

AD-A046 538

DEFENCE AND CIVIL INST OF ENVIRONMENTAL MEDICINE DOW--ETC F/G 6/14  
AN AEROBIC POINTS NOMOGRAM FOR RUNNING.(U)  
AUG 77 W S MYLES, D G BELL

UNCLASSIFIED

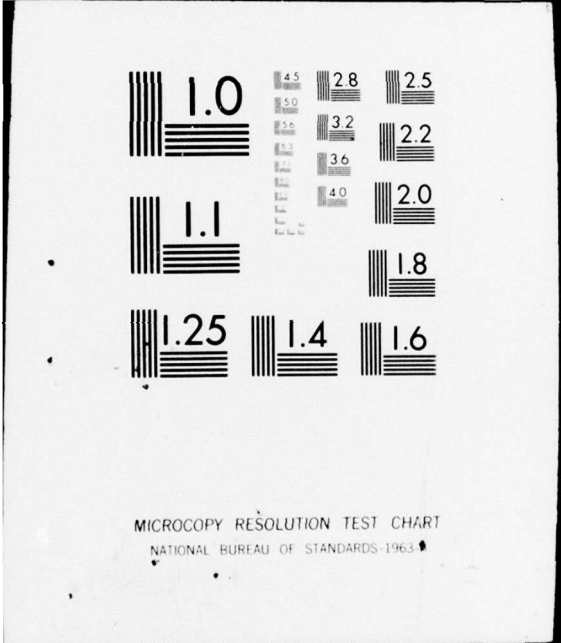
DCIEM-TR-77-X-38

NL

| OF |  
40  
AO46538



END  
DATE  
FILMED  
12-77  
DDC



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A



11 August 1977

DCIEM Technical Report No. 77X38

3  
DCIEM-TR-

9

12 9 P.

6 AN AEROBIC POINTS NOMOGRAM FOR RUNNING.

10 W.S. Myles  
D.G. Bell

DISTRIBUTION STATEMENT A  
Approved for public release;  
Distribution Unlimited

D D C  
RECEIVED  
NOV 17 1977  
S E

Health Sciences Division  
Defence and Civil Institute of Environmental Medicine  
1133 Sheppard Avenue West, P.O. Box 2000  
Downsview, Ontario M3M 3B9

DEPARTMENT OF NATIONAL DEFENCE - CANADA

406 986

mt

## TABLE OF CONTENTS

	Page
ABSTRACT .....	v
INTRODUCTION .....	1
THE AEROBIC CONCEPT .....	1
AN AEROBIC POINTS NOMOGRAM FOR RUNNING .....	2
HOW TO USE THE NOMOGRAM .....	3
TABLE 1 .....	4
REFERENCES .....	5

ADMISSION for

THIS  Write Section

DDC  Buff Section

UNANNOUNCED

JUSTIFICATION

---

BY DISTRIBUTION/AVAILABILITY CODES

Dist.  of SPECIAL

A

#### ABSTRACT

A nomogram was constructed which simplifies the computation of aerobic points for running. This form of exercise was selected because the energy cost (oxygen consumed) of running can be reliably predicted from time and distance. Aerobic points for swimming, cycling and team sports may not represent exercise of the same intensity for everyone. This report outlines the aerobic concept, how the nomogram was developed from Cooper's aerobic point charts and recommends a training programme based on the points system for Canadian Military personnel.

## INTRODUCTION

A nomogram has been constructed which simplifies the computation of aerobic points for running. A copy of this nomogram is included with this report which assesses the validity of the aerobic points system for exercise prescription.

## THE AEROBIC CONCEPT

Aerobics is a term applied to exercises such as running, walking, swimming and cycling where there is a high sustained demand for oxygen. When these activities are performed at sufficient intensity and for sufficient duration, the organs of the body responsible for transporting oxygen to the working muscles undergo a training effect. This effect is particularly evident in the heart and results in a lower pulse rate at rest and during submaximal exercise.

The concept of aerobics was made popular by Cooper (3, 4) who defined categories of VERY POOR, POOR, FAIR, GOOD or EXCELLENT for aerobic fitness. An individual could estimate his aerobic fitness category from the distance he could run in 12 minutes of maximum effort (2). Since Cooper's five categories are essentially the same as fitness levels one through five (CFAO 50-1), Canadian military personnel can substitute the CF aerobic fitness test which is a 1.5 mile run or an equivalent. The objective in any training programme should be to achieve at least the GOOD (level 4) category of aerobic fitness.

The three parameters which define a training programme for improving aerobic fitness are frequency, intensity and duration of exercise. Whereas three times per week is generally accepted as the minimum frequency required to produce a training effect, the other two parameters are more difficult to define. The aerobic points system greatly simplifies this problem. Periods of exercise where the intensity is defined as some easily measured parameter, such as speed, are assigned aerobic points. According to Cooper, 30 points per week are required to produce and maintain the GOOD (level 4) category of aerobic fitness.

In spite of wide acceptance by the general public, the aerobic points system has been subject to some criticism. In a critical review, Massie et al (7) concluded that the system works well for running. This is probably because the energy cost (oxygen consumed) of running is reliably predicted by time and distance covered (6). On the other hand, the energy cost of swimming varies greatly with individual skill and that of team sports is further influenced by player position and motivation. Similarly, the energy cost of cycling varies with the type of machine and the nature of the terrain. Since points

are assigned on basis of energy cost, it follows that aerobic points in swimming, cycling and team sports may not always, as claimed by Cooper, represent exercise of the same intensity for everyone.

#### AN AEROBIC POINTS NOMOGRAM FOR RUNNING

An aerobic points nomogram was constructed for running since the point system seems to be most valid for this form of exercise. Times and distances, in each case the fastest time quoted, were taken from Cooper's point charts (3). For example, where Cooper allows 30-36 minutes to run three miles, the same distance must be covered in 30 minutes to earn 9 points using the nomogram.

In a revised edition of his book (4), Cooper reconstructed his point charts to allow "bonus" points for longer distances. This was based on the fact that the last half of any aerobic exercise period is more beneficial than the first. This is because the body requires the first few minutes to achieve "steady-state" conditions where oxygen demand is being met by oxygen intake. By extrapolation, 20 minutes of exercise involves more of this endurance-type exercise than 10 minutes of the same exercise. Kavanagh (5) has also stressed the safety value, particularly for older personnel, of increasing distance at the expense of running speed. The nomogram does not allow endurance points for longer distances. They are omitted because, in contrast to the original point system based on energy cost, endurance points seem much more difficult to quantitate.

The maximum capacity for aerobic exercise ( $VO_2$  max) declines due to the physiological effects of aging. In his revised edition (4), Cooper devised point charts for different age groups. Since points are assigned on the basis of the energy cost of exercise which must be a minimum percentage of  $VO_2$  max to produce a training effect, a simpler approach is to apply the age correction factors of Astrand and Rodahl (1). Table 1 shows the number of aerobic points per week required to produce and maintain the GOOD category of fitness for men aged 25, 40, 50 and 60 years.

The aerobic fitness of women tends to be less than that of men, partly because they normally have more body fat and a lower level of blood haemoglobin. Cooper recommends that women require 24 aerobic points per week in order to produce and maintain what is for them a GOOD level of aerobic fitness. This agrees reasonably well with Astrand and Rodahl (1) who contend that  $VO_2$  max in women is 15-20% lower than that of men.



### HOW TO USE THE NOMOGRAM

The nomogram is very simple to use. Align running time and distance covered and read the aerobic points per mile. Alternatively, the process can be reversed and aerobic points per mile may be converted to time and distance.

The objective of an aerobic training programme is to achieve and maintain at least a GOOD (level 4) fitness category. According to Cooper, 30 points per week are sufficient provided they are spread over at least three days per week. Those individuals in the VERY POOR to FAIR categories should begin with as little as 10 points per week and progress to 30 points over a period of ten weeks or more. These individuals may begin with brisk walking (at least 4 mph) or a combination of walking and running and progress in time to continuous running. For older personnel, distance should be emphasized at the expense of speed.

Since it is intended for military personnel, it is perhaps as well that the nomogram dictates a more demanding training programme than that outlined in Cooper's latest point charts (4). The nomogram dictates a more demanding programme for 30 points because it is based on the fastest running times for each distance and does not credit the individual with endurance points for longer distances.

## HOW TO USE THE PROGRAM

The program is very simple to use. After entering time and distance covered and total aerobic points per week, the program will calculate the number of aerobic points per week that can be covered in the time and distance.

The objective of an aerobic training program is to obtain and maintain at least a 1200 (level 4) fitness score, according to Cooper's 12-point fitness test. This test is a good indicator of health and fitness. It is a good test to use to measure progress in an aerobic program. The program is designed to help you reach this goal. It will calculate the number of aerobic points per week that you need to reach this goal. It will also calculate the number of aerobic points per week that you can cover in the time and distance that you have available. This information can be used to help you plan your aerobic program.

TABLE 1

## AEROBIC POINTS PER WEEK SUGGESTED FOR DIFFERENT AGES

AGE	AEROBIC POINTS PER WEEK
25	30
40	25
50	22.5
60	20

## REFERENCES

- ASTRAND P.O. & RODAHL K. (1970) Textbook of work physiology. McGraw-Hill, New York.
- COOPER K.H. (1968) A means of assessing maximal oxygen intake. A Amer. Med. Assoc. 203: 201-204.
- COOPER K.H. (1968) Aerobics. Evans Co. Inc. New York.
- COOPER K.H. (1970) The new aerobics. Evans Co. Inc. New York.
- KAVANAGH T. (1976) Heart attack? Counter attack? Van Nostrand Reinhold Ltd. Toronto.
- MARGARIA R., AGHEMO P. & PINERA LIMAS R. (1975) A simple relation between performance in running and maximal aerobic power. J. Appl. Physiol. 38: 351-352.
- MASSIE J., RODE A., SKRIEN T. & SHEPHARD R.J. (1970) A critical review of the "Aerobics" points system. Med. Sci. Sports. 2: 1-6.