, squat 75 per cent of their body weight using the correct technique, complete 75 sit-ups and achieve level 10 on the multi stage fitness test. The results of the military skills activity confirmed all soldiers could complete the designated task objectives.

Conclusion

4.38 It is imperative that unit physical training programs are designed in collaboration with other unit commitments. A periodised program structured around unit commitments will complement the unit's task specific performance. The adoption of the six step planning method ensures the unit training program is task focused and progressively designed to promote gradual adaptation. In contrast, rapid adaptation often results in unnecessary injuries.

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Annexes:

A. Training Program Planner Template

B. Task Specific Fitness Program

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ANNEX A TO CHAPTER 4

TRAINING PROGRAM PLANNER TEMPLATE

Week	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
1					
2					
3					
4					
5					
6					
7					
8					
		Component of Fitness Trained			
	a. Strength	a. Coordination	a. Aerobic	a. Core Stability	a. Assessment
	b. Muscular Endurance		b. Anaerobic Training		b. All Components of Fitness

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ANNEX B TO CHAPTER 4

TASK SPECIFIC FITNESS PROGRAM

Week	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
1	Multistage Fitness Test Push-ups, Sit-ups Squats	Muscular Endurance Circuit 1 Core Stability		Long Slow Distance	Coordination Exercises Muscular Endurance Circuit 1
2	Vaulting and Agility 1 2.4 km Individual Run	Muscular Endurance Circuit 1 Core Stability		5 km Cross-country Route March	Lifting Techniques Muscular Endurance Circuit 1
3	Vaulting and Agility 1 Aerobic Circuit 1	Muscular Endurance Circuit 2 Core Stability		Coordination Exercises 3.2 km Individual Run	Lifting Techniques Muscular Endurance Circuit 2
4	Vaulting and Agility 2 Interval Running	Lifting Techniques Muscular Endurance Circuit 2		Indoor Obstacle Course	Deep Water Running Light Pool Circuit Pool Relays
5	Vaulting and Agility 2 3.2 km Ability Group Run	Muscular Endurance Circuit 3 Core Stability		Lifting Techniques Muscular Endurance Circuit 3	Obstacle Course Walk-through 7.5 km Cross-country Route March
6	Coordination Exercises Aerobic Circuit 2	Run, Dodge, Jump Muscular Endurance Circuit 3		Individual Cross-country Run	Lifting Techniques Muscular Endurance Circuit 3

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Week	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
7	Vaulting and Agility 3 Interval Running	Run, Dodge, Jump Muscular Endurance Circuit 3		Lifting Techniques Muscular Endurance Circuit 3	Obstacle Course 10 km Cross-Country Route March
8	Minor Team Games	Military Skills Activity	Deep Water Running Light Pool Circuit Pool Relays		Multistage Fitness Test Push-ups, Sit-ups Squats

Component of Fitness Trained

a. Strength b. Muscular Endurance	a. Coordination	a. Aerobic b. Anaerobic Training	a. Core Stability	a. Assessment b. All Components of Fitness

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CHAPTER 5

DELIVERING COMBAT FITNESS TRAINING

SECTION 5-1. INSTRUCTIONAL TECHNIQUES

Introduction

5.1 Physical education is a science, but teaching and coaching are an art. It is essential CFLs and PTIs have a thorough working knowledge of their subject. Learning and remembering is a voluntary process, so the instructor must gain the interest and cooperation of the students if their instruction is to be effective.

5.2 Personnel will generally cooperate and try hard if the following occurs:

a. they are interested,

b. there is an incentive, and

c. they can see a reason for the activity.

5.3 The following principles are a good guide to successful instructors; they should ensure the following:

a. be objective,

b. plan and prepare,

c. maintain interest and enthusiasm,

d. use the right senses

e. keep it simple,

f. be aware of human factors, and

g. maintain progress checks.

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Objectives

5.4 All training should be purposeful. The CFLs and PTIs must have clearly defined objectives for all sessions, which are the following:

a. the immediate objective, and

b. the ultimate objective.

5.5 **Immediate Objective.** Immediate objectives are progressive targets set for each individual exercise training session and stage of training.

5.6 **Ultimate Objective.** The ultimate objective is to produce the fittest and most effective soldier possible.

5.7 The CFLs and PTIs must know the immediate objectives before planning combat fitness programs, combat fitness sessions or individual exercises.

Qualities Required of a Good Instructor

5.8 CFLs and PTIs can be shown how to best apply an exercise, how to make the most of their voice and other practical techniques, but their art is so bound up with human relationships that success depends more on personality and attitude of mind than on the knowledge of a set of rules. The qualities required of good CFLs and PTIs are as follows:

a. *Purposeful.* CFLs and PTIs must have the objective clear in their minds but should not proceed regardless of the varying ability of the soldiers to achieve the objective.

b. *Subject Knowledge.* This includes a thorough theoretical knowledge backed up by competent practical performance.

c. *Painstaking.* Time spent in thorough preparation will pay big dividends during training. Any plan must be sufficiently flexible to allow for unforeseen changes to training programs.

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d. *Enthusiastic.* Enthusiasm is catching. Enthusiastic CFLs and PTIs cannot help but get a return of enthusiasm from their soldiers. However, this enthusiasm must be balanced and any tendency towards fanaticism must be avoided.

e. *A Pleasing Manner.* Clear, distinct speech and emphatic orders coupled with a fair, firm and friendly attitude will help avoid any unnecessary mannerisms.

SECTION 5-2. PHYSICAL TRAINING LESSONS

Introduction

5.9 As detailed in Chapter 4, thorough planning and preparation is necessary if the PT program is to be successful. The factors that should be considered are as follows:

a. the terminal objectives and related enabling objectives;

b. the number of PT sessions required to achieve the objectives;

c. the exercises and skills that need to be taught;

d. the need for PT to be complementary to unit training objectives;

e. the standard of fitness of the soldiers to be trained, which will indicate the level at which training can commence, and the possible necessity of grouping older and weaker soldiers for certain exercises;

f. the number of soldiers to be trained;

g. medical restrictions, safety requirements and climatic conditions;

h. the availability of assistant instructors;

i. the availability and state of repair of apparatus; and

j. the training areas available.

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Plan a Physical Training Session

5.10 A PT session in a training environment is usually a 40-minute period of instruction. (Research indicates that 60 minutes is preferable.)

5.11 During preparation, the instructor must consider the following:

a. the stage of training of the group;

b. the number of periods left in the training syllabus;

c. whether the group progression is satisfactory or not;

d. the coaching points for new exercises and skills that are to be taught;

e. the extra attention that may be required by the less proficient soldiers, which may be in the form of remedial training or division into ability groups;

f. the location and availability of the working area;

g. the elimination of previous faults;

h. the apparatus that may be required, its availability, safety, and positioning for economic use and maximum activity;

i. the number of soldiers in each class, which will affect the activities selected, the size of the groups, and the distribution of the apparatus and the size of the working area;

j. the number of assistants available and their experience, which will determine the number of the groups;

k. the availability of alternative locations and activities in the case of inclement weather; and

l. class comfort; for example, the direction of the sun and wind.

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Session Formats

5.12 Within PT instruction, there are three different types of sessions and they are as follows:

a. *Teaching Session.* The teaching session is used for the initial instruction period when new activities and skills are taught.

b. *Skills Practice Session.* The skills practice session is used to practise those activities and skills that have been learned in the teaching session.

c. *Combination Teaching and Skills Practice Session.* In the combined teaching and practice session, new activities and skills are taught in one or more of the main group's activities, and previously learned skills practised in the other main group activity.

SECTION 5-3. CONSTRUCTION OF THE SESSION

Session Plan

5.13 The session plan is an essential requirement for a successful PT session.

5.14 The amount of detail and the format will vary according to the need. The detail required in a session plan is as follows:

a. the objective;

b. the number in the squad;

c. the type of session;

d. the level of training;

e. timings, which should include the start time of the session, its length and the time for completion;

f. the location;

g. the stores that are required should be listed, including the number of each item required;

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h. hazard identification and risk mitigation strategies; and

i. by using diagrams, the class formation to be used for each exercise should be detailed. They should also show where the instructor and leader, if used, will be positioned to begin the exercise.

Session Parts

5.15 All PT sessions are based on a framework that divides the session into the following three parts:

a. *Part 1.* Range of movement.

b. *Part 2.* Main group activities.

c. *Part 3.* Cooling down and stretching.

Time Factors

5.16 The standard PT session of 40 minutes should be divided as follows:

a. *Part 1.* 12 minutes;

b. *Part 2.* 24 minutes; and

c. *Part 3.* 4 minutes.

5.17 If the period allotted is less than 40 minutes, Part 2 should be reduced accordingly.

Construction of Each Part of the Session

5.18 **Part 1 – Range of Movement.** Warming up and ROM prepares the body for the more vigorous activities which follow. The exercises should begin with light jogging to increase blood circulation throughout the muscular system, followed by a variety of stretching and strengthening exercises. Warm-up and ROM exercises are described in Chapter 6 and Chapter 10.

5.19 **Part 2 – Main Group Activities.** The main part of the session is ideally divided into two, 12-minute periods of group activities; however, the instructor may vary the group activity from 5 to 24 minutes, depending on the skill being taught or practised.

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5.20 Main group activities may be selected from Chapter 13, and they include:

a. heaving and heaving abdominal,

b. log exercises,

c. rope climbing and balancing techniques,

d. game form activities,

e. rifle exercises,

f. medicine ball exercises,

g. stick exercises,

h. pushing and pulling,

i. lifting and carrying,

j. vaulting and agility,

k. relays, and

l. circuit training.

5.21 **Part 3 – Cooling Down and Stretching.** The need for cooling down after vigorous exercise is based on physiological requirements. If cooling down and stretching exercises are not done, there may be adverse effects such as blood pooling, faintness, hyperventilation, shock, muscle cramps and muscle soreness. Cooling down and stretching exercises are described in Chapter 6.

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SECTION 5-4. SESSION PROCEDURES

Instructor/Student Ratio

5.22 PTIs and CFLs may find individual coaching difficult when conducting sessions for a class of 25 soldiers or more. Assistant instructors should be used for groups of this size and larger. The recommended instructor/student ratio is as follows:

a. for a teaching session where specific gymnastic type skills such as groundwork, vaulting and obstacle training are taught, a ratio of 1:10;

b. for a teaching session where conditioning exercises such as rifle exercises, log exercises and stick exercises are taught, a ratio of 1:25; and

c. for all skills practice sessions, a ratio of 1:25.

Phases of Teaching

5.23 In a teaching session, the demonstration will be performed first, followed by a brief explanation, and then class practice in which the instructor will individually coach and correct faults. Since soldiers learn more by action than by listening, the instructor must rely more on practical participation and the soldier's response than on talking and demonstrating. In summary, for all teaching sessions, the procedure for instruction follows the DEP principle, which is as follows:

a. D — good demonstration;

b. E — brief explanation; and

c. P — maximum practise.

5.24 The recommended balance of time to be spent during a session on the aspects of explanation, demonstration, practise and coaching, is shown in Chapter 13.

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Teaching New Skills

5.25 To teach, confirm and practise new skills, the following control systems are used:

a. *The Go System.* The 'Go System' provides for the class to perform individually under strict control of the instructor. The word of command 'GO' is given for each participant. Figure 5–1 shows the go system class arrangement.

b. *Stream Fashion System.* The instructor confirms what has been taught by putting the class through the new skill in 'stream fashion' once only. The stream fashion system operates without the word of command being given by the instructor. Working on a modified follow-the-leader procedure, the next soldier takes up the start position for the activity as the preceding soldier begins the activity. Figure 5–2 shows the class arrangement for the stream fashion performance of an activity. Once the instructor is satisfied, the participants practise the new skill, again using the stream fashion system.

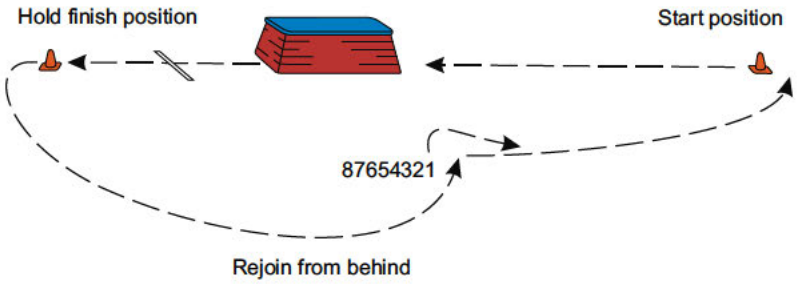


Figure 5–1: The Go System Class Arrangement

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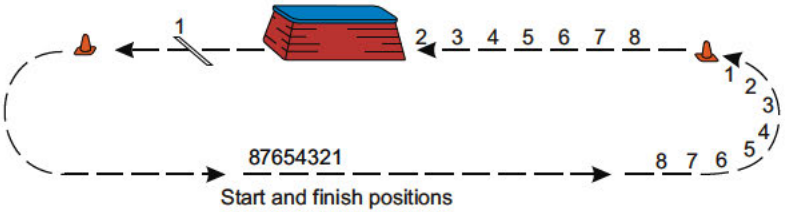


Figure 5–2: The Steam Fashion Class Arrangement

Hints for Taking Sessions

5.26 The following points should be considered during all PT sessions:

a. A leader may be used at the discretion of the instructor for ease of instruction. Where leaders are used; for example, for rifle exercises, the instructor must set the rhythm for the exercise.

b. All the class must be within the view of the instructor.

c. The instructor's movements around the class must be purposeful.

d. The instructor must coach positively. The habit of teaching soldiers what to do must be developed; telling them what NOT to do must be avoided.

e. Soldiers should be grouped for activities according to their ability and progression and can, therefore, be controlled accordingly. In certain exercises and games (eg. log exercises, game form exercises, lifting and carrying, medicine ball, sticks, pushing and pulling, and formation running) the class will need to be grouped by height and/or weight.

f. Body contact by the PTI or CFL with soldiers should be avoided where possible, except for standing-in and demonstration of 'pair' exercises.

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g. Maximum activity must be achieved. When the body is resting during the session, the brain must be active (through observation of activity).

h. Major faults should receive correction before minor ones. The whole activity is reviewed first rather than the discrete skills.

i. Weaker soldiers must be encouraged. Good work and improvement in performance should be praised.

j. Instructors cannot coach properly unless they thoroughly know each exercise's aim, difficulty and stages of progression.

k. Instructors normally work as 'mirror images' to the class.

SECTION 5-5. SAFETY AND STANDING-IN PROCEDURES

General

5.27 The effectiveness of teaching largely depends on the soldier's trust in the instructor's ability to prevent accidents. Although warming up and correct progression are major factors in the prevention of accidents, standing-in and anticipating behaviour are also major factors.

5.28 Standing-in is when the instructor provides assistance and support to the soldier in the early stages of teaching and skill development. It reduces the possibility of the soldier falling and being injured while performing agility activities.

5.29 Two other related techniques are 'padding', which is the technique used by an instructor to give minimal physical support to a soldier in performing an activity, and 'spotting', which is the confidence support provided by the closely positioned instructor. These are used in the later stages of skill development after practice.

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Safety Procedures for Standing-in

5.30 The following rules must be understood and practised:

a. The instructor must always be alert for the unexpected.

b. The instructor must be correctly positioned for each activity and must be close enough without hindering the participant (when vaulting exercises are being performed, the instructor should have at least one hand in contact with the apparatus at the beginning of the exercise).

c. The instructor must know and watch the likely danger points in groundwork and running vaults.

d. The instructor must be adept at using either arm when standing-in.

e. The instructor should anticipate the soldier's faults.

f. The instructor should move with the soldier and ensure that he/she reaches a controlled standing position after landing.

g. No more assistance should be given than what is necessary to perform the skill properly.

h. An instructor must place the soldier's safety before their own.

i. The soldier's head must never be allowed to hit the floor and limbs should not be grasped; however, in an emergency, the instructor should grasp around the soldier's trunk.

j. The instructor must study a soldier's action as well as their faults, as the main purpose of standing-in is to correct mistakes.

5.31 Correct standing-in is essential, even for proficient performers, but care should be taken to avoid making the soldiers 'accident conscious'.

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SECTION 5-6. METHODS OF STANDING-IN

General

5.32 The following methods of standing-in are to be used by instructors. Minor variations are permitted providing they are safe. It should be noted that only fundamental instructor positions for the more frequently used heaving, vaulting and agility exercises are illustrated. These exercises are not listed in a logical progression. Exercises and activities are categorised in the following groups:

a. head protection and assistance with the other hand,

b. chest and back support,

c. flank support,

d. upper arm and chest support, and

e. lower back and upper leg.

Head Protection and Assistance with the Other Hand

5.33 Head protection and assistance with the other hand is used to protect the soldier's head when performing actions such as a forward roll or shoulder roll.

5.34 The instructor is to place one hand behind the back of the soldier's neck to ensure that the head is tucked in during the roll. The other hand is used to assist the soldier to complete the roll. This method is also used when assisting in steps. One hand supports the neck while the other is on the lower back to assist with the activity.

Chest and Back Support

5.35 Chest and back support assistance is used to prevent soldiers from falling when performing activities such as a running through vault running or horizontal astride vault (horse lengthways).

5.36 Instructors stand to the side of the landing, and place their hands on the soldier's chest and back as the soldier approaches the ground.

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Flank Support

5.37 Flank support assistance is used when a soldier performs a foot assisted vault.

5.38 The instructor is to stand to the side of the soldier. As the soldier performs the vault, the instructor will place one hand at the chest and the other hand is positioned so the instructor can stop the soldier from falling backwards after he/she has performed the vault.

Upper Arm and Chest Support

5.39 Upper arm and chest support assistance is used when soldiers are performing face vaults.

5.40 The instructor is to place the opposite hand on the soldier's shoulder and the other hand is placed on the solar plexus. The instructor moves in the opposite direction to which the soldier jumps; for example, if the soldier jumps to the right, the instructor moves to the left. This allows free movement through the action of the face vault.

Lower Back and Upper Leg

5.41 Lower back and upper leg assistance is used to provide help with heaving activities.

5.42 The person assisting is to stand to the side of the soldier performing the heave. When they are facing the heaver, they will place the rear hand at the swell of the back and the front hand under the knee. The assistant is to give only enough help so that the soldier performing the heave can complete it.

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CHAPTER 8

MUSCULAR ENDURANCE TRAINING

SECTION 8-1. INTRODUCTION

8.1 Endurance walking, marching and running are essential components of the soldier's total physical fitness. Progressive, specific and realistic endurance training exposes soldiers to the effects of physiological and psychological fatigue in a controlled environment. The outcome will be adaptation and management of these stresses when required in an operational environment or the day-to-day life stresses of training. PTIs and CFLs have a variety of activities to select from to develop a soldier's cardiovascular and cardiorespiratory fitness, muscular endurance and psychological fitness.

8.2 The ability to operate under physical stress for lengthy periods is a quality that all military personnel must possess. The level of individual fitness will vary with the employment of that soldier. This variety of employment must be taken into consideration when formulating a unit endurance training program.

8.3 The individual's psychological fitness is an important consideration, as the soldier may be required to carry out duties in adverse conditions, such as being wet, cold or hot.

8.4 Endurance training also entails mental conditioning, and instructors must be constantly aware of the psychological aspect during training. Instructors must aim at developing the will to survive and to fight to win, regardless of physical hardship. Soldiers must be taught to accept discomfort and hardship as part of a purposeful PT program, and must be encouraged to take pride in their toughness and ability to withstand long periods of stress.

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SECTION 8-2. PHASES OF ENDURANCE TRAINING

8.5 The phases of endurance training are as follows:

a. the introductory phase,

b. the assessment phase, and

c. the training phase.

Introductory Phase

8.6 During the introductory phase, the soldier is shown the technique of the exercise, and spends time learning the technique and adjusting to the activity. In some cases, this includes overcoming muscle soreness. It is important that the technique is perfected during this phase.

8.7 Incorrect technique can cause injury or undue soreness and, if allowed to persist, may be impossible to eliminate later. Incorrect technique also has the effect of robbing specific exercises of their validity. If performed incorrectly, an exercise which has been designed for a particular muscle or muscle group will not fully exercise that muscle or muscle group. An example of this is straight leg sit-ups. This exercise will primarily develop hip flexor muscles, not abdominal muscles.

8.8 The duration of the introductory phase will depend on a variety of factors, and these are as follows:

a. the condition of the soldier before exercising,

b. the nature of the exercises, and

c. the frequency of training.

Assessment Phase

8.9 The assessment phase allows the instructor to evaluate the condition of the soldier, and assess the length and intensity of training required to reach the desired level of fitness. This is an ongoing process during training.

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Training Phase

8.10 The work phase should be a specified period of time with a clearly defined objective. This allows the soldiers to pace themselves over the entire period of training.

SECTION 8-3. METHODS OF TRAINING

Recruits and Detrained Soldiers

8.11 Endurance training must be introduced at the beginning of recruit training, and the basic skills of running and walking must be taught from the outset. Training must be progressive and consistent, and all types of training activities must be employed so that good endurance is achieved.

Trained Soldiers

8.12 All trained soldiers should participate in endurance training and it should be a fundamental part of the unit training program. Training activities include:

a. cross-country marching;

b. cross-country running;

c. inter-unit competitive distance races;

d. circuit training;

e. obstacle and confidence courses;

f. orienteering;

g. relays; and

h. to a lesser degree, most forms of activity performed within a PT session.

8.13 Further examples of training are in Chapter 7.

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SECTION 8-4. PROGRAM DESIGN CONSIDERATIONS

8.14 In all forms and at all stages of endurance training, consideration must be given to the following aspects:

a. *General Planning Considerations.* Planning considerations for endurance training are as follows:

(1) training objectives;

(2) time available;

(3) the number of soldiers involved;

(4) the number of assistants available;

(5) the type of training areas available;

(6) the standard of fitness of the soldiers (ability groups);

(7) the number of stages of progression required;

(8) the number of sessions allocated to endurance training;

(9) the duration of each endurance training session;

(10) the number of personnel medically restricted (these require special progression);

(11) the climatic conditions;

(12) any medical regulations; and

(13) the state of acclimatisation of the troops involved.

b. *Before the Session.* When planning the session the following factors are to be considered:

(1) weather conditions, especially heat and humidity;

(2) the stage of progression of the squad;

(3) the standard of dress and footwear;

(4) the availability and state of equipment;

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(5) the need for alternative training for partially medically restricted personnel;

(6) the best time of day to conduct such training;

(7) whether the session precedes or immediately follows other forms of strenuous activity;

(8) training is not to be carried out within half an hour before, or 1 hour after, a meal;

(9) troops are to be adequately hydrated and a resupply of water is to be available;

(10) medical assistance is to be available;

(11) transport, if required, is to be available; and

(12) checkpoint locations, if required.

c. *During a Session.* During the session, it is necessary to ensure the following:

(1) the instructor sets the correct pace,

(2) the soldiers are kept together as a group,

(3) the instructor coaches correctly,

(4) there is an assistant instructor at the rear to coach the weaker soldiers and to deal with any casualties, and

(5) medical assistance is available and can accompany the activity with the transport.

d. *After the Session.* After the session, it is necessary to ensure the following procedures are carried out:

(1) the feet of all soldiers are examined,

(2) all casualties are reported to the regimental medical officer as soon as possible,

(3) all soldiers showing undue distress are to be presented to the regimental medical officer, and

(4) soldiers are to bathe or shower.

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Special Considerations

8.15 The endurance of recruits is generally poor. Skilled teaching and carefully planned progression is necessary to improve the components of endurance.

8.16 It is essential that medical advice is sought for those soldiers who show signs of physical distress during endurance training. In most cases, physical distress is caused through poor breathing habits and a lack of physical coordination.

8.17 The efficiency of the heart can be developed by progressive physical and endurance training. As the soldier becomes fitter, the heart will beat slower for the same amount of work. The soldier will suffer fatigue less easily and his/her movements will become more efficient.

8.18 The incidence of fatigue can be reduced by teaching the soldier to march, run, climb, vault and surmount obstacles in a competitive environment. The teaching of skills in these activities must emphasise economy of effort and conservation of energy. Relaxation is a very important factor in endurance training, particularly in running and walking.

SECTION 8-5. METHODS OF ENDURANCE TRAINING

8.19 Critical soldier tasks require the ability to move quickly on foot. Walking, running and marching short distances, efficiently, is essential to moving under direct and indirect fire. Waking, running and marching, for longer distances at a constant speed, develops the stamina needed to endure sustained operations.

Endurance Walking

8.20 There is a correct technique for walking just as there is a correct technique for running and jumping. Without correct training, the posture of the body may be stooped or stiff and, consequently, the legs execute a series of short, bent knee steps instead of firm strides from the hips. The methods of acquiring correct endurance walking techniques are based on economy of effort

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and conservation of energy. The soldier will derive the maximum benefit from the time allotted to walking training, if correctly instructed under the supervision of PTIs or CFLs.

8.21 The essentials of correct endurance walking whether in PT dress or in battle order are as follows:

a. *Arm Action.* Arm actions are performed as follows:

(1) The arms act as speed and balance controllers. They should be bent so the hands are level with, or just above, the hips.

(2) Pushing from each shoulder in turn they should move close to and across the body from side to side at an angle of approximately 800 mils to the line of march. These movements must be smooth, rhythmical and purposeful; the shoulders move with the arms. This will facilitate a smooth flowing action and give constant forward impetus to the body, with each forward movement of the arms carrying forward the body's centre of gravity.

(3) For speed walking over short distances, the arms should be raised slightly, and more vigorous arm punches towards the opposite shoulder should be employed. This small radius of arm action will result in a quickening of the pace.

(4) For long distance walking, the arms must be lowered and the trunk allowed to rest or ride easily on the hips. The hands must be held loosely closed but not clenched, with the arms slightly bent. The evenness of the pace is important.

(5) During long-distance walking there is a tendency for a slackening of the pace to occur. This will be overcome by increasing the arm and shoulder action.

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b. *Leg Action.* Leg actions are performed as follows:

(1) The power of the stride in walking is derived from the drive of the rear leg, together with the relaxed swing through from the hip.

(2) To obtain the maximum drive, the feet must always point directly forwards. Any tendency to turn the toes outwards must be corrected, as this positioning of the feet not only impedes progress, but also throws the full weight of the body onto the ankle joint at an awkward angle, and eventually leads to injury.

(3) The drive from the rear leg must be followed by the swing through from the hip, with the kneecap leading and the foot raised just sufficiently to clear the ground.

(4) On all surfaces the feet must be kept as near to the ground as possible to conserve energy.

c. *Body Posture.* The characteristics of good posture are as follows:

(1) The trunk and head should be held erect with the trunk balanced easily on the hips. The hips act as shock absorbers and help to make walking over rough ground less tiring.

(2) The chin should be held in a natural position and the eyes should look straight ahead.

Route Marching

8.22 Technique. In applying the walking technique to route marching, careful progression and good coaching is important. Distance rather than speed must increase progressively.

8.23 Only slight adjustments to the basic walking technique are required. The leg action must remain fundamentally the same; that is, the correct position of the feet, and the relaxed leg swing through from the hips, should still be stressed. Care should be

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taken to ensure that correct breathing patterns are maintained during route marches.

8.24 When marching uphill, the pace should not be forced; a shortening of the stride and a slight leaning forward of the body should be stressed. Any tendency to over straighten or lock the knee joint should be avoided. On reaching level ground, the stride may be lengthened again.

8.25 When marching downhill, full use should be made of body relaxation to counteract jolting, but the pace should be maintained. Any tendency for the body to sway off balance, which is often noticeable towards the end of a long march, should be corrected.

8.26 Full use should be made of halts. Fluid replenishment must be during these rest periods. Officers and non-commissioned officers must ensure that soldiers are adequately hydrated before recommencing. Equipment should be loosened and, if possible, removed so the respiratory organs can have full ROM. Lying on the back and resting the feet in a raised position are also beneficial.

Hill Walking

8.27 Movement over rough ground, up and down steep slopes, in high altitudes, and in varying climatic conditions, demands prolonged physical effort and a high standard of endurance. This can be achieved only by intensive training based on the applied progression principles of intensity, frequency and duration.

8.28 Excess clothing should be removed in hot environmental conditions and the shirt should be open at the neck and wrists, as this reduces the risk of overheating of the body and reduces sweating. The tendency to move too quickly at the start of a climb must be checked as this leads to early fatigue. Good balance is essential for safety and for conserving of energy. It is important to walk so that the whole of the foot is in contact with the ground as this ensures the body weight is distributed over as large a surface area as possible, thus, placing less strain on the ankle joint and muscles of the leg.

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8.29 The effort required to overcome the gradient can be lessened by travelling obliquely across the hill. On difficult slopes, the ground underfoot should be checked for firmness at each step before transferring the weight of the body onto the upper foot. On a steep slope, leaning in too far should be avoided, as this causes the feet to slope outwards and downhill; the body should be balanced on the feet, rather than supported by the hands. To assist balance, the arms should be free, with the hands empty, ready to check a fall should the feet slip. During a steady ascent, any tendency to straighten the leg fully should be avoided as this action causes unnecessary fatigue. The rear leg should be lifted through the hip, with the lower leg muscles relaxed and the foot just clearing the ground.

8.30 The descent is best made by running downhill with short, springy steps to prevent the full weight of the body jarring on one leg. It is necessary to put the weight onto the heels on steep slopes and the whole body must be kept relaxed in order to absorb the shock of each pace. The hands must be free to maintain balance.

8.31 The pace should be regular and in rhythm with the breathing. It should be as fast as possible but consistent with the distance to be covered. Personnel should learn to walk at their own pace. This is established by experience. When climbing or descending, no attempt should be made to keep step. As the gradient increases so the stride should be shortened, and as the slope eases the stride should be lengthened. Speed is increased by taking a longer pace and decreased by shortening the pace, but the rhythm of walking must not be changed.

8.32 Halts should be kept to a minimum and should be taken as close as possible to natural features for protection from the weather. It may be advisable to put on extra clothing while resting, as it is important to avoid the rapid loss of body heat that occurs when resting in a cold wind. Halts of less than 10 minutes duration give little or no rest.

8.33 In the initial stages of hill walking, squads should be kept to small numbers and muscles should be strengthened through progressive exercises. Efficiency and confidence is the first aim

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of training as speed can be developed later. Owing to the strenuous nature of hill walking, it is important not to push the soldiers too hard or they will lose enthusiasm and interest. Hill racing must not be encouraged until the squad has acquired the balance and rhythm necessary for hill walking.

8.34 Initially, training should be without equipment. When the soldiers are able to move with a good balance and rhythm, basic webbing may be worn. Similarly, slopes and the roughness of the terrain may be made progressively more severe.

8.35 The PTI or CFL should, at all times, move behind and slightly to the flank of the squad as this will enable them to observe, coach and correct faults.

Forced Marching

8.36 The application of basic training in walking and running, to forced marching, must be progressive. Forced marching presupposes that, in order to cover the required distance, some running will be necessary. Distances and speeds should be increased gradually and the basic principles of economical marching and running observed and practised. Walking, marching or running provides useful training activities for forced marching.

8.37 In forced marching, a well coordinated leg and arm action is essential, and the value of full and rhythmical breathing cannot be over emphasised.

8.38 To travel with maximum efficiency, in a forced march, it is essential to maintain the correct marching and/or running technique. All actions, except individual mannerisms which affect the style, should help the soldier to cover the required distance with the minimum expenditure of energy.

Endurance Running

8.39 Endurance running is taught to enable the soldier to cover ground at maximum speed with the minimum of effort, and this type of running is military rather than athletic. The technique has been devised bearing in mind the fact that the soldier will

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have to run wearing boots and equipment. When running in boots, in order to conserve energy, the knees should not be lifted unnecessarily high.

8.40 The essentials of military endurance running are as follows:

a. *Position of the Head and Balance of the Body.* Correct position of the head and balance is as follows:

(1) The position of the head controls the balance of the body. It should be held steady in alignment with the trunk, neck muscles relaxed, with the eyes looking straight ahead.

(2) The chest and hips should remain square to the front.

(3) There should be no bending at the hips, either forward or backward, the line being straight from head to heel.

(4) At first, a conscious effort to maintain this alignment may be necessary, but with practise, natural balance will be developed, and with it, greater relaxation and freedom of movement.

b. *Leg Action.* The desirable leg action is:

(1) Leg action is the main dynamic factor in running. The legs are the driving force behind the body as well as the supporting power beneath it. Since the aim is to move the body as quickly and economically as possible in one direction, any excess movement away from this straight line is obviously wasted effort.

(2) The toes should be pointed straight ahead and not turned outwards.

(3) The knees should be lifted forward, not sideways, and hip rolling must be avoided.

(4) Care must also be taken to avoid an artificial bounding stride in which the body weight is shifted

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upward unnecessarily, incurring a waste of energy. The lower leg should be completely relaxed as it swings forward during the recovery phase, with the foot just clearing the ground. To avoid jarring when the leading foot meets the ground, it should be relaxed at the ankle as the heel touches first.

(5) As the body weight moves forward, the supporting foot rises to the ball of the foot and the toes. Similarly, on landing, the knee should be slightly bent, but straightened out as the body weight moves forward and the rear leg drive continues.

c. *Arm Action.* The desirable arm action is described as follows:

(1) As in walking, the arms act as speed and balance controllers. They are not primarily propulsive and the least possible energy consistent with these aims should be used in their movements. Comfort and economy are the guiding considerations.

(2) Soldiers will find it most comfortable to hold the arms at about the mid-line. The most economical direction for the swing is forward and inward, partly following the general direction of the body movement and partly in towards the centre of the body mass.

(3) The shoulder movement, following the arms, should be reduced to a minimum. Shoulder rolling or shrugging should be avoided.

(4) There should be no lifting of the shoulders or contraction of the neck muscles.

(5) The hands should also be lightly clenched.

d. *Limb Coordination and Rhythm.* Limb coordination and rhythm must be automatic in order to maintain body balance and to ensure smooth movement. A change or break of rhythm leads to less efficiency and greater

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fatigue. Even breathing follows an automatic, rhythmical rate set by limb movements.

e. *Relaxation.* Relaxation is the secret of muscular economy. A certain degree of relaxation comes naturally to all, but maximum use requires practise.

f. *Running Up a Gentle Slope.* When running up a gentle slope the pace must not be forced. A slight shortening of the stride length and a slight forward lean of the upper body should be employed. On reaching level ground the stride may be lengthened again.

g. *Running Down a Gentle Slope.* When running down a gentle slope, full use should be made of body relaxation to counteract jolting but the pace should be maintained. The stride should be slightly lengthened.

h. *Running Up a Steep Slope with a Loose Surface.* The stride should be kept short. Care must be taken not to lean too far forward as this tends to cause the feet to slip backward. To assist balance, the body should be relaxed with the hands empty to check a fall should the feet slip. The gradient of any slope and the effort required to overcome it can be lessened by zigzagging.

i. *Running Down a Steep Slope with a Loose Surface.* The best method is to run with short, springy steps to prevent the full weight of the body jarring one leg. The whole body should be kept relaxed to absorb the shock of each step. The arms should be free to help maintain balance. On a long but gentler slope, the stride should be slightly longer and of a 'heel-jabbing' style.

j. *Running Over Sand.* The body should be held almost upright and a shorter stride than in normal endurance running should be taken. On this type of surface it is necessary to raise the feet higher than usual, especially when they tend to sink into the sand. Running on this type of surface is very tiring even for a short time. For this reason, walking and running alternately is preferable to continuous running.

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SECTION 8-6. MOVEMENT OF TROOPS ON PUBLIC ROADS DURING PHYSICAL TRAINING

8.41 The following relates to the movement of troops in relation to all aspects of physical training. This includes members being administratively moved to and from physical training.

Movement of Troops in Physical Training Sessions

8.42 The movement of troops along roadways is often necessary as part of military physical training. To avoid accidents, such road movement is to be controlled at all times. In all cases the movement of troops must involve guides. If the risk is too high, the activity should be cancelled. Where possible, large troop movement should be avoided by breaking the numbers down to section sizes.

Control of Movement

8.43 The movement of troops, as formed bodies, along roadways is to be controlled in any of the following manners:

a. *Use of Safety Vehicles.* Safety vehicles carrying warning signs are stationed to the front and rear, and troops are to move along the left-hand side of the roadway with the traffic flow. Safety vehicles are to be positioned approximately 50 m ahead of and behind the main body; one scout is to be positioned 25 m ahead and behind the group.

b. *Absence of Safety Vehicles.* When safety vehicles are not in use troops are to move along the left-hand side of the road with the traffic flow. Scouts are to be positioned 25 m and 50 m ahead and behind the main body. The number of scouts used depends on the number of troops.

c. *Visibility of Scouts.* Scouts should be outfitted in items of clothing to enable early and clear identification. Suggested items include fluorescent vests such as those worn by road maintenance workers, reflective strips attached to a suitable vest and/or a sign affixed to a vest

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warning of 'Troops on Road'. Dusk or night moves will require the use of lamps and/or suitable warning lights.

d. *Hills, Corners and Perceived Hazards.* Due care is to be exercised when cresting hills or rounding corners. The aim of having two scouts at the front and rear is to allow one scout to remain at a perceived hazard while the second moves forward.

SECTION 8-7. LOAD CARRIAGE

Introduction

8.44 Before the 18th Century, foot soldiers seldom carried more than 15 kg while on the march, but loads have progressively risen since, presumably attributed to the weight of weapons and equipment that incorporate new technologies to increase protection, firepower, communications and mobility. Locating the load centre of mass as close as possible to the body's centre of mass, results in the lowest energy cost and tends to keep the body in an upright position, similar to unloaded walking. Loads carried on other parts of the body result in higher energy expenditures. Each kilogram added to the foot increases energy expenditure by 7 to 10 per cent; each kilogram added to the thigh increases energy expenditure 4 per cent. Hip belts on rucksacks should be used whenever possible as they reduce pressure on the shoulders and increase comfort. Low or mid-back load placement might be preferable on uneven terrain but high load placement may be best for even terrain.

8.45 Physical training that includes aerobic exercise, resistance training targeted at specific muscle groups and regular road marching, can considerably improve road marching speeds and efficiency. The energy cost of walking with backpack loads increases progressively with increases in the weight carried, body mass, and the walking speed or grade. The type of terrain also influences energy cost. Common injuries associated with prolonged load carriage include foot blisters, stress fractures, back strains, metatarsalgia, rucksack palsy (through the

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restriction of blood supply to the fingers) and knee pain. Load carriage can be facilitated by lightening loads, improving load distribution, optimising load carriage equipment and taking preventive action to reduce the incidence of injury.

Weight Distribution

8.46 The distribution of equipment around the body is one of a number of governing factors controlling how efficiently soldiers march. It not only affects the marching style, but energy consumption as well. The heavier the burden, the greater the need for adjustment of stride length, balance and posture. Equipment should be spread evenly so that both legs are carrying the same weight and curvature of the spine is as near to normal as possible.

8.47 If feasible, avoid carrying a weapon across the shoulder, slinging it across the chest or back and hanging off one shoulder. Each of these positions restricts arm movement to such a degree that it can alter walking cadence radically. The arms are part of the mechanism of walking as well as balance. Try walking with your arms held by your side and see how much they alter the coordination of movement.

8.48 It is possible the best place to carry a weapon is at arm's length. In this position, the weapon acts as a limited pendulum assisting arm swing. Changing arms periodically will allow each arm to rest and balance out body posture over the period of the march.

8.49 Finally, keep the chest area clear of restrictions that will prevent maximum chest expansion. Early on during the march you may not notice it too much, but as oxygen demand increases during the latter stages, any restriction of movement can reduce lung capacity to such an extent that you are forced to slow down to compensate.

Arm Action

8.50 It has already been stated that arm action is one of the controlling factors of forward movement. To maximise efficiency and minimise energy consumption, your shoulders

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should be relaxed and the arms allowed to swing as low as feasible; hands should never be permitted to form a tight fist. A good point to remember is the tighter you clench your fists and the higher you hold your hands, the more energy and effort your arms and shoulders must use to work.

Head Posture

8.51 To ensure the body can get optimum advantage out of coordinating all its movements for forward propulsion, the head must remain upright. Any tilting forward of the head immediately rounds the shoulders, which in turn pushes the spine out of alignment. If this is kept up for any length of time it results in an uneven weight distribution along the length of the spine which will cause an aching back.

Leg Action

8.52 A great deal has already been said about leg action, but it is essential to define the ideal movement and sequence for walking. Each leg in turn must bear the total weight of the body, including equipment. When it does so it must adjust its stride length to compensate. This allows it to limit the amount of pressure on each leg at any given time. The same rule applies when you want to speed up; shorten, not lengthen your stride and speed up your rhythm. This and avoiding driving your heels into the ground (regimental drill movement) which is extremely bad for ankle, knee and hip joints, will ensure as smooth a walking action as can possibly be achieved under the circumstances.

Shuffle Step

8.53 The validity of the shuffle step is often argued, both from its injury producing potential and its efficiency value. There is no doubt that boot running on hard surfaces, over long distances, aggravates ankle, knee and shin injuries.

8.54 The foot is lifted sufficiently clear of the ground to ensure forward movement. The emphasis is on swinging the lower leg forward rather than picking the whole leg up. Finally, the foot is

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placed down in a limited heel and toe action, all this continues in a very efficient action.

8.55 The reason for the shuffle step is summed up in the often used term ‘to shake it out’. The periodic shuffle helps prevent that mental tunnel vision that many people fall into; it wakes them up. It also gives the whole body, especially the legs, a break from the enforced walking action, allowing them to stretch the muscles in a slightly different movement. Besides this, there is the added bonus of having a method of moving that maintains the march speed without disrupting the marching rhythm.

8.56 **When to Shuffle Step.** The shuffle step should be introduced, when on flat ground, about every 800 m and should continue for no more than 200 m. The distances will shorten once the squad becomes tired. Never run uphill, but shuffle downhill, terrain permitting until the ground levels out, then marching should begin. The golden rule to go by is to keep the shuffle speed the same as the marching pace, unless there is a need to increase the overall speed of the march.

Water

8.57 The human body contains more water than any other single element. It will not register thirst until approximately one litre of water is lost. Once sweating commences and activities continue, you cannot keep up with the water loss. Water plays a large part in energy conversion and muscle movement, so the more we lose the quicker the onset of muscle fatigue and mental disorientation.

8.58 As soon as personnel start perspiring they should start drinking and every 10 to 15 minutes, thereafter, they should drink again. Personnel should never swill their mouths and spit out, nor pour it on themselves, unless suffering heat illness. If any restriction should be made on water, it is in the quantity swallowed at any one time. One of the best ways to gauge this is to drink no more than three mouthfuls at once and space the consumption out over 50 m to aid digestion. Personnel will never keep up with water loss until they stop activity. The best that can be done is to limit the amount lost.

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Boots

8.59 Next to physical fitness, boots constitute the second biggest problem during marching. There is a whole range of evils that boots cause. The following points will increase comfort:

a. If you insert the liner from the inside of your jogging shoes, you create a perfect pad for the bottom of your feet. You do not need to use two pairs of socks.

b. When you put your boot on, pull your sock up and turn it over the top of the boot, then tie the lace around the top of the sock and boot. This stops your socks running down.

c. Do not tie your laces too tight where the boot bends around the ankle.

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CHAPTER 9

STRENGTH TRAINING

SECTION 9-1. INTRODUCTION

Aim of Strength Training

9.1 The aim of strength training is to increase the force that can be exerted in the performance of physical activity. A good level of muscular strength is essential for the following:

a. stabilising joints;

b. coordinating movement in a manner that minimises stress on the rest of the musculoskeletal system (tendons, ligaments, cartilage and bone);

c. using the normal elasticity of the muscle to absorb shock; and

d. aiding in injury rehabilitation and prevention.

9.2 Muscular strength is the maximum amount of force a muscle or group of muscles can perform through one repetition in a single action. Strength can take several forms, each one brings a specific advantage to the performance of physical activity. Forms of muscular strength include:

a. Absolute (contractile) strength is necessary to overcome inertia and to provide further acceleration.

b. Eccentric strength is necessary for deceleration, quick stopping and changing direction.

c. Torso strength is essential because the torso (core) is the body's connective link and will effectively support other parts of the body.

d. Unilateral (one leg) strength is very important, especially for activity involving lateral movement.

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Strength Training Definitions

9.3 There are several terms associated with strength training that are used to describe programming options, and they include the following:

a. *Intensity.* Intensity is described in two ways:

(1) the actual amount of resistance lifted per repetition in a training exercise, or

(2) a percentage of maximum strength.

b. *Volume.* Volume is the number of exercise repetitions performed in one continuous exercise set.

c. *Repetition Maximum.* Repetition maximum (RM) refers to completing the volume of an exercise with maximum effort. Therefore, 10 RMs is the maximum load that can be lifted 10 times. The maximum strength in one effort is one RM.

d. *Sets.* The number of sets refers to how many times a training stimulus set is repeated in a session.

e. *Frequency.* Frequency indicates how often training stimuli are repeated, usually during a week.

f. *Recovery.* Recovery duration indicates the time period to be used for recovery. Recovery activities are performed during recovery periods to stimulate accelerated recovery from the specific fatigue of an exercise.

SECTION 9-2. FACTORS AFFECTING STRENGTH TRAINING

9.4 There are several factors that determine the rate, scope and acquisition of strength. They predominantly centre on individual potential.

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Heredity

9.5 Genetic factors have a great influence on muscle strength. Large individual differences can be observed in body biomechanics and muscle mass in untrained individuals and, thus, also in muscular strength. These differences are largely determined by genetic factors.

Initial Fitness Level

9.6 The pre-training status of an individual will strongly affect the relative strength gains induced by training. Untrained persons can rapidly gain strength by resistance training due to learning effects in the central nervous system.

Gender

9.7 The number of muscle fibres in a given muscle group and the maximum tension developed per unit of cross-sectional area do not differ between men and women. Also, there is no systematic difference in fibre type distribution in the skeletal muscle between men and women. By deduction, the difference in maximum strength is primarily explained by a difference in size of the individual muscle fibre.

9.8 It is, therefore, to be expected that when men and women participate in various types of resistance training, they respond in a comparable fashion. After resistance training, men have greater absolute increases in both strength and muscular hypertrophy than women; however, when comparing relative increases in muscular strength, women respond similarly to men in upper and lower body strength. The greater relative strength gains of women compared to men, especially in the arms and hands, can be explained by the fact that the average woman starts training at a lower level of strength fitness.

9.9 Although there is a great range and overlap of strength abilities in men and women, the average man is considerably stronger than the average woman for all muscle groups tested.

9.10 An important factor determining the differences in strength between men and women is the variation in body composition. This difference in strength between men and women can be

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explained by absolute differences in the amount and location of muscle tissue, rather than differences in the quality of muscle tissue. These differences are as follows:

a. *Male.* The average adult male is about 10 per cent taller than the average female, weighs 10 to 15 kg more, and his body fat composition is about 15 per cent. In non obese men, muscle mass comprises 40 to 45 per cent of body weight.

b. *Female.* The average adult female has about 25 per cent body fat composition. In non obese females, muscle mass comprises 25 to 35 per cent of body weight.

9.11 Generally, absolute strength differences are as follows:

a. female upper body strength being 50 to 60 per cent is as strong as a male, and

b. female lower body strength being 70 to 80 per cent is as strong as a male.

9.12 This factor should be a strong consideration in the allocation of work tasks involving strength.

9.13 Both males and females generally reach their peak muscle strength at approximately 30 years of age. The main cause of the reduction in function is due to loss of muscle mass. This can be as a result of changing exercise and activity patterns; however, around the age of 65 this strength is reduced on average by the following:

a. males, 10 to 20 per cent; and

b. females, 20 to 30 per cent.

9.14 Regardless of age, muscle strength can be increased with a regular training regime.

Technique

9.15 The technique used in a resistance exercise will determine strength gains. Adherence to a specific technique will produce specific improvements in a short time. Simple movements will show rapid improvement, with complex movements taking

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longer. However, the more restricted a technique and/or the simpler a movement, the less transfer there will be of strength gains to a functional action.

Speed of Movement

9.16 Low speed, high resistance (heavy weight) exercises produce strength increases only in slow speed movements; however, high speed, low resistance (light weight) exercises produce strength effects in both high and low speed movements. For activities where speed of movement is a notable feature, quickly executed resistance exercises would have more general value in terms of training effects than would those exercises performed with slow movements.

9.17 The specific training effect that results from strength work is related to the controlling function of the brain, rather than to the energising capacity of muscle fibres. Muscle growth is related to the amount of tension produced in the muscle by the training stimulus. Slow velocity training may be necessary to stimulate maximum adaptation within the muscle. On the other hand, low resistances and high repetitions do not produce hypertrophy and stimulate only a restricted number of muscle fibres. Thus, it may be best to combine activities of varying velocities to produce added training effects. Fast movements might be used to train the nervous system, and slow movements to train the greatest number of fibres. This supports the usual practice of engaging in strength training with high resistances and lower speeds before power training with lower resistances and higher movement speeds.

Contraction

9.18 The manner in which muscles contract determines the type of changes that occur. For example, muscles exert more force when contracting eccentrically than when performing concentrically. Eccentric contractions can be three times as forceful as concentric ones. There may be an advantage to doing eccentric training because it stimulates a greater number of muscle fibres in the contraction. Eccentric contractions are used in plyometric or 'rebound' training, which activates the

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stretch-shortening cycle and embellishes the force of contraction. Eccentric contractions are involved in most sporting movements. Eccentric training is likely to be most effective where muscles are compelled to exert high magnitudes of eccentric force (eg. running, jumping, bounding, tumbling) where lowering the body weight is resisted.

9.19 The effects of strength training are so exact that for any transfer to occur from the training activity to other activity, the type of contraction must be the same. Thus, isotonic contractions may be the most useful for training since they are the most common form of contraction in military activity and sports.

Specificity of Strength Training

9.20 Strength training in one exercise will increase strength in that exercise but not significantly in another, even though the same muscle groups might be involved. The load is carried in a different manner by the muscles. Even a change in posture can affect the specificity of strength training. Thus, alterations in exercise from one position to another will drastically reduce the transfer potential of strength gains.

9.21 Resistance training is not a single entity, rather improvements in the contractile properties (maximal force, velocity of shortening and rate of tension development) of the muscle. The muscle itself can vary in a manner that is highly specific with the type of contraction used in training. Consequently, both static and dynamic training methods produce significant increases in muscular strength, no one system can really be considered 'superior' to the other. The crucial consideration is the intended purpose for the newly acquired strength.

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Cross Training

9.22 The concept of cross-training implies that the development of physical capacities in one activity will transfer to (crossover to) another; for example, the benefits of bench pressing will carry over to shotputting. Essentially, there are two opposing positions as follows:

a. *Specific Effects.* Strength training exercises should simulate movement as closely as possible in terms of pattern, velocity, contraction type and contraction force. Each departure from these simulation requirements lessens the amount of transfer of strength training effects to a target activity.

b. *General Effects.* Strength training exercises need only train the muscle groups without much concern for specificity. The cross-training position contends that it is only necessary to train muscle groups for a large proportion of training time. The gains that are made in such training can then be ‘educated' into other actions.

Neural Adaptation

9.23 It is generally accepted the primary factors determining the amount of force a muscle can develop are the size of the muscle being used and degree of stimulation given that muscle by the central nervous system. While angles of pull and associated leverages are important, it is the bulk (cross-section) of muscle tissue and ‘motor learning’ by the central nervous system which can be changed by resistance training and are the primary determinants of maximal possible force of movement.

9.24 Quick gains in strength in the initial part of a resistance training program are attributed to adaptations in the nervous system. The possible neural factors involved are as follows:

a. increased frequency and synchronisation of motor unit firing,

b. recruitment of additional high threshold motor units, and

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c. inhibition of the reflex protective mechanism.

9.25 These adaptations result in a better inter and intramuscular coordination and, hence, a higher maximal force production. The nervous system, therefore, is of great importance for the expression and development of strength. Marked increases in strength can be achieved without changes in muscle size but not without neural adaptations.

9.26 Rapid increases in strength develop during the first 2 to 8 weeks of training. These marked improvements occur without any increase in muscular size. Strength training effects first occur at the neuromuscular level. This means that the first response to strength training is a harnessing of existing capacities and resources. Training a group of muscles in a particular exercise will increase strength in that exercise but will not generalise to any appreciable degree to another involving the same muscle (see specificity). The following are the four responses that produce strength increases without any visible changes to the body:

a. neural adaptations appear first to improve technique,

b. the firing rate of motor units increases,

c. additional recruitment of motor units in the muscle are recruited, and

d. the synchronisation of the motor units is improved.

9.27 Changes to the size and shape of the muscle occur after neural adaptations have been exhausted or, in other words, once skill levels have been developed.

Muscular Adaptation

9.28 Additional gains in strength can be obtained by increasing muscle mass. Muscle hypertrophy, as reflected by a greater muscle cross-sectional area, is primarily the result of increased size of individual muscle fibres. These effects are apparent as early as six to eight weeks after the onset of training.

9.29 The muscle is essentially composed of two types of muscle fibres. ST fibres are adapted to perform aerobic exercise due

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to a high oxidative capacity. They possess characteristics needed for low intensity, long duration activities, such as marching, and long-distance running. FT fibres are suited for exercise where a large amount of force or speed is necessary and the activity is of short duration. FT fibres are able to shorten at high speed and relax quickly.

9.30 The type of motor unit recruited during an activity depends mainly on the force and speed which has to be developed to perform the muscular contraction. If, for example, a light weight is being lifted slowly, predominant ST motor units are recruited to perform this movement. If the weight is increased, or if it is moved at a faster velocity, FT motor units, in addition to the ST units, are recruited. FT motor units are not recruited unless high intensity (anaerobic) activity is performed.

9.31 To enlarge FT fibres, resistance training with forces of 70 per cent of one RM and above is required. This is because high threshold units (FT units) are recruited only at higher force levels. Frequent use of high threshold FT motor units is probably necessary to learn more efficient patterns of neural control.

9.32 With correct progression, in addition to increasing muscular strength, resistance training may also aid in the prevention of injuries. Resistance training promotes growth and/or increases in the strength of ligaments, tendons, tendon to bone and ligament to bone junction strength, joint cartilage and the connective sheaths within muscle. It can also lead to increased bone mineral content.

9.33 In summary, the adaptive response to resistance training occurs both within the nervous system and within the muscle itself. During the first phase of the adaptation, improvements in muscular strength are due to learning within the central nervous system. As training continues over several months, the muscular response becomes more important. This involves the synthesis of new contractile proteins, especially in the FT fibres, which results in further improvements in muscular strength.

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Loss of Strength

9.34 Programs of strength maintenance can be conducted less frequently than those aimed at producing strength change. Intensity is a more important factor than training frequency in maintenance training for strength. The practical implication for this is that muscular strength can be maintained over a relatively long period by performing as little as one intense training session a week.

SECTION 9-3. TRAINING TO INCREASE STRENGTH

Training for Muscular Strength

9.35 To perform well on the job under all kinds of circumstances, a soldier must possess good physical fitness. Good health and high fitness is required to perform optimally in combat and survive on a modern battlefield. In addition to aerobic fitness, muscular strength is an important factor that determines performance. Typically, military tasks that consist of a large strength fitness component include manual material and ammunition handling, and carrying heavy loads over short distances. On the battlefield, one has to be physically prepared to march with heavy loads exceeding 60 kg, to evacuate the injured, to dig weapon pits and to load heavy weapons systems.

Trainability of Muscular Strength

9.36 To improve dynamic strength, high loads with few repetitions should be used. Dynamic strength increases between 24 and 73 per cent over 21 to 60 training days. Loads of 2 to 10 RM are most effective in developing maximum dynamic muscular strength and that, beyond a 20 RM load, the gains in strength began to diminish. When maximum muscular strength increases are of primary importance, it is recommended that heavy resistance exercises be conducted, consisting of heavy loads with the RM being no greater than 10 repetition maximum.

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9.37 Strength is a capacity that can be gained quickly. Gains in strength, of up to 70 per cent, can occur in the first 10 sessions of a weight training program. Over the next 20 sessions, gains can be less than 30 per cent of the original strength values. Generally, strength increases 19 per cent after three weeks, 27 per cent after six weeks and 38 per cent after 10 weeks. The initial rapid gains can be encouraging and motivational for soldiers. However, as gains then become less obvious, adherence to a continuing program of strength training may become a problem because of diminishing returns.

9.38 There is a ceiling level of strength development. There is also a level at which the attainment of further training benefits is not a worthwhile pursuit. For most activity where strength is not the primary capacity for performance, a certain amount of strength assists performance. Above that level, the extra capacity is not taxed or used. More is not always better. There is the possibility that strength training may be very useful for bringing weak soldiers to a level of strength that is appropriate for their mission.

9.39 Progressive resistance training has been demonstrated to be the most efficient method of improving muscular strength, since it can provide a training load of sufficient intensity to overload muscles. Furthermore, basic training principles; for example overload and specificity of training, should be applied more consistently during military physical training.

Military Performance In Relation To Aerobic Fitness and Muscular Strength

9.40 The main goal in military fitness is to provide improved performances in task specific activities such as digging, road marching with heavy loads, material handling and general military readiness.

9.41 A combination of resistance training and aerobic fitness training is necessary to improve performance (about 13 per cent) on a load bearing task of a short duration, high intensity nature. Programs which focus only on aerobic fitness or muscular strength are not effective. Upper body muscle group

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strength, as opposed to leg strength, appears to play a more critical role in a heavy load, short duration bearing task.

9.42 Resistance training programs are particularly useful in physically demanding jobs, where it is not practical to train by performing the specific occupational tasks. However, thorough evaluation of the job requirements should be made to select the appropriate training exercises and equipment. This indicates that both general fitness training and task specific training should be part of a military training program.

Common Strengthening Exercises

9.43 **General Training Phases.** Push-ups, chin-ups, squats, dead lifts, lunges, curls, tricep extensions, dips, rope climbing, back extensions, abdominals with and without equipment or material are common general training exercises.

9.44 **Specific Training Phases.** Chin-ups, bench press, dips, dead lift, bent rowing, military presses, push presses, upright rows, high pulls, cleans, clean and press, lunges, squats, bench steps, shrugs and curls are specific training exercises.

9.45 Refer to Chapter 13 for further information relating to common strengthening exercises.

SECTION 9-4. PROGRAM DESIGN

Isotonic Training

9.46 Training overloads can be altered by increasing the resistance, decreasing the recovery interval and increasing the number of repetitions. Only by increasing the resistance will strength be increased. Decreasing the recovery interval and increasing the number of repetitions are the means by which muscular endurance is stimulated. Thus, to become stronger, a soldier has to experience step-like increases in absolute resistances.

9.47 The number of sets of repetitions normally ranges from 1 to 3 when strength training stimuli are first introduced. This allows for adaptation and reduces the soreness that could result from overworking while in an untrained state. When the stage of

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adaptation for the stimulus has been entered, the number of sets should increase to between three and six. Performing multiple sets of an exercise induces greater developments, and faster increases in strength and muscular endurance gains, than do single sets.

9.48 A major factor in strength training is the number of repetitions in relation to the load. The following factors need to be considered:

a. six or less repetitions seem to be most effective for increasing strength and power;

b. training with heavy loads and as few as two repetitions produces smaller gains than more moderate loads of four to six repetitions; and

c. as the number of repetitions increases beyond six, the strength training effect is progressively lost, while muscular endurance increases. Strength is not noticeably stimulated beyond 20 repetitions.

9.49 The frequency with which strength training sessions are programmed depends on the trained state of the individual. In early adaptive phases, the frequency may be as low as twice per week to allow for complete recovery of the soreness and stiffness that may result. If muscle soreness remains after a previous session, then the frequency of training intensity is probably too great.

9.50 A program that aims at steady strength increases should be planned for every other day. As individuals adapt to training, they can tolerate greater frequencies. The overload stress, the type of strength work and the recovery capacities of the individual will determine this. Residual fatigue (general and local), from resistance training, must be considered when programming extensive strength training or combined training programs.

9.51 High volume, low intensity training (eg. LSD) requires large total energy expenditure and is associated with chronic fatigue to a much greater extent than lower volume, higher intensity

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training (eg. interval training). High total workload training sessions require longer recovery periods than do those of moderate stress.

9.52 Short and inadequate recovery periods (normally less than 1 minute) contribute to the accumulation of lactic acid in the blood. Therefore, rest periods of up to 3 minutes may be required to facilitate full recovery between sets. The length of the training period will be determined by how fast lactic acid accumulates. Strength training is best completed without increases in lactic acid.

9.53 Proper form/technique should always be maintained during a resistance training exercise. If a movement is altered, then muscles that are not intended to be stressed by the exercise become stressed. This reduces the possible training effect on the targeted muscles. Effective training occurs only when employing correct movement patterns uses the intended muscles. Improper execution also increases the possibility of injury.

9.54 The exercises should adhere to the principle of specificity. The use of free weights usually requires more sophisticated and complex techniques than those needed for machines. They also allow movement in all three planes, whereas machines usually direct actions in only one. Free weights using whole body activities (eg. squat, clean and jerk, bent over rowing) and involving movement activities (eg. pulleys or medicine balls) are more akin to performing sport actions than are the particularly restricted or simpler machine determined actions. There is likely to be a greater amount of transfer to functional movements from more complicated free weight exercises than simpler machine exercises.

Steps in Sequencing an Isotonic Strength Training Session

9.55 The decisions that need to be made when developing strength should encompass those factors that best stimulate its development.

9.56 Strength training is scheduled within a training session after all learning, speed and power work has been completed. If

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activities associated with these factors have been done, it is most likely that the body will be sufficiently warmed to start strength training. The use of general and specific stretching between sets also accelerates the rate of recovery. If a strength training activity has not been preceded by a warm-up it will be necessary to complete one. Such a warm-up should at first be general with the main objective being to prepare the body for the activity which is to follow.

9.57 The major decisions that have to be made in the programming of strength training are as follows:

a. determine the objectives of the strength or resistance training program;

b. develop the program for the appropriate training phases;

c. plan the transition from general to specific exercise content across the training phases;

d. decide the number of repetitions to be used to achieve the desired capacity development (at one extreme pure strength; in the middle, a strength and muscular endurance effect; and at the other extreme, a muscular endurance effect);

e. decide the range of loads to be used for each individual;

f. select the exercises for the program objectives; and

g. test the maximum strength for each exercise, the capacities developed by each exercise and the carry over of training effects to the desired activity.

9.58 A suggested exercise prescription model for strength training is summarised as follows:

a. *Assess the Needs of the Participant.* The health and fitness of the soldier will modify program needs. The starting level of fitness has a dramatic effect on the improvement capabilities of a participant. The higher the initial strength level of the soldier, the slower and less obvious will be strength improvements. In a group where the strength of participants varies considerably, differing

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improvement rates could become a source of motivational and exercise adherence problems. The capacities for strength gains are also related to each soldier's genetic potential. Those with the greater number of FT motor units in muscles are likely to perform better and show greater improvements on strength exercises than do individuals endowed with more ST fibres.

b. *Establish Program Objectives.* The objectives that are formulated will determine the nature of the exercises that are used. Five different areas that require different exercise prescriptions are strength development and/or maintenance, muscle hypertrophy, changes in body composition (decrease body fat), muscular endurance and power.

c. *Determine Session Training Variables.* Training variables incorporate the stimulus qualities that will be employed to achieve specific effects. Not all programs labelled 'strength' produce the same effects. The choice of exercises should be based on an analysis of the muscles and joint angles to be trained. Every time the posture of exercising, the ROM and the rate of execution changes, the potential training effect is altered. Thus, exercises must adhere as perfectly as possible to a particular form, otherwise their value will be lost to unintended effects gained through technique alterations. The degree to which an exercise mimics the qualities of the desired action governs the amount of transfer that will occur.

9.59 The principle of specificity should be heeded when selecting exercises. Non-specific exercises will produce non significant effects for a specific activity.

9.60 The order of the exercises requires planning. Usually large muscle groups are worked before small groups. It is customary to alternate the muscle groups to be trained. However, the recent and growing popularity of pre-exhaustion exercises,

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where muscles are deliberately fatigued before the next exercise, appears to be threatening this traditional approach.

9.61 The benefits of pre-exhaustion exercises have not been adequately researched and trainers should be wary of their use. On the surface, it seems to have a number of potentially negative effects including:

a. an increase in the level of fatigue, which would then necessitate greater periods of recovery to achieve training effects;

b. it advocates ‘more is better’; and

c. excessive fatigue does not enhance the level of training effects, the extra work produces no extra gain and increases the chances of muscle soreness and injury.

9.62 The resistances to be used should be based on the capabilities of each soldier. They should facilitate the execution of sufficient repetitions to achieve the specific training objective. The number of repetitions performed should be of high intensity. Thus, the resistance chosen should be that which requires a maximum effort for the number of repetitions prescribed. These will govern the type of training effect. General guidelines for determining what number of repetitions are appropriate is shown in Table 9–1.

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Table 9–1: Training Phase Objectives

Phase	*Objective*	*Sets*	*Repetitions*	*Intensity (% of 1 Repetition Maximum)*	*Duration*
Accumulation	Muscular Endurance	3 to 5	15 to 30	50 to 70 per cent	4 to 6 weeks
	Hypertrophy	3 to 5	6 to 15	70 to 85 per cent	4 to 6 weeks
Intensification	Maximum Speed/Strength	3 to 5	1 to 5	85 to 100 per cent	2 weeks
	Speed/Strength	3 to 5	5 to 8	30 to 80 per cent	2 weeks

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9.63 The length of recovery periods modifies training effects. Shortening recovery periods increases the amount of lactic acid that accumulates in the muscles. In turn, this reduces the volume of work that can be achieved. Short recovery intervals are used by body builders for definition and size but are not appropriate for the development of maximum strength.

9.64 Heavy resistance, pure strength training should be entertained only when soldiers have below adequate strength for the correct execution of the skills of a specific activity. The planning of resistance and strength training programs should follow the guidelines of sound programming. The application of overloads should be 'periodised' into stepped increases, with the end of each step employing a session of reduced stimulus intensity. Examples of weight training programs, including a periodised program, are shown in Annex A. Variations in exercise stimulation are needed to make optimum gains in strength and power. Thus, a general feature of programming will be to employ a variety of tasks to achieve the same training objective.

Final Considerations

9.65 The ability to use strength is inversely proportional to the speed of the performance action. Very fast activities do not need high levels of strength, while slow activities do. In some military activity it may be necessary to develop strength for relatively slow movements (eg. bridge construction) but not for other aspects of the activity (eg. building clearance). Thus, strength training would seem to be of greater value for slower forms of movement.

9.66 The value of the time that is dedicated to strength training sessions has to be balanced with the amount of time spent in training for a specific military activity. There is the possibility that strength training could be overemphasised to the point where it interferes with the performance gains that can be expected from other training forms. If the residual fatigue from a resistance training session carries over to actual training, then learning skills and developing capacities, such as speed, power and aerobic endurance, may be hindered. If the time

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spent is such that specific sport training is reduced to accommodate it, then performance improvements will be lessened because of the reduction in the volume of specific training.

9.67 When strength gains lessen (that is, when a ceiling level of development is approached) and performances still improve, the need for strength training becomes one of maintenance. The training time released through a maintenance program should be employed for more beneficial military-specific training.

Delayed Onset of Muscle Soreness

9.68 There are several possible explanations for the delayed onset of muscle soreness that accompany strength training as follows:

a. minute tears in the muscle tissue,

b. osmotic pressure changes and water retention,

c. muscle spasms, and

d. overstretching and perhaps muscle and connective tissue tears.

Load Fatigue

9.69 The most common cause of tearing or breaking of body tissue is the application of a single load which exceeds the tissue's strength limit. Similar injuries can result, however, from repeated smaller loads, tile size of which, with respect to the strength limit, will determine the number of load cycles required to cause damage (refer Table 9–2 in Annex A). The smaller the load, the greater the number of load cycles that can be tolerated.

Summary

9.70 A soldier's capacity for muscular strength is largely determined by physiological factors, such as size and type of muscle fibres, as well as by the anatomical lever arrangement of bone and muscle. This strength capacity is probably greatly affected by

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neural influences from the central nervous system that activate the prime movers in a specific muscular action.

9.71 Genetic, exercise, nutritional, hormonal, environmental and neural factors interact to regulate skeletal muscle mass and corresponding strength development.

9.72 Increases in strength with resistance training are due to improved capacity for motor unit recruitment, changes in the efficiency of the firing pattern of motor nerves and significant alterations in the contractile elements within the muscle cell itself.

9.73 As muscles are overloaded and become stronger, they normally hypertrophy or grow larger. This process involves increased protein synthesis with resulting myofibril thickening, proliferation of connective tissue cells and an increase in the number of satellite cells that surround each fibre.

9.74 Muscular hypertrophy generally involves structural changes within the contractile mechanism of individual fibres, especially that of the FT fibres as well as increases in anaerobic energy stores. If new muscle fibres actually develop, their contribution to muscular enlargement is as yet undetermined.

9.75 Heavy resistance training does not bring about adaptations in cellular components that would contribute to enhanced local aerobic energy transfer.

9.76 Strength improvements for females, on a percentage basis, are similar to those of men. Generally, females are capable of significant relative increases in muscle mass as a result of resistance training.

9.77 Conventional resistance training exercises contribute little to cardiovascular aerobic fitness. Due to their relatively low caloric cost, they would not be effective major activities in a weight reducing program.

9.78 By using lower resistance and higher repetitions, circuit resistance training offers an effective alternative for combining the muscle training benefits of resistance exercise with the cardiovascular benefits of more continuous dynamic exercise.

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9.79 Strength program examples are in Annex A.

9.80 Any part of the body which is subjected to repeated mechanical loads is liable to develop an injury and the likelihood of such injury, caused by wear or fatigue, depends not only the size but also on the frequency and duration of the load. Individual factors such as build, age, training level, previous injuries and illness are also relevant.

9.81 There is one essential difference between fatigue occurring in biological tissue and that occurring in non-biological material. Body tissues have the ability to adapt to the strains to which they are subjected. Adaptation of the body to repeated physiological loading results in improved performance. Its adaptation to repeated overloading, however, can cause sore muscles, pains in the legs, peritendinitis, and so on as a result of an inflammatory response. Such discomforts are warning signals and, if they are not taken seriously, the body may not have time to repair an incipient injury. If, on the other hand, a suitable training level is chosen, the inflamed tissue can repair itself and gradually adapt to tolerate the higher load.

9.82 Injuries due to repeated overuse can occur in several parts of the body, and this includes:

a. the skeletal system, which is often prone to stress fractures as a result of overtraining; and

b. the soft tissues of the locomotor system (tendons and muscle attachments).

9.83 These injuries can make certain activity impossible for months or even years, if they are not given the opportunity to heal.

Annex:

A. Weight Training Programs

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CHAPTER 14

INJURY PREVENTION

SECTION 14-1. INTRODUCTION

Overview

14.1 From 1991 to early 2000, systematic efforts were made at the Army Recruit Training Centre to address the high rates of injury and discharge among recruits. These efforts were very successful, saving thousands of personnel from injury and discharge, and significantly reducing medical and compensation costs. These preventive efforts were refined over the years, and were recognised by Training Command - Army and the Defence Health Service Branch. In April 2000, the Director General Defence Health Service decided to adopt the Army Recruit Training Centre model of injury prevention for application across the Australian Defence Force (ADF). The Army Recruit Training Centre model has been adapted for use in all types of military establishments. The program has become known as the Defence Injury Prevention Program (DIPP).

14.2 The DIPP has been developed in response to an identified need within the ADF to more fully address the prevention of injury to military personnel, especially in sport, PT and other forms of physical activity. The DIPP enables local unit personnel to source, through the local injury prevention adviser or injury surveillance manager, reports of injury surveillance information that have been collected by local health care facilities. This information provides units with comprehensive and detailed information regarding the circumstances surrounding local injuries and assists unit personnel in prioritising local injury problems for further action.

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14.3 The DIPP also provides tools and training to local unit personnel to equip them to properly analyse causes of key injuries, and to develop and implement appropriate countermeasures. In these ways, the DIPP strengthens the capacity of local unit personnel (including CFLs and PTIs) to monitor and effectively manage injury risks, and to control injury rates.

14.4 The following preventive practices, implemented at the individual or command level, will contribute strongly to:

a. minimising personal disability and suffering;

b. maximising personnel availability and readiness for deployment and general military service;

c. maximising operational capability;

d. reducing the rate of premature separation of military members from the ADF;

e. optimising learning conditions and, hence, training outcomes and skill development; and

f. minimising medical and compensation costs.

14.5 Strong results in all these areas have been clearly demonstrated at numerous sites and highlight the benefits of these approaches.

SECTION 14-2. INJURY PREVENTION RESPONSIBILITIES

General

14.6 The CFL and PTI have a mandated responsibility to ensure that all activities conducted are subjected to a thorough risk assessment, and risk treatment process, to ensure that reasonably preventable injuries are avoided. Responsibility also extends to ensuring that if an injury occurs, irrespective of its nature, it is appropriately recorded and reported. The DIPP, where implemented, relies on the accuracy of information

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provided by the injured person via a DIPP questionnaire which is completed at the treating medical facility.

14.7 PTIs have additional responsibilities to ensure activities, conducted by CFLs and other personnel in their area of responsibility, are properly risk managed. The key goal is to minimise rates of reasonably preventable injuries, ensuring maintenance of operational capability and personnel readiness for commanders. PTIs are key subject matter experts (SMEs) for the conduct of physical activity and should provide advice on these matters to commanders, occupational health and safety (OHS) committees and activity managers, both routinely and when requested.

Combat Fitness Leaders

14.8 CFLs are responsible for the following:

a. familiarising themselves with unit operational objectives, command direction for unit training activities, the key skills and conditioning required by unit personnel, and key injury risks for unit personnel;

b. planning physical training programs (progressive sequences of activities) and individual physical activities well in advance, and in accordance with the objectives identified above, and subjecting these plans (including risk management plans) to scrutiny by the PTI assigned responsibility for the unit;

c. refining plans in accordance with advice from the PTIs, previous post-activity reports, lessons learned, extant policy and procedures, consideration of proper progression to avoid overuse injuries, and any other SME advice;

d. inspecting facilities and equipment before use to ensure serviceability and that hazards are properly controlled or removed;

e. checking that all participants possess the required levels of skill, conditioning and general health as a prerequisite to participation;

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f. controlling, modifying, substituting or even cancelling activities or individual participation, as necessary, in order to control or eliminate any risks evident prior to or during activities;

g. ensuring that any injured personnel receive necessary medical care, including first aid;

h. writing and filing post-activity reports for all activities, including key injury prevention lessons learned, as an aid for future planning and conduct of similar activities; and

i. seeking external advice from the appropriate SME if operating outside limits of expertise.

Physical Training Instructors

14.9 PTIs are responsible for the following:

a. conducting physical activities in accordance with the responsibilities established for CFLs;

b. ensuring that all physical activity and sport, conducted by others within their assigned area of responsibility, are conducted in accordance with the responsibilities established for CFLs;

c. attending unit OHS committee meetings as a key SME and advocate for physical activity and sport;

d. coordinating, advising and training local CFLs and sports coaches to better enable them to meet their DIPP responsibilities;

e. assisting unit DIPP coordinators and OHS committees to investigate injury trends in physical activity and sport in order to identify causal factors and potential countermeasures;

f. providing reports and advice through the appropriate chain of command, as appropriate or required; and

g. providing continued education to units on the DIPP and injury prevention for sport and physical activity.

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Occupational Health and Safety Committee and Unit Defence Injury Prevention Program Coordinator

14.10 Each unit should have an active OHS committee and many units will have a unit DIPP coordinator (UDC) and an assistant UDC. These are key members of the OHS committee with a delegated responsibility from the unit commander for managing DIPP processes in the unit. The assistant UDC is required to ensure that DIPP processes do not cease in the absence of the UDC.

14.11 The UDC is responsible for the following:

a. receiving and analysing (with the assistance of PTIs and others) injury surveillance reports from local health facilities and conducting risk assessments to identify priority injury problems of the unit. They also recommend action to investigate causes and develop countermeasures for implementation to reduce injury risks;

b. developing and maintaining a local network of SMEs, including PTIs, to investigate and manage unit injury problems, particularly those related to physical activity and sport;

c. ensuring that all priority injury problems are raised with the OHS committee for discussion and action;

d. advising the OHS committee and unit commander regarding approaches to injury risk management, causal analysis and control;

e. reporting on unit injury prevention activities to the regional injury prevention adviser.

14.12 The unit OHS committee is responsible for managing all aspects of unit OHS on behalf of the unit commander, and in accordance with current Defence policies and procedures.

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Injury Prevention Advisers

14.13 Injury Prevention Advisers have a regional responsibility, covering many units, for facilitating, monitoring, reporting and advising on all aspects of injury risk management for sport and physical activities. In this role they will be in regular communication with local PTIs, UDCs and OHS committees, and help facilitate DIPP processes within the region.

SECTION 14-3. INJURY PREVENTION METHODS

14.14 PTIs, CFLs and others who conduct or manage physical activities and sport are expected to do so in accordance with current Army and Defence policies and procedures for risk management, safety management and injury prevention. These can be sourced through Army and ADF doctrine, the Defence Safety Management Agency and the Defence Health Service (incorporating DIPP). These policies and procedures reflect Australian Standards and best, current international practices in these fields, and are continually updated for this reason. PTIs and CFLs are expected to ensure that they possess current knowledge and competence in these areas. Further information can be found in *Better Coaching, F. Pyke,* 1991, *Australian Defence Force Health Status Report,* 2000 and *Defence Safety Manual,* 2002.

Key Concepts

14.15 Key areas for consideration by all parties in order to prevent injuries should include:

a. provision of adequate quantity and quality of activity supervision and officials;

b. adequate inspection, maintenance and repair or replacement of facilities, equipment, footwear and protective equipment;

c. proper training progression, which steadily develops skills and conditioning for a task or activity at a rate that is suited to the starting levels of participants, while

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avoiding excessive fatigue, repetition, loads and resultant injuries;

d. past histories of injury and medical conditions of participants, ensuring that rehabilitation and health care management is satisfactorily completed to control risk of further injury;

e. attention to correct technique with the correction of major faults first;

f. the total activity program context so that fatigue and stresses related to external activities are considered as risk factors, as well as fatigue and other risk factors associated with the physical activity itself;

g. development of agility and coordination through specific exercises designed for this purpose, with requirements of core trade or sport tasks considered;

h. attention to policing and enforcement of sport and activity rules, procedures and codes of conduct;

i. climate, acclimatisation status of personnel, and current weather and associated ground surface conditions;

j. principles of balanced competition;

k. OHS legislation policies and requirements, as well as organisational safety management plans for the specific activity (eg. sports safety management plans);

l. ready availability of adequate medical support for the activity such as first aid, evacuation, and so on;

m. allowance for adequate recovery periods, hydration and nutritional intake between or within activities; and

n. principles of training variety and appropriate, goal directed activities.

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Examples of Injury Prevention Strategies

14.16 The following are examples of practical strategies a PTI or CFL might apply to reduce risks of injury in an activity, in accordance with the key concepts discussed in paragraph 14.15:

a. obtain fitness test results and activity experience information for unit members who intend to participate in the activity to gauge the level at which the activity should commence and the progression that will be needed;

b. shorten game or activity duration to suit the participant fitness and skill levels to avoid excessive mental and physical fatigue;

c. if fatigue is to be used as a training tool, plan how to manage the safety of participants once in a fatigued state; for example, by making sure environmental hazards are well controlled at that time or that levels of supervision are higher;

d. use individualised levels of activity where possible. This may require some creativity if teamwork is to be maintained; for example, by grouping participants by fitness and skill levels or structuring the teamwork so that contributions and activity levels of individuals are comparable, but challenging to their fitness and skill levels;

e. monitor workloads using; for example, simple self-reporting of rates of perceived exertion or HR monitors;

f. employ a variety of activities to develop necessary skills and conditioning for a task or activity; for example, employ water running in a pool, strength training and agility exercises, as well as running training in preparation for a cross-country event;

g. add additional stresses (eg. heat, noise, load, reduced visibility, verbal pressure to perform) and hazards (eg. typical rocky ground or urban obstacles experienced in the operational setting) into the activity and activity

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environment gradually, as skill levels and attention capacity sufficiently improve to enable participants to cope with these without injury;

h. employ regressions and progressions of instruction as required during the activity; for example, by going back a step and breaking down steps of instruction for individuals who have been identified as not being able to apply the initial instruction, for reasons of confidence, lack of skill or lack of fitness; and

i. seek support from additional, experienced personnel to assist with supervising the activity.

14.17 This list of examples is by no means exhaustive. Additional ideas can be gathered from other (especially experienced) instructors, health personnel (eg. physiotherapists), external organisations, post-activity reports, relevant Defence intranet and internet web sites and other sources of subject matter expertise.

14.18 The relevant Defence intranet web sites are as follows:

a. Defence Health Services at <http://defweb2.cbr.defence.gov.au/dpedhs>.

b. Defence Safety Management Agency at <http://dsma.dcb.defence.gov.au/default.htm>.

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CHAPTER 15

HEALTH AWARENESS

SECTION 15-1. HEALTH AWARENESS CONSIDERATIONS

Introduction

15.1 There are a number of factors that affect the way in which people will be able to perform physical tasks. This must be considered when developing unit and individual physical training programs.

Gender Issues

15.2 Fit trained females can sustain the same intensity of physical training as males; the unfit female has a similar propensity to injury as the unfit male. The size and strength difference between males and females is an important factor to consider when training males and females in body contact activities such as minor team games. Due care must be taken on route marches; the average height difference between males and females may lead to longer and more frequent strides by females increasing the tendency for injury.

Pregnancy and Physical Training

15.3 The ADF policy for members who are pregnant is contained in *Health Directive Number 235, Management of Pregnant Members of the Australian Defence Force,* 2002. Once a member is aware of her pregnancy, she is not to undertake the single service PT test. Before any individual or group PT session, the pregnant member is to consult PT staff. It is recommended that pregnant members consult a specialist in obstetrics for information on training while pregnant.

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Age Issues

15.4 Personnel older than 40 years of age, who have exercised regularly, may continue to exercise at the same level as they did before reaching age 40. Members who have been sedentary should consider seeking medical clearance before undertaking a PT program.

Special Considerations

15.5 Members who have medical restrictions are to disclose their health status to the instructor before the commencement of training. Members are to participate in PT within the limits of their restrictions. They are not to place themselves at risk of further accident or injury. Members who are medically restricted and are unable to participate in regular physical training are to have a rehabilitation program designed, by a medical officer or physiotherapist, to assist them with recovery and maintenance of fitness.

Health Risk Factors

15.6 A number of risk factors are closely associated with cardiovascular disease, and they are as follows:

a. increased cholesterol in the bloodstream;

b. excessive alcohol consumption;

c. obesity (excess weight);

d. high blood pressure;

e. smoking;

f. stress;

g. family history; and

h. lack of physical activity.

15.7 **Increased Cholesterol in the Bloodstream.** Cholesterol is a fat-like substance, a certain amount of which must always be present in the body to maintain life and good health. However, excessive quantities of cholesterol have been shown to be associated with developing certain heart and blood vessel

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diseases. Some cholesterol is manufactured by the body itself; however, large quantities are contained in certain foods. The intake of cholesterol in the diet should be less than 300 milligrams daily. This is the equivalent of one egg. Popular foods that are high in cholesterol include lamb, beef, pork, ham, crustacean seafood (prawns, lobsters), butter and cream.

15.8 Obesity. Obesity is defined as an excessive accumulation of body fat. Soldiers who are overweight increase their chances of having a fatal heart attack compared to those who would be considered to be of normal weight. There is a definite relationship between obesity and certain cardiovascular diseases. This is due to the following:

a. extra stress placed on the heart because of the added workload,

b. closely related high blood pressure, and

c. increased level of cholesterol and other lipids (fats and oils) in the body.

15.9 High Blood Pressure. High blood pressure is often referred to as hypertension and occurs when the blood pressure exceeds accepted normal levels. These levels increase with age.

15.10 Smoking. Smoking contributes to, and accelerates, the development of coronary heart disease. Apart from the higher incidence of lung cancer among smokers, smoking is directly related to many other diseases. Smoking should be discouraged so that optimal effects are obtained from training.

15.11 Stress. Stress is a condition caused by physical and emotional factors. PTIs and CFLs must be aware that a soldier's performance may suffer as a result of stress resulting from the demands of training or employment.

15.12 Family History. Where there is a history of heart disease in a soldier's immediate family, that soldier has a higher risk of coronary heart disease.

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15.13 Lack of Physical Activity. A soldier in the field will undoubtedly have a more active lifestyle than the soldier in an office. The desk bound soldier must make a definite commitment to a regular PT program. A sedentary life increases the chances of suffering a heart attack.

15.14 In summary, it should be stressed that in no instance can a cause and effect relationship be established between one or all of these seven risk factors and the occurrence of a heart attack. However, a soldier can reduce his/her chances of suffering a heart attack by taking positive action to reduce the risk.

Exercise and the Asthmatic

15.15 PTIs and CFLs may encounter asthmatics in their units. A knowledge of exercise in relation to asthmatics is, therefore, necessary. Asthma is a disorder of respiration with laboured breathing. This difficulty is due to a temporary narrowing of small air ducts in the lungs. Asthmatics have a hypersensitive lining on their bronchial tubes. This membrane readily becomes inflamed and swollen when it overreacts to certain stimuli. These may include dust, pollens, cold and exercise. Other factors such as stress and anxiety also have an influence.

15.16 The most common sign of an asthma attack is ‘wheezing’, especially during expiration. Apart from medical treatment, relaxation, breathing training, postural drainage and moderate physical activity are of assistance. Exercise is also important to prevent or help correct faulty posture. Swimming is particularly helpful in improving respiratory muscles. There are, however, a number of situations which must be avoided. Exercises which involve breathing to a command, especially when combined with arm movements, are not to be encouraged. Any exercise that attempts to improve the breathing pattern, such as breathing in and out to regular counting, is not helpful and may cause distress.

15.17 An asthmatic must stop activity temporarily when becoming breathless or fatigued. After recovery, activity may be recommenced.

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15.18 Some soldiers require medication before commencing regular exercise to prevent the onset of exercise induced asthma. It is in the interests of asthmatic soldiers to be reviewed by medical officers to determine their need for medication before PT, recreational or sporting activities.

Environment and Exercise

15.19 Exercise in hot climates must be conducted in accordance with current accepted practice. It is recognised that graduated exercise accelerates the acclimatisation process in hot climates. Instructors are to understand the implications of the wet bulb globe temperature index detailed in *Defence Safety Manual,* 2002. Commanders must ensure PT is conducted at a suitable time of the day in hot climates and give due consideration of preceding activity and environmental conditions. Members should carry a personal water bottle while performing PT and be free to access water during training at all times. Before the commencement of training, instructors are to identify water points to members and explain the importance of hydration.

15.20 When training in hot or cold environments, instructors are to be trained to recognise and manage hyperthermia, hypothermia, dehydration and injuries or illnesses caused by environmental conditions.

SECTION 15-2. ACCLIMATISATION

15.21 Successful acclimatisation strategies are required to prevent heat related injuries and illness. Further information on the prevention of heat related injuries and illness is explained in *Defence Safety Manual,* 2002. This publication can be found in the Defence Safety Management Agency website, as detailed in paragraph 14.18.

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15.22 To achieve acclimatisation the following points must be observed:

a. A period of two weeks with progressively increasing exposure to heat and physical activity is required for substantial acclimatisation. Personnel who are required to do heavy work before being acclimatised have a high potential for heat illness. For these people, the development of full work capacity in heat may be retarded, and may result in poor work quality and efficiency.

b. Acclimatisation to heat begins with initial exposure and is usually 50 per cent developed by the end of the first week. Some individuals, who are especially susceptible to heat illness, will require longer acclimatisation times. Full acclimatisation is attained most quickly by progressively increasing work in the heat. Full acclimatisation can be obtained by as little as two 50-minute periods of work in the heat each day. The work should require cardiovascular endurance work, such as running in place, if physical training is used, instead of muscle work such as push-ups. Resting for three or four days in the heat, with activity limited to that required for existence, results in only partial acclimatisation. Physical work in the heat must be accomplished to result in full acclimatisation.

c. If it is necessary for personnel work during acclimatisation, the cooler hours of the day should be used. A recommended work schedule for unacclimatised personnel, which provides increasingly longer work periods alternating with rest periods is provided in *Defence Safety Manual,* 2002.

d. One major mechanism of acclimatisation is increased sweating. Larger volumes of sweat are produced, sweating begins at a lower temperature and; the concentration of salt in the sweat is progressively reduced. Therefore, the water intake requirements

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detailed in *Defence Safety Manual,* 2002, must be followed to keep acclimatised personnel well hydrated.

e. The other major mechanism is that there will be cardiovascular adjustments made by individuals during days 1 to 5 of an acclimatisation program.

SECTION 15-3. HYDRATION

15.23 Hydration is a complex subject. Commanders at all levels require a working knowledge of subjects such as the benefit and rules of hydration including recommended fluid intakes. This information should then be used to formulate an area standing operating procedure on hydration, which should be adhered to by all personnel conducting physical activity. Details on hydration are explained in *Defence Safety Manual,* 2002.

SECTION 15-4. NUTRITION

Introduction

15.24 In addition to exercise, proper nutrition plays a major role in attaining and maintaining total health and fitness. Good dietary habits greatly enhance the ability of soldiers to perform any given tasks at their maximum potential. A good diet alone, however, will not make up for poor health and exercise habits. This section gives basic nutritional guidance for enhancing physical performance. Soldiers must know and follow the basic nutrition principles if they hope to maintain weight control, achieve maximum physical fitness, good health and mental alertness. Healthy eating should be a subject promoted by all commanders.

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Principles of Nutrition

15.25 Food consists of seven categories of nutrients, each with its own set of functions. The seven nutrients and their functions are as follows:

a. carbohydrate – energy;

b. fat – energy;

c. protein – growth and repair of tissue;

d. vitamins – growth and repair of tissue;

e. minerals – regulation of body processes;

f. dietary fibre – regulation of body processes; and

g. water – regulation of body processes.

15.26 Carbohydrates. The main function of carbohydrates is to serve as energy fuel for the body. The energy is derived from the breakdown of glucose (sugar) and glycogen is used to power muscular contraction as well as other normal body functions. Carbohydrates are absorbed as sugars and then transported and moved to various sites of the body via the bloodstream. Carbohydrates will first enter the liver, move through the heart and then enter the bloodstream again. The main types of carbohydrate are as follows:

a. sugars:

(1) monosaccharides (glucose);

(2) disaccharides (sucrose and maltose sucrose is one molecule of glucose and one molecule of fructose joined together, maltose is two molecules of glucose joined together); and

(3) polymers (maltodextrins – chainlike structures of glucose joined together); and

b. starches (chainlike structures of glucose joined together).

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15.27 Fats. Fats not only provide energy for the body, but are precursors for the synthesis of various important compounds and tissues vital for normal functioning. They also form insulation for the body and protection for vital organs. Compared to carbohydrate as an energy source, fats hold almost double the amount of potential energy. However, fat takes greater time to use and cannot provide sufficient energy rapidly enough to fuel high intensity exercise. The two forms of fat are: saturated fatty acids, normally found in animal fats; and unsaturated fatty acids, commonly found in vegetable or fish oil. The normal Australian intake of fat per day as a percentage of total intake is 40 per cent, although this amount should be under 25 to 30 per cent for most people.

15.28 Protein. Proteins are used as a building block for tissue repair and an alternative energy source during periods of starvation or long endurance exercise. The body requires only a certain amount of protein per day; 10 to15 per cent of the total energy intake is recommended. If too much is consumed, the excess is mostly converted into fat and stored.

15.29 Vitamins. Vitamins are chemical compounds needed by the body in minute amounts to perform specific functions. In general, they cannot be made by the body and so have to be consumed in the diet. Vitamins can be broadly classified as follows:

a. fat-soluble vitamins (A, D, E and K); and

b. water-soluble vitamins (B and C).

15.30 Minerals, Electrolytes and Trace Elements. Minerals are chemicals required by the body in very small amounts. They include iron, sodium, potassium, calcium, phosphorus and magnesium. They generally exist as mineral salts (sodium chloride) which when dissolved in water, separate into their constituent ions (sodium and chloride ions). Other chemicals (copper, zinc and fluorine) are required in extremely small quantities and are called trace elements. They are all essential for life and are important components of bone, connective tissue, haemoglobin, hormones and many enzymes within the

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body. Excess consumption of some minerals, particularly when taken as supplements, can result in a toxic accumulation which may be harmful (eg. iron by female athletes). Electrolytes, also known as mineral salts, break down into their constituent elements (sodium chloride splits to give sodium and chloride ions). They are present in most body fluids and assist in maintaining the acid base equilibrium of the blood. Electrolytes are often included in commercial sports drinks (sodium chloride, potassium and magnesium) to replace those lost in sweat and help increase fluid absorption.

15.31 Dietary Fibre. Dietary fibre is the portion of plants which cannot be broken down by the human body and, because of its role, it is also referred to as roughage. Dietary fibre is a broad term, describing a number of different plant materials including cellulose, hemicellulose, pectin, polysaccharides, gums, mucilage and lignin. These are found in wholegrain cereals and their products, fruit, vegetables, nuts and legumes. The benefits of dietary fibre for the soldier are great. Dietary fibre slows down the release of sugar from food, thereby preventing large fluctuations in blood sugar levels. This gives the soldier a more sustained release of energy. Fibre also increases bulk in their diet without providing extra kilojoules. Therefore, for soldiers on a weight reduction diet, a high fibre diet is recommended. Fibre can interfere with the absorption of certain minerals. It is recommended that soldiers consuming a high fibre diet pay particular attention to ensure that their diets contain adequate amounts of mineral, particularly iron and calcium.

15.32 Water. Water makes up 55 to 65 per cent of the body's total weight, it is essential to life and has many functions within the body. Some of these include assisting in temperature regulation, transportation of nutrients and waste and controlling the distribution of various elements that are important for tissue/organ function around the body.

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Guidelines for Healthy Eating

15.33 Eating a variety of foods and maintaining an energy balance are basic guidelines for a healthy diet. Good nutrition is not complicated for those who understand these dietary guidelines. To be properly nourished, regularly eat a wide variety of foods from the major food groups, selecting a variety of foods from within each group. A well-balanced diet provides all the nutrients needed to keep a person healthy. Most healthy adults do not need vitamin or mineral supplements if they eat a proper variety of foods. There are no known advantages in consuming excessive amounts of any nutrient, and there may be risks in doing so. For soldiers to get enough fuel from the food they eat and to obtain the variety of foods needed for nutrient balance, they should eat three meals a day. Even snacking between meals can contribute to good nutrition if the right foods are eaten. Another dietary guideline is to consume enough calories to meet one's energy needs. Weight is maintained as long as the body is in energy balance.

Energy Requirements

15.34 The energy in a diet is obtained mainly from carbohydrates and fats with protein providing a minimal amount. The energy available within these nutrients is as follows:

a. carbohydrate 16 kilojoule/4.0 kilocalorie per gram;

b. protein 17 kilojoule/4.0 kilocalorie per gram; and

c. fat 37 kilojoule/9.0 kilocalorie per gram.

15.35 There are many factors regarding daily energy requirements. The basal metabolic rate refers to the amount of energy required in 24 hours at rest. Factors that affect basal metabolic rate include age, body composition, level of fitness, size and gender. However, exercise and physical activity is by far the greatest factor modifying energy expenditure. If more energy is consumed than expended the excess will be stored as fat and body weight will increase. In contrast to this, if energy intake is insufficient the body's fat stores will be used, resulting in weight loss. It should be noted that muscle might also be used as an

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energy source in certain cases, but usually only after several days or weeks of severely inadequate protein and/or energy intake.

The Healthy Food Pyramid

15.36 The healthy food pyramid best describes the ideal training diet for soldiers. Most of the daily energy should come from the foods at the base of the pyramid shown in Figure 15–1; that is, breads, cereals, rice, pasta, fruits and vegetables. It is important that a moderate amount of protein food is consumed. However these should be low in fat; for example, skim milk, non-fat yoghurt, low-fat cheese, lean red meat, fish, chicken and legumes. The intake of simple sugars, oils and fats should be kept to a minimum.

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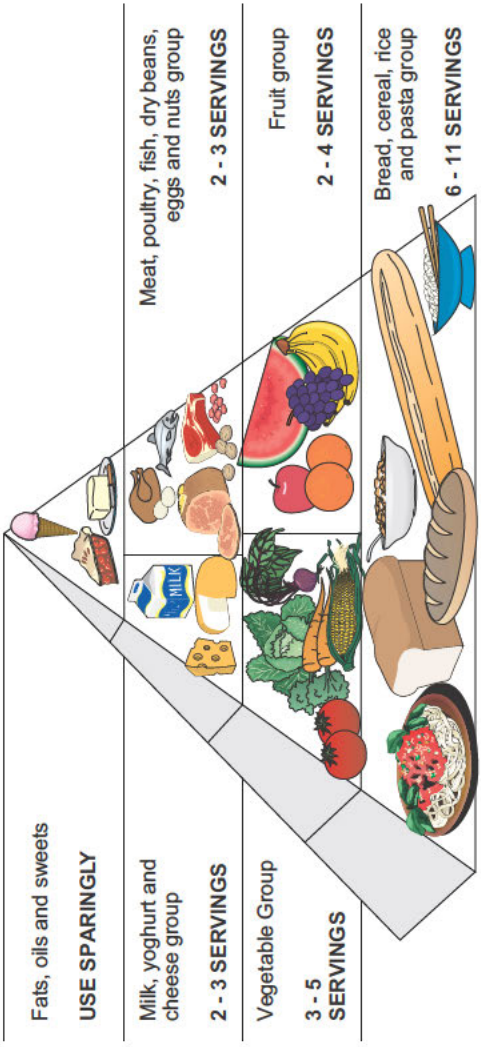


Figure 15–1: Food Guide Pyramid

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15.38 Takeaways. One type of food not mentioned, but commonly consumed in a soldiers' diet is takeaways. These foods may be based on cereals or vegetables, but are usually very high in fats and salt; for example, potato chips and pizza. These foods should be kept to a minimum in the diet. However, there will be times when the soldier is travelling and they need to be consumed. In these cases, the soldier should try to choose healthier varieties of takeaways; for example, souvlaki made with a lean meat and filled with lettuce and tomato. Salad sandwiches, plain hamburgers, steamed rice with Chinese vegetables and barbecued chicken without skin, are all good choices.

15.39 Alcohol. While alcohol is said to have an energy value, the human body cannot process this fuel into useable energy to fuel muscles. Furthermore, alcohol affects the ability of the body to effectively process ingested foods. Therefore, any food consumed while alcohol is in the system will not be used as the primary energy source and will be stored as fat.

15.40 Many other issues are associated with excess alcohol consumption and these include:

a. hypertension (increased blood pressure);

b. cardiomyopathy (failure in heart function);

c. polyneuropathy (neural failure);

d. cancer of the throat, mouth and pancreas;

e. weakening of the immune system;

f. cirrhosis of the liver; and

g. hepatitis of the liver.

Guidelines

15.41 In accordance with current ADF health publications, alcohol intake should be limited to one standard drink per day for women and no more than two standard drinks per day for men. Another point to remember is that binge drinking is especially detrimental to health.

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Weight Reduction and Weight Maintenance

15.42 The main cause of an overweight soldier is when food intake far exceeds energy output levels. Energy can neither be gained nor lost, it can only be changed in form. When food intake exceeds the energy output, the balance is deposited as body fat. Conversely, when energy output exceeds intake, fat is lost.

Reducing Weight

15.43 The most successful method of weight reduction is to reduce food intake, as discussed in the previous paragraphs, and to follow a regular exercise program.

Dieting/Specialist Advice

15.44 Severe dietary restrictions require specialist medical advice and supervision. This is beyond the scope of the information contained in this section. PTIs and CFLs should advise soldiers on the very basics of nutrition, as contained in this section, and should always refer soldiers to consult a regimental medical officer, rather than imposing a severe diet on them. A loss of about half a kilogram a week can be achieved by cutting food intake down to approximately 2000 to 4000 kilojoules a day below the required expenditure level. This lost body fat is used up as energy. Meals must not be missed; rather, less should be eaten at each meal.

Weight Maintenance

15.45 Once a desirable weight has been attained, the diet should be eased gradually so as not to continue losing weight. Once weight remains constant at a desirable level, weekly weight checks must be made to monitor weight.

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Key Nutrition Points

15.46 Key points relating to nutrition are as follows:

a. Food is essential for energy, growth, repair and strengthening of tissue. A poor diet, lacking in potential energy or essential nutrients, can result in poor performance, physiological breakdown and injury.

b. The energy in a diet is obtained mainly from carbohydrates and fats with protein providing a minimal amount. Exercise and physical activity is by far the greatest factor in energy consumption. If more energy is consumed than expended, the excess will be stored as fat. If energy intake is insufficient, then the body's fat stores will be used resulting in weight loss.

c. The main function of carbohydrates is to provide an energy fuel. It is stored as glycogen in the liver and muscles. The main types of dietary carbohydrate are starches and sugars.

d. Fats hold almost double the amount of potential energy than carbohydrates. However, fat takes greater time to use and cannot be used to maintain high intensity exercise.

e. Proteins are primarily used for the manufacture of tissue components such as haemoglobin, enzymes and contractile proteins.

f. Most vitamins cannot be manufactured within the body and must be consumed in the diet. It is essential to consume adequate carbohydrates between training sessions or even to replenish the system during prolonged physical sessions.

g. Water makes up 55 to 65 per cent of the body's total weight. The sensation of thirst an individual feels is an inadequate method of monitoring hydration and will often lead to dehydration and poor performance.

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h. Eating a variety of foods and maintaining an energy balance are basic guidelines for a healthy diet.

i. If more energy is consumed than expended the excess will be stored as fat and body weight will increase

j. While alcohol is said to have an energy value, the human body cannot process this fuel into useable energy to fuel muscles.

k. Severe dietary restrictions require specialist medical advice and supervision, and should always be referred to a regimental medical officer.

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CHAPTER 16

ARMY FITNESS ASSESSMENTS

16.1 Army fitness assessments are required to measure the fitness standards across the Army. This is necessary to determine suitability for the various roles within Army, ranging from the basic minium standard required for initial entry to the higher levels required of special operations personnel. These consist of the following assessments:

a. pre-entry barrier assessment,

b. BFA,

c. combat fitness assessment,

d. Army swim test, and

e. in-service barrier tests.

16.2 Further information on Army fitness assessments can be found in current Defence instructions. Current Defence instructions should also be referred to ensure accuracy of information within this chapter.

Pre-entry Barrier Assessment

16.3 Pre-entry barrier assessments provide the minimum standard that civilian applicants are required to achieve before appointment or enlistment, and are to be completed no earlier than eight weeks before enlistment. Further information on pre-entry barrier assessments is available on the Defence Force recruiting website.

16.4 The current minimum requirement to pass a pre-entry barrier assessment is as follows:

a. a multistage fitness test to a standard of 7.5,

b. 45 sit-ups, and

c. 15 push-ups for men and eight push-ups for women.

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Basic Fitness Assessment

16.5 The BFA measures the minimum fitness standard for all members of the Army. Information on the BFA can be found in *DI(A) PERS 148-2, Army Physical Conditioning Assessment System,* 2007.

16.6 The BFA consists of push-ups, sit-ups and run or walk activities. These assess the general strength and endurance of the body and its cardiorespiratory (heart lung) efficiency. The minimum standard required for each activity is graded according to age and gender.

16.7 To pass the BFA a member must achieve at least the minimum BFA pass standard in each activity. The pass standards are graded according to age and gender. The minimum standards required for a pass in each age group are detailed in Table 16–1 and Table 16–2.

Table 16–1: Minimum Basic Fitness Assessment Standards – Male

Age	*Push-ups (repetitions)*	*Sit-ups (repetitions)*	*2.4 km run (time)*	*5 km walk (time)*
25 and under	40	70	11:18	–
26 to 30	35	65	11:48	–
31 to 35	30	57	12:18	–
36 to 40	25	50	12:42	–
41 to 45	20	30	13:12	44:00
46 to 50	10	20	13:48	45:00
51+	6	15	14:30	45:00

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Table 16–2: Minimum Basic Fitness Assessment Standards – Female

Age	*Push-ups (repetitions)*	*Sit-ups (repetitions)*	*2.4 km run (time)*	*5 km walk (time)*
25 and under	21	70	13:30	–
26 to 30	18	65	14:00	–
31 to 35	15	57	14:30	–
36 to 40	10	50	15:00	–
41 to 45	7	30	15:30	45:00
46 to 50	3	20	16:00	47:00
51+	3	15	16:30	47:00

Combat Fitness Assessment

16.8 The combat fitness assessment measures a soldier's ability to perform the physical demands of combat. Currently, only units on 90 days readiness or less are required to conduct the combat fitness assessment. The combat fitness assessment sequence is as follows:

a. a run, dodge and jump course for males and females (under 41 years of age) in 50 seconds and 70 seconds for males and females (over 41 years of age). For females, the run, dodge, jump course is to be modified so that the wall is 150 cm high and the ditch is sandbagged to a width of 170 cm;

b. for non-combat arms units, the 15 km endurance march is to be conducted in patrol order and with a weapon, with a weight not exceeding 20 kg, in 2 hours and 45 minutes; and

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c. for combat arms units, the march is to be conducted in marching order, with a load configuration not exceeding 35 kg, in 2 hours and 45 minutes.

16.9 The run, dodge, jump course is to be completed first and the endurance march completed second within a 24-hour period. Further information on the combat fitness assessment can be found in *DI(A) PERS 148-2, Army Physical Conditioning Assessment System,* 2007.

Swim Test

16.10 The minimum standard of swimming proficiency to be achieved is as follows:

a. swim 30 m using any swimming stroke, dressed in disruptive pattern camouflage uniform without footwear; and

b. tread water and remain afloat, out of depth, for 2 minutes.

16.11 Further information on the swim test can be found in *DI(A) PERS 148-2, Army Physical Conditioning Assessment System,* 2007.

In-service Barrier Tests

16.12 In-service barrier tests detail the minimum standard required by serving members applying for further specialist training.

16.13 Information on elective tests available can be found in *DI(A) PERS 148-2, Army Physical Conditioning Assessment System,* 2007. Information on the Special Forces barrier test is available on the SFTC website.

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CHAPTER 17

REHABILITATION

SECTION 17-1. INTRODUCTION

17.1 Rehabilitation is an essential component of in-service health care. It has the following three major interrelated components:

a. *Medical Rehabilitation.* Medical rehabilitation focuses on the restoration of physical and mental function following an injury or incident.

b. *Vocational Rehabilitation.* Vocational rehabilitation focuses on the restoration of productive work function and effective functioning of personnel within the Army, or in their transition to civilian occupation.

c. *Psychosocial Rehabilitation.* Psychosocial rehabilitation focuses on therapeutic activities or interventions provided individually, or in groups, that may include development and maintenance of daily and community living skills, self-care and social skills training.

17.2 The aim of rehabilitation is to maximise the potential to restore a person who has an impairment, or an incapacity for service or work, as a result of an Army injury or disease to at least the same social, vocational and educational status, as the member had before the injury or disease.

17.3 Further information on rehabilitation can be found in current Defence Instructions.

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SECTION 17-2. ELEMENTS OF BEST PRACTICE

Return to Work Framework

17.4 The framework and philosophy for rehabilitation, injury management and return to work (RTW) programs are benchmarked against implementation of best practice regarding workplace rehabilitation. This paradigm is to be inculcated by, firstly, incorporating statutory rehabilitation obligations for military personnel into standard practice and, secondly, by acknowledging that delaying or denying personnel compensation claim entitlements and RTW initiatives will continue to have negative effects on Army's capability.

17.5 The seven elements of best practice in relation to rehabilitation and RTW program arrangements can be described as total injury management. These total injury management elements can be described as follows:

a. Early RTW is the expected outcome of rehabilitation. Rehabilitation should be workplace based and aimed at the maintenance or restoration of personnel to appropriate employment.

b. Commanders are responsible for assisting in the provision of rehabilitation to injured personnel, as well as keeping their jobs available for a reasonable period.

c. Rehabilitation is not required for all injured personnel, but where necessary to achieve an RTW it is most effective when delivered as soon as possible after injury and subject to regular assessment for relevance, effectiveness and results.

d. Rehabilitation should provide an environment where injured personnel see an early RTW as the most appropriate outcome. This involves an obligation on behalf of injured personnel to participate positively in the rehabilitation program and RTW program.

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e. All agencies and stakeholders should ensure that there is a clear focus on rehabilitation and RTW programs that complement military personnel compensation claims management processes.

f. Rehabilitation is most effective when injured personnel, other workplace personnel, medical and rehabilitation providers (where involved) jointly develop, implement and show a commitment to RTW programs.

g. Commanders at all levels are responsible for developing and fostering a culture that supports and reinforces the expectation of RTW as the normal outcome for any work related injury or disease. The commander's role should be to develop, communicate, promote and enforce the policy and legislative framework required to provide rehabilitation and achieve an RTW.

17.6 It is not always possible or appropriate to maintain injured personnel in the workplace in accordance with the optimal RTW philosophy, and there will be situations where local resource constraints preclude providing consolidated rehabilitation services. Where this is the case, centralised rehabilitation facilities, injury management and RTW programs offer an alternative solution. Centralised rehabilitation facilities aim to provide members with the following:

a. access to comprehensive, multidisciplinary rehabilitation services, injury management and RTW programs;

b. access to other key support services, including psychology and philanthropic services;

c. complementary vocational or military training to maintain and/or enhance skills;

d. links to member peer group and/or pre-rehabilitation environments are made possible;

e. a culture and philosophy that reinforces the positive nature of rehabilitation, injury management and RTW processes, and is inclusive of members who are ultimately discharging from the Army; and

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f. supervision by high quality personnel who provide an exemplary leadership role model.

17.7 For clarity and consistency, rehabilitation services are expressed in terms of capability bricks in order to provide Army with the appropriate framework to support service delivery. A rehabilitation capability brick ideally will consist of the following personnel as a minimum:

a. a rehabilitation coordinator,

b. a rehabilitation medical officer,

c. a rehabilitation physiotherapist,

d. a rehabilitation PTI, and

e. a rehabilitation administrative officer.

17.8 Other services that may enhance providing rehabilitation services, injury management and RTW programs may include, but are not limited to, the following:

a. psychiatrists,

b. psychologists,

c. dieticians,

d. occupational therapists,

e. sports or other specialist physicians, and

f. other philanthropic services.

17.9 Rehabilitation capability bricks can comprise the following personnel elements:

a. full-time or reserve military personnel,

b. a contract health practitioner, and

c. Australian Public Service staff.

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SECTION 17-3. ROLES OF PHYSICAL TRAINING INSTRUCTORS AND COMBAT FITNESS LEADERS IN REHABILITATION

Role of the Physical Training Instructor

17.10 The role of the PTI is a critical component of a rehabilitation capability brick. The key focus of the PTI is to assist with the delivery of rehabilitation, injury management and RTW programs by ensuring the following:

a. assisting health care professionals to conduct, monitor and adjust rehabilitation program by:

(1) ensuring the aims of the rehabilitation and RTW programs are monitored and adjusted in consultation with relevant health care professionals;

(2) providing feedback and discussion with relevant health care professionals regarding rehabilitation and RTW program progress;

(3) if appropriate, and in accord with the principles of the members confidentiality, engaging other relevant stakeholders to keep them informed of developments; and

(4) maintaining effective communication with the member and other relevant stakeholders in accordance with best practice sports trainer principles;

b. applying the fundamental principles of psychology of injury as follows:

(1) typical psychological responses to injuries are recognised and appropriate support structure implemented to address them; and

(2) psychological skills and strategies are applied to assist the member through the rehabilitation and RTW process;

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c. introducing supplementary strategies to support the rehabilitation and RTW program:

(1) supplementary strategies to support the rehabilitation and RTW program that prevent loss of general fitness and ensure specific skills are developed and implemented in consultation with the member, relevant health care professionals and other relevant stakeholders;

(2) the member and other relevant stakeholders are provided with supplementary strategies to support the rehabilitation and RTW program based on FITT principles, the specific adaptations to imposed demands (often referred to as SAID) regime and the performance parameters of the activity;

(3) assistance and instruction is provided to enable the member to implement supplementary strategies to support the rehabilitation and RTW program;

(4) relevant information, explanations and demonstrations are provided to assist the member to complete exercises, activities, stretches and the like as part of their supplementary strategies to support the rehabilitation and RTW program; and

(5) all rehabilitation and RTW programs are appropriately supervised to ensure they are conducted in accordance with best practice principles to ensure the prevention of further injuries.

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17.11 In addition, PTIs may have responsibility for the following:

a. providing specialist advice to other multidisciplinary rehabilitation capability brick members regarding the application of appropriate techniques to manage rehabilitation exercise and RTW programs for specific injuries and conditions;

b. providing specialist advice regarding the techniques to appropriately motivate personnel within a rehabilitation and RTW exercise environment;

c. ensuring that policies and procedures are implemented and governed regarding measuring, monitoring and modifying a member's progression in rehabilitation exercises and RTW programs;

d. communicating and maintaining appropriate rehabilitation and RTW program records in accordance with extant legislative and policy requirements;

e. assisting in the management of facilities and resources on behalf of Army and other Defence agencies for the purposes of rehabilitation and RTW programs;

f. planning rehabilitation and RTW sessions for heterogenous groups;

g. providing specialist rehabilitation exercise advice to other multidisciplinary team members, injured members and other key stakeholders to prevent recurrence of injuries; and

h. developing CFLs skills and knowledge in the art of rehabilitation.

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Role of the Combat Fitness Leader

17.12 The role of the CFL is also crucial in supporting well-defined elements of physical training operations in a rehabilitation and RTW environment. The key focus of the CFL is to ensure the following:

a. they apply Army physical conditioning practices in accordance with Army physical training policy and procedures;

b. they develop and deliver remedial combat fitness training programs, under the supervision of PTIs, to prepare members for assessment within a rehabilitation and RTW program;

c. they assist PTIs in providing emergency response and management of injuries in a rehabilitation and RTW program;

d. they conduct Army fitness assessments, under supervision of a PTIs, in a rehabilitation and RTW environment;

e. they apply injury prevention principles to combat fitness training in a rehabilitation and RTW environment; and

f. they promote health and fitness awareness within a rehabilitation and RTW environment.