CIRCUIT TRAINING

As Adapted for the Training of Recruits

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IN the legend of Milo, there is a description of him lifting a calf every day until it grew into a bull. So there is evidence in ancient times that the principles of progressive resistance exercises and circuit forms of training were known. Subsequently much experimental work has proved that skeletal muscle responds to contraction against systematically increased load by both increase in power and hypertrophy and also that the capability of prolonged repetition of action is increased following circuit methods of training.

Progressive resistance exercises and progressive repetition method are now applied on a scientific basis to develop muscle power and capability, and to increase circulo-respiratory function, i.e. stamina, strength and endurance. The purpose of circuit training in recruit training is to develop general rather than specific muscle group fitness and also to enable large numbers of heterogeneous recruits to train together.

Basic physical training in any group, should result in muscle suppleness, relaxation, quality of movement (agility) and in the increase of power. It should also aim at the ultimate stage in the acquisition of any skill which is the ability to still perform correctly even if fatigued.

Circuit training is a form of progressive training towards this concept of acquiring basic physical fitness. It aims at the attainment of a higher level of functional vigour, flexibility, speed, strength and endurance, fundamental to preparation for specific (military) skills.

The advantages of circuit training are, simplicity, adaptability to the needs of the individual, and the facility for each participant to observe and assess his own improvement in fitness. This has a stimulating effect on effort and morale, and encourages a more determined striving to catch up with their fellows. Thus self-confidence is raised in addition to stamina, and the level attained is often such as to prevent accidents on later military skills (confidence areas, assault courses, etc.). This general state of mental and physical fitness is essential to a man who needs to give a good account of himself in varied and unforseen circumstances; and leads to a high work output by the body.

This high potential work output is due to the efficiency of the muscular and circulo-respiratory systems and it is only through work, assuming adequate rest and nutrition, that the power of these systems is built up. This efficiency may be expressed in terms of:-

a. Strength—the capacity to exert muscular force against resistance. The minimum level is that required to do daily work without undue fatigue.

b. Muscular Endurance—the capacity for performing heavy localised activity.

c. Circulo-Respiratory Endurance—i.e. stamina, the capacity to perform rapid and prolonged action of large muscle groups.

d. Power—which is the product of force and velocity, i.e. the capacity for fast explosive movement against hard resistance.

The body in circuit training adapts to training schedules, which must be regular, and continued over a long period. The intensity of effort required must be gradually increased at a rate which accords with each participant. Slow work followed by fast work involving different muscle groups must be made and will lead to an increased load on the circulo-respiratory systems with corresponding functional improvement.

The method described below was devised in conjunction with Major A. Greaves, A.P.T.C., Master at Arms, Eastern Command, and was scientifically tried at the Guards Depot in the Basic Physical Training Programme both on indoor and outdoor circuit training areas.

There have been arguments against the introduction of this form of training for recruits, the main ones, which have been overcome in the scheme to be described, being:-

a. Lack of specialised equipment.

b. Involved administrative work.

Final Principles of Action Adopted

1. Five minutes warm up to result in easy relaxed full range movements in limb and trunk joints.
2. 30 seconds hard going at each of ten " pieces of apparatus, see Activity charts," aiming at maximum effort.
3. 10 seconds interval between each apparatus for changing position and resting; this time to be reduced to 5 seconds as performance improves.
4. 3 circuits to be performed in a total time of $17\frac{1}{2}$ minutes.
5. After this period of circuit training (C.T.) $17\frac{1}{2}$ minutes of military skills and agility follows; and a final minute is allotted to posture correction and class formation.

Principles of Assessing Progress

Method 1

1. After the exercises have been learned, the initial maxima of the participants in 30 seconds is taken and recorded on proforma as below:-

Repetition Chart	NAME..... SQUAD.....									
ACTIVITY	1	2	3	4	5	6	7	8	9	10
TARGET	Sit-ups	Runn-ing	Heav-ing	Step-ups	Para-llel	Ropes	Bur-pees	Astr-ides	Press ups	Squats
INITIAL NUMBER										
WEEK I										
WEEK II etc.										

2. A repeat number of maxima in any exercise is taken and recorded each week on the chart. This new maxima becomes the individual target for each circuit in the following week.
3. It is of vital importance that an atmosphere of enthusiasm and interest be maintained throughout. This must start with the instructor who must give encouragement to all frequently.
4. It is equally important that each participant carried out each repetition fully and correctly, paying particular attention to beginning and ending points of each exercise; and that the order of the exercises is as above.
5. Healthy rivalry and competition between participants is of value for stimulating greater individual effort; but instructors should watch carefully the weaker brethren, and seek individual improvement on previous performance as the criterion and not inter-individual competition.
6. The general atmosphere should be " fitness for one and all ", and this if created and fostered has the value of stimulating each participant to give his utmost.

Method 2

In this case, the instructor fixes the time and dosage of 4 standards for very good, good, average and below average performances. This must be studied and carefully worked out by trial and retrial of the dosages for each grade with a variety of personnel of different degrees of fitness training. A colour code, see footnote to each activity, is then devised and displayed at each activity giving details of the standard number of repetitions required for each colour grading. Once a performer can do his colour grading in each activity in the 30 seconds, no time should be lost in putting him up to the next higher dosage.

Assessment of Fitness of Recruits
A study carried out at the Guards Depot, Pirbright
February—July, 1964

Aims

1. To acquire knowledge of state of fitness of recruits at each week of the training programme.
2. To obtain a " fitness index " of this state for comparison purposes.
3. To compare the present fitness state with that produced by C.T. methods at specific stages in training, i.e. 2nd, 6th and 12th weeks.

Method

The Rapid Fitness Index was used as it is speedy and simple yet gives results which agree closely with other methods.

Theory

Brouha et al. (1943) and Sloan et al. (1959) have shown that the Harvard step test can be used on healthy individuals to assess their capacity for strenuous physical effort, and is valuable in the selection of athletes, of military personnel for arduous duties, and in following their response to training.

Definitions

Physical fitness may be defined as the general capacity of the body, in particular the cardio-vascular-respiratory system to undertake hard work and to recover quickly from that work.

Gallagher et al. (1944) divided the state of physical fitness into three categories:-

a. Static Fitness—no detectable organic disorder and the ability to carry on normal life for age.

b. Dynamic Fitness—the ability to perform strenuous physical work of an unskilled nature.

A test of this dynamic fitness should subject large muscle groups to stress in such a fashion that the subject's performance is limited by circulo-respiratory EMBARRASMENT AND NOT MUSCLE FATIGUE. Ideally, the test must be graded so that about $\frac{1}{3}$ of the subjects fail it. A satisfactory estimate of dynamic fitness can thus be obtained by exposing the man to a standard exercise that no one can perform for more than a few minutes, and one taking account of two factors:

(1) the length of time the subject can sustain the exercise and

(2) the deceleration of the heart rate after exercise.

Criticisms of this form of test are that the figures obtained merely measure the ability to perform the step test, and that the fitness index is based on two unassociated measurements, i.e. duration of exercise and post exercise pulse rate. Both these criticisms have been dispelled experimentally by Brouha (1943).

c. Motor Skills Fitness—the ability to perform particular acquired co-ordinated movement such as those involved in swimming, throwing, jumping etc., must be taken in conjection with state of dynamic fitness.

Test

1. Equipment — *a.* Stop watch, bob and pendulum.
   b. Long rigid stepping platform 20 inches high.
2. Conduct — *a.* 5 subjects together step on and off the platform timed by the pendulum at 30 steps per minute. Full straightening of the legs and back at each step and maintenance of rhythm is essential.
   b. Exercise is continued for 5 minutes or less if the individual stops from exhaustion.
   c. If a subject falls behind in the rhythm, he is told to sit down and his duration of effort to the nearest second noted.
   d. Beginning exactly 1 minute after he stops, the number of pulse beats for exactly 30 secs. thereafter is noted.
3. The calculation formula is:-

$$\text{Rapid Fitness Index} = \frac{\text{Duration of Exercise in secs} \times 100}{5.5 \times \text{Pulse Count } (1\text{—}1\tfrac{1}{2} \text{ mins after exercise})}$$

Results

The Rapid Fitness Index, before training commenced, and at the 2nd, 4th and 12th weeks of training, was prepared for five squads on normal basic P.T. (Table I) and four on C.T. (Table II).

It is considered that the results, although the samples are small, are significant, especially as the initial Rapid Fitness Index of the eight squads was similar at the start of the test.

Conclusion

The evidence offered gives indication of increased standard of fitness of recruits on C.T. methods compared with present basic P.T. methods. This evidence amply backs up

TABLE I—Basic P.T. Squads—March 1964

Individual Scores

Squad 1. Name of Recruit	Duration of Initial Effort Secs.	Rapid Fitness Index			
		Initial	Week 2	Week 4	Week 12
N	240	55	59	68	86
W	250	48	92	100	104
F	200	53	66	78	88
D	180	48	60	70	82
H	300	60	90	96	102
O	300	58	94	99	104

Averages of Other Squads

Squad 2	68	77	87	94
Squad 3	66	78	89	98
Squad 4	64	76	88	87
Squad 5	65	79	87	95

TABLE II—Circuit Training Squads—March 1964

Individual Scores

Squad 1. Name of Recruit	Duration of Initial Effort Secs.	Rapid Fitness Index			
		Initial	Week 2	Week 4	Week 12
Sm	300	68	100	106	not avail
S	300	58	94	102	120
P	300	54	103	110	112
H	210	50	77	88	not avail
T	240	60	73	82	99
A	300	66	83	96	120

Averages of Other Squads

Squad 2	69	88	96	113
Squad 3	68	90	101	114
Squad 4	66	92	106	118
Squad 5	64	83	99	116

subjective assessments of increased physical fitness as defined in this paper. Personal observations also indicate improved physical ability at the same stage of recruit training by those who were trained by C.T. methods.

Achnowledgements

1. Lieutenant-Colonel D. W. Scott-Barrett, M.B.E., M.C., Scots Guards, Commandant Guards Depot for his enthusiasm at all times and his willingness to interrupt programmes and make recruits available for testing.
2. Cpl. C. Garrad R.A.M.C. for many hours of painstaking testing and calculations.

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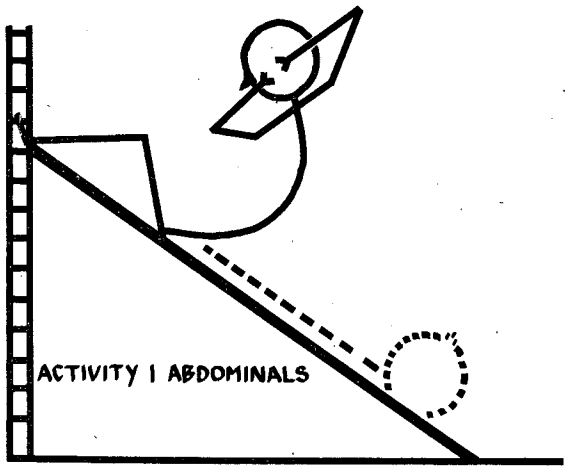
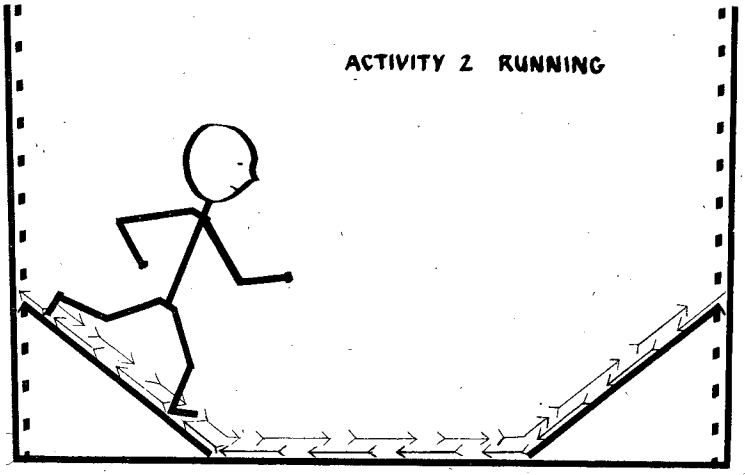
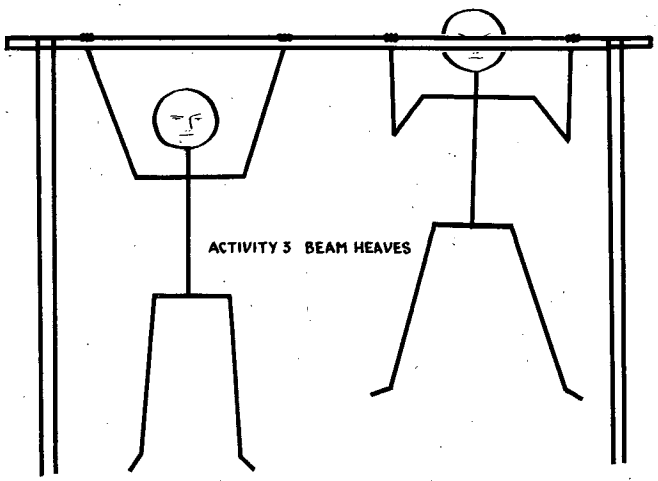


White circuit 3 repetitions
Black „ 5 „
Yellow „ 8 „
Red „ 10 „



White circuit 6 repetitions
Black „ 8 „
Yellow „ 10 „
Red „ 12 „



White circuit 3 repetitions
Black „ 5 „
Yellow „ 8 „
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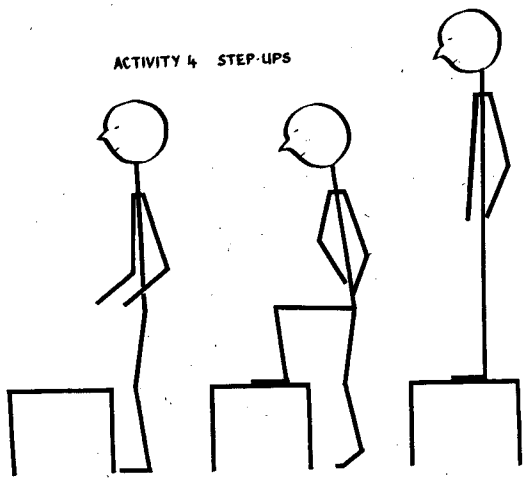
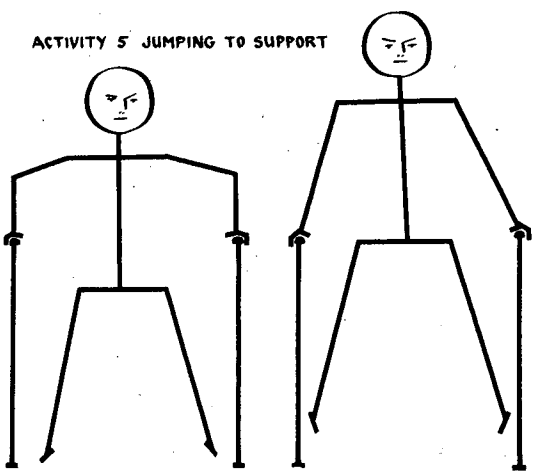
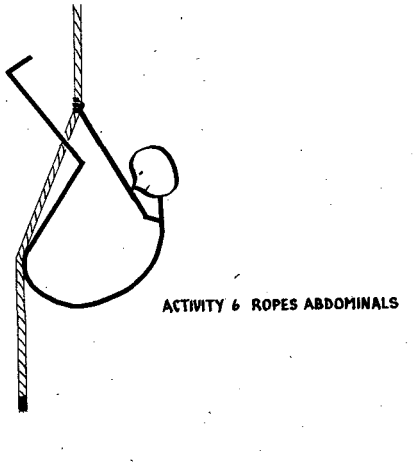


White circuit 10 repetitions
Black „ 12 „
Yellow „ 14 „
Red „ 16 „

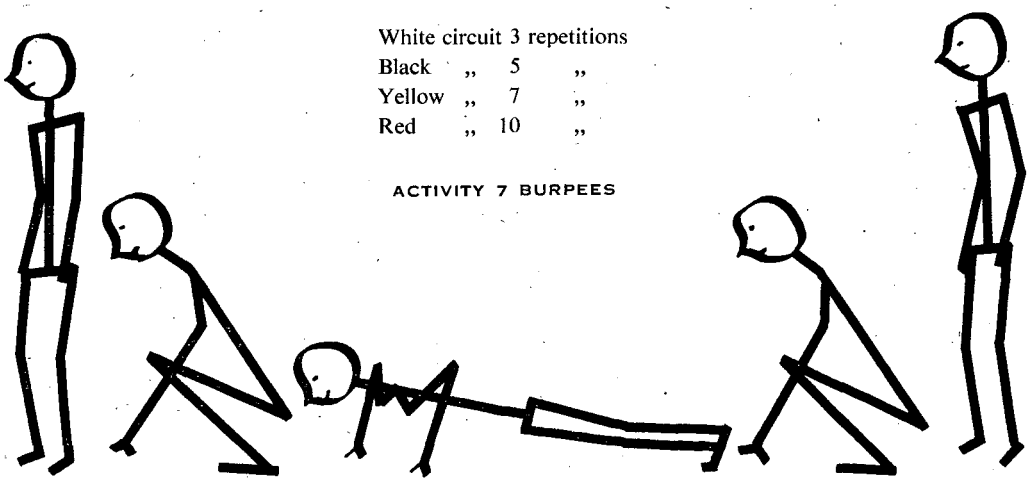


White circuit 3 repetitions
Black „ 5 „
Yellow „ 7 „
Red „ 10 „



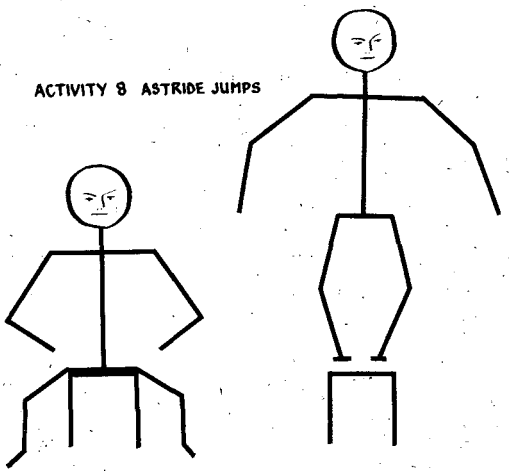
ACTIVITY 6 ROPES ABDOMINALS

White circuit 3 repetitions
Black „ 5 „
Yellow „ 7 „
Red „ 10 „



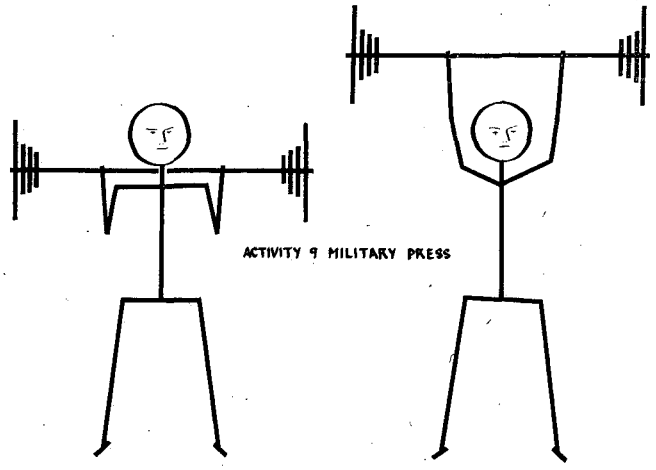
White circuit 3 repetitions
Black „ 5 „
Yellow „ 7 „
Red „ 10 „

ACTIVITY 7 BURPEES

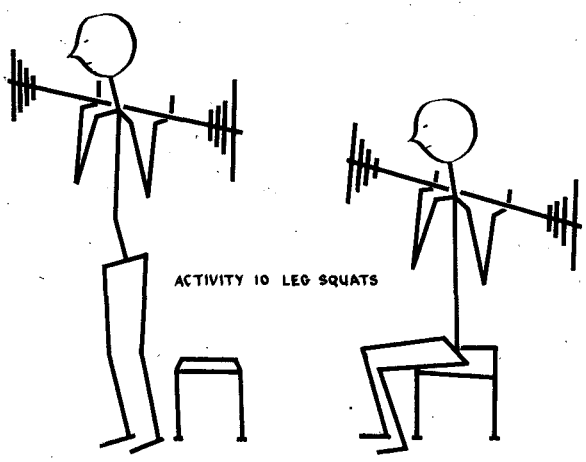


ACTIVITY 8 ASTRIDE JUMPS

White circuit 10 repetitions
Black „ 14 „
Yellow „ 18 „
Red „ 20 „



White circuit 3 repetitions
Black „ 5 „
Yellow „ 7 „
Red „ 10 „



White circuit 10 repetitions
Black „ 15 „
Yellow „ 20 „
Red „ 25 „

Army Medical Cadetships

Thirteen medical students have been awarded Army cadetships recently. Their names and colleges are listed below.

To qualify for a cadetship a student must have passed his second M.B. or equivalent examination and be prepared to serve after full registration for a minimum period of five years with the Royal Army Medical Corps.

When accepted, he is granted a probationary commission as a second Lieutenant. He then receives Army pay and allowances and has his tuition fees paid by the Army.

The thirteen successful candidates are as follows:—

Guy's Hospital, London	—	A. A. G. THOMSON
St. George's Hospital, London	—	J. RICHARDSON
St. Mary's Hospital, London	—	E. P. GREEN; R. J. KNIGHT
University College Hospital, London	—	N. E. INCE
University of Leeds	—	R. MACFAUL
University of Edinburgh	—	M. W. MARSHALL
Queen's University, Belfast	—	R. G. KERR
Trinity College, Dublin	—	P. E. P. MICHAEL; B. G. HANNIGAN; A. M. CARROLL
University College, Dublin	—	M. CONROY
University College, Galway	—	M. MOLLOY