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Exercise Prescription for the Healthy Adult

SUMMARY

The exercise prescription manipulates the primary variables of training, frequency of exercise, intensity of exercise, time for each session, type of exercise, and rate of progression. The goal is for the patient to reach a satisfactory level of cardiovascular fitness by a prudent application of these factors. By this means, the goal of improved fitness can be met while minimizing the risk of an overuse injury and maximizing the enjoyment. (*Can Fam Physician* 1988; 34:101-104.)

RÉSUMÉ

La prescription d'un programme d'exercices englobe les variables suivantes: entraînement, fréquence, intensité, type d'exercices, durée de chacune des sessions et rythme de progression. L'objectif de chacun des patients est d'atteindre un niveau satisfaisant de forme cardiovasculaire en individualisant prudemment l'application de chacun de ces facteurs. Il devient alors possible d'atteindre cet objectif d'une meilleure forme physique tout en minimisant le risque de blessures provoquées par les abus et en maximisant le côté agréable.

Key words: exercise prescription, cardiovascular fitness, fitness, healthy adult

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GIVEN THE NUMBER of people engaged in some form of physical activity, it behooves the physician to acquire a reasonable amount of expertise in the basics of physical fitness. As might be imagined, different needs and requirements apply to persons varying from children to the aged, the sedentary in habit to the competitive athlete, the clinically limited to the healthy. Yet physical training involves a series of principles that serve as the foundation for all participants. Variations occur when one applies these

principles to selected subgroups of the population.

The exercise prescription describes activity that is prudent, and that will improve fitness. Particular attention is paid to the cardiovascular system. Proper manipulation of these principles will encourage adherence to the guidelines and a resulting increase in physical fitness.

Physical Fitness

It is not uncommon to define physical fitness in a variety of ways. Fitness for the participant in weightlifting differs from that of the soccer player, which differs from that of the marathon runner and that of the triathlon competitor. A broader view of fitness is that it is an 'umbrella term' for a multitude of factors (Figure 1). The cyclist, for example, does not require a great deal of eye-hand co-ordination, while this factor is very important for participants in implement sports such as golf, tennis, racquetball, and squash.

Physicians are regularly asked what aspect of physical fitness is of primary importance. Most health-care professionals consider cardiovascular endur-

ance the most important aspect of fitness. The reason is that increased cardiovascular fitness is favourably related to improvement in such clinical conditions as ischemic heart disease, hypertension, diabetes mellitus, and obesity.

Getting Started

To write an effective and safe exercise prescription, the physician must have sufficient information about the health status of the patient. A physical examination usually precedes entry into a fitness program. Particular attention is paid to the cardiovascular system, but orthopedic evaluation is also important, especially for anyone assisting in the selection of the types of exercise to be undertaken. Patients often ask whether they should take an exercise test before participating in a particular sport or program. The American College of Sports Medicine suggests that apparently healthy adults under 45 years of age probably do not need an exercise test, while those over 45 years should undergo a test. Patients who are already exercising should also take an exercise test on reaching 45 years.¹ Suggested guide-

lines and age limits differ for patients in higher-risk categories.

Once the health status of the patient is determined, the details of a fitness program can be discussed. These consist of:

- frequency of exercise;
- intensity of exercise;
- time of each session;
- types of activity.

The acronym 'FITT' makes it easy to remember these primary factors. One final factor is also considered:

- progression of fitness.

Frequency of Exercise

Of the primary variables of exercise, frequency has been described as less important than intensity or duration.² Nevertheless, the regularity of exercise does figure as a vital consideration.

Three to five exercise sessions per week are typically recommended, though if the intensity and duration of

the sessions are appropriate, cardiovascular gains can be documented from programs of fewer than three days per week. The disadvantages of infrequent sessions, however, are reduced adherence to the program, the disruption of the weekly routine, and the sense that one is always starting over.³ In any case, exercise frequencies involving fewer than three days per week should be viewed as a temporary arrangement.

The risk of injuries, too, must be considered. Excessive frequency and duration of exercise are routinely associated with overuse injuries, especially in running programs, but these are rare in exercise programs of three days per week.⁴ Injuries are also associated with poor initial fitness, excess weight, and age. Adults with poor initial fitness may begin a program with two sessions per day of 5–15 minutes per session and progress to a single session of equivalent time. Overweight people are best served by daily

exercise, as weight loss is more effective with five- rather than three-day per week programs.⁵

Intensity of Exercise

Intensity of exercise is often considered the most important,² but the most difficult, variable¹ to prescribe because it requires an individual approach. The appropriate training intensity is usually expressed according to some measure of the patient's functional capacity. Various methods for detailing intensity are available.

It is generally accepted that cardiovascular endurance is most effectively improved by exercising at 60%–90% of maximal capacity.¹ In each method, therefore, some value is established as a maximal figure, be it estimated or measured. To predict maximal heart rate, one can use the simple formula:

$$\text{maximal heart rate} = 220 - \text{age.}$$

The calculated figure would then be multiplied by 60% and 90% to obtain a desired training intensity. For example, the training rate for a 50 year old would be:

$$.6(220 - 50) = 102$$

$$.9(220 - 50) = 153$$

Thus the preferred training zone would be between heart rates of 102 and 153 beats per minute. A limitation with use of the estimated maximal heart rate is the variability of the estimated figure. The 95% confidence interval is 24 beats.² For our sample 50-year-old, therefore, actual maximum heart rate may fall between 146 and 194 beats per minute. It is preferable, therefore, to use a known maximal heart rate.

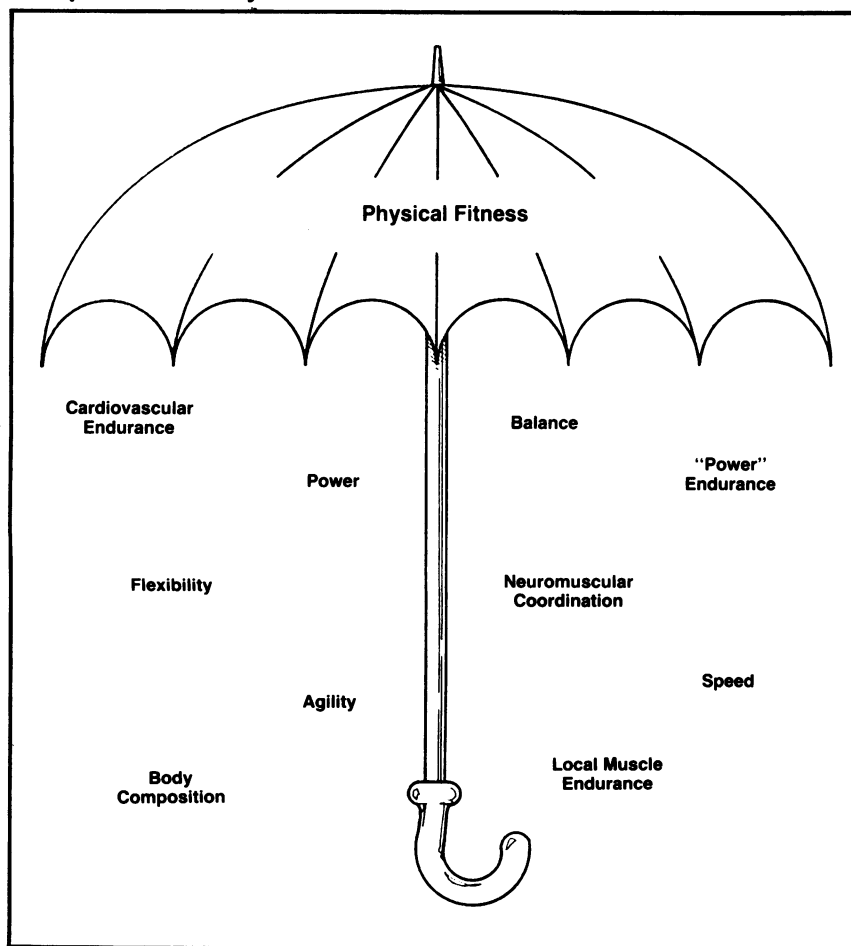
A further refinement of the prescription for intensity is to use a percentage of the heart-rate reserve: the difference between the patient's resting and maximal heart rate. The estimated maximal heart rate can be used to calculate this percentage. In the following example, let us assume that the 50-year-old patient took a maximal exercise test and showed a maximal pulse rate of 168 and a resting pulse rate of 70. The per cent of heart-rate reserve is added to the resting pulse score for the training range:

$$.6(168 - 70) + 70 = 129$$

$$.9(168 - 70) + 70 = 158$$

This method gives a narrower range for the preferred training zone of 129–158.

Figure 1
Components of Physical Fitness



A third method narrows the preferred range even further. It uses a sliding scale of functional capacity. In most cases, functional capacity is reported as a Metabolic Equivalent (MET) capacity. This figure is then added to the minimal intensity (60%) and this sum is then taken as the preferred training intensity. Let us now assume that our 50-year-old with a resting pulse rate of 70 and a maximal heart rate of 168 also had a 10-MET capacity.

$$\begin{aligned} \text{Minimal intensity} + \text{Maximal METS} \\ = \% \text{ heart-rate range} \\ 60 + 10 = 70 \\ .7 (168 - 70) + 70 = 139 \end{aligned}$$

The suggestion, therefore, would be for this person to train at a heart rate of 139 beats per minute.

One can also plot heart rate in comparison with test workload. The 60% and 90% levels of total work performed are determined, and the heart rate at those work intensities serves as the preferred range. This method works easily if the test was on a cycle ergometer (usually reports which work load as watts: a measure of power output), but does not work well if the test mode was a treadmill (which reports workload as speed and per cent of elevation).

A variation can be used, especially if the initial test was performed on a treadmill. One may use not the workload (speed and elevation), but the MET equivalent for each workload. (The MET rate is not often reported on exercise-test summaries, but it can be calculated: see Reference 1.) Suppose a person has a 10 MET capacity: he would be encouraged to exercise at the heart rate that registered at 6 and 9 METS during the test.

Table 2
Rating of Perceived Exertion:
"How Hard is the Exercise?"

0	Nothing at all
.5	Just noticeable
1	Very light
2	Light
3	Moderate
4	Somewhat hard
5	Hard
6	
7	Very hard
8	
9	
10	Very, very hard (almost maximal)
***	Maximal

To measure his or her own pulse rate, the patient needs only to learn to obtain the carotid, radial, or temporal pulse. The count should begin immediately on cessation of the continuous activity. Six-, 10-, or 15-second counts, corrected for one minute, are typically used. Numerous pulse-rate monitors are on the market and vary considerably in their accuracy. For the most part, accuracy is improved if the device attaches directly to the chest.

Another method of using METs takes only the maximal MET figure for the test. Again, let us assume a 10-MET capacity. Activities that are continuous in nature, requiring 6 to 9 METS, are to be encouraged. Numerous tables are available for comparison (Table 1; cf. 2, 3).

A final method involves using the rating of perceived exertion (Table 2). The question asked is, "How hard is the exercise?" Responses are based on the patient's definition of the key words. It is suggested that exercise be "moderate", "somewhat hard" to "hard". Generally, people will begin an exercise program using heart rate as a guideline. Once they have developed a "feel" for the exercise intensity, they will use perceptual cues to govern

their exercise according to the perceived exertion scale.

Duration of Exercise

Exclusive of warm-up and cool-down phases, the duration of the aerobic phase of exercise should be between 15 and 60 minutes; typically, it will be 20–30 minutes per session. The lower the initial level of fitness, the shorter and more frequent should be the training sessions. This pattern reduces the risk of orthopedic injuries, while ensuring some reasonable progress without compromising program adherence.

Type of Activity

This factor may well be the most critical. Should the chosen activity not be enjoyable, adherence declines. Proper aerobic exercises are rhythmic, involve a large muscle mass, and can be maintained continuously. Many activities satisfy these criteria, including walking or hiking, jogging, swimming, cross-country skiing, rowing, skating (ice or roller), cycling (mobile or stationary), rope skipping, bench stepping, and various dance activities.

Games are frequently discussed as

Table 1
Estimated MET Requirement of Selected Activities

Activity	Met Range	Activity	Met Range
Backpacking	5–11	Running	
Badminton	4–9+	12:00/mile	8.7
Bowling	2–4	10:00/mile	10
Calisthenics	3–8+	8:00/mile	12.5
Recreational cycle	3–8+	6:00/mile	16
Dancing	4–7	Skiing, downhill	5–8
Golf, cart	2–3	crosscountry	6–12+
walk	4–7	Swimming	4–8+
Handball, racquetball,	8–12	Tennis	4–9+
squash			
Hiking	3–7		

Source: Table modified from References 2 and 5.

Table 3
Improvement Stage Progression for a 50-Year Old

Frequency	Intensity	Duration	No. of Weeks
3	HR= 129–155	15'	1–5
4	129–155	15'	6–10
4	129–155	20'	11–15
4	129–155	25'	16–20
4	129–155	30'	21–25

Prescribe Ceclor* (cefactor)

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CECLOR: PRESCRIBING SUMMARY

INDICATIONS: The treatment of the following infections caused by *Strept. pyogenes*, *Strept. pneumoniae*, Staphylococci (including coagulase-positive, coagulase-negative, and penicillinase-producing strains), *E. Coli*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *H. influenzae* (including ampicillin-resistant strains):

1. Otitis media.
2. Lower Respiratory Infections, including pneumonia, bronchitis, and pulmonary complications resulting from cystic fibrosis.
3. Upper Respiratory Infections, including pharyngitis and tonsillitis.
4. Skin and Soft-Tissue Infections.
5. Urinary Tract Infections.

CONTRAINDICATIONS: Persons who have shown hypersensitivity to the cephalosporin antibiotics.

WARNINGS: Cephalosporins should be given only with caution to penicillin-sensitive patients. There is some evidence of cross-allergenicity between penicillins and cephalosporins. Patients have been reported to have had severe reactions (including anaphylaxis) to both.

Administer with caution to any patient who has demonstrated some form of allergy, particularly to drugs. If an allergic reaction to Ceclor occurs, the drug should be discontinued and the patient treated with the usual agents. Pseudomembranous colitis has been reported with virtually all broad-spectrum antibiotics; therefore, it is important to consider its diagnosis in patients who develop diarrhea in association with the use of antibiotics.

PRECAUTIONS: Safety during pregnancy has not been established. Small amounts of Ceclor have been detected in mother's milk following administration of single 500 mg doses. The effect on nursing infants is not known. Caution should be exercised when Ceclor is administered to a nursing woman. Prolonged use may result in the over-growth of non-susceptible organisms. If superinfection occurs, administration of Ceclor should cease and appropriate measures taken. Positive direct Coombs' tests have been reported during treatment with cephalosporins and may be due to the drug. Administer with caution in the presence of markedly impaired renal function. The safe dosage is likely to be lower than that usually recommended. A false-positive reaction for glucose in the urine may occur with Benedict's or Fehling's solution or with Clinitest tablets but not with Tes-Tape* (Glucose Enzymatic Test Strip, USP).

ADVERSE REACTIONS: Of 1,493 patients treated with cefactor, 87 (5.8%) had adverse reactions or abnormal laboratory values judged to be drug-related. These included: nausea and vomiting, dyspepsia, diarrhea, rash (including urticaria & morbilliform eruptions), positive Coombs', eosinophilia, genital moniliasis, vaginitis, elevated SGOT, and elevated SGPT. Other adverse reactions experienced less frequently include: pruritus, dizziness, headache, somnolence, abdominal pain, leg cramps, abnormal taste, and fever. Leukopenia, decreased hemoglobin and hematocrit, neutrophilia, elevated alkaline phosphatase, lymphocytosis, lymphocytopenia, thrombocytosis, elevated BUN and creatinine, hematuria and pyuria have also been reported. Cases of serum-sickness-like reactions (including skin manifestations, fever and arthralgia/arthritis), anaphylaxis, and pseudomembranous colitis have been reported.

SYMPTOMS AND TREATMENT OF OVERDOSAGE: There has been no experience of overdosage with Ceclor. If a large overdose has been recently consumed, the patient should be kept under observation and appropriate treatment undertaken as considered necessary.

DOSAGE AND ADMINISTRATION: Ceclor is administered orally. **Adults** — The usual adult dosage is 250 mg every 8 to 12 hours. The maximum recommended dosage is 2 g per day, although doses of 4 g per day have been administered safely for 28 days.

Children — The usual dosage for children is 20 mg/kg/day in divided doses every 8 to 12 hours. In more serious infections, otitis media, and those infections caused by less susceptible organisms, 40 mg/kg/day is recommended, up to 1 g per day.

For lower respiratory tract infections, the total daily dosage should be divided and administered 3 times daily. For B-hemolytic streptococcal infections administer for at least ten days.

CECLOR FORMS:

Ceclor 250 mg Pulvules 3061. Each opaque purple and white capsule contains 250 mg cefactor. Bottles of 100 capsules.

Ceclor 500 mg Pulvules 3062. Each opaque purple and grey capsule contains 500 mg cefactor. Bottles of 30 and 100 capsules.

Ceclor 125 mg for Oral Suspension (M-5057). Strawberry flavored, 125 mg/5 mL.

Ceclor 250 mg for Oral Suspension (M-5058). Grape flavored, 250 mg/5 mL.

Reconstitute suspensions by adding 60 mL of water to each 100 mL bottle or 90 mL for each 150 mL bottle in two portions. Shake well after each addition. After mixing, store in a refrigerator. The mixture may be kept for 14 days without significant loss of potency. Shake well before using. Keep tightly closed.

Product Monograph available on request.

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modes and can be an effective stimulus for fitness. To be most effective, opponents should be of similar abilities. It is suggested that games be a recreational outlet rather than a primary mode of fitness. "Don't play the game to get in shape, get in shape to play the game."

Rate of Progression

Rate of progression is the variable typically abused, and its abuse may result in some form of overuse injury. It consists of three distinct stages: initial, improvement, and maintenance.

Initial stage

Beginners to exercise should include in their activities stretching, calisthenics, and light aerobic activities. The degree of soreness they will experience in the beginning is less because the exercises are of lighter intensity. The initial level of fitness should determine the duration of time spent in this phase. The lower the level of fitness, the longer one will spend getting accustomed to activity. Four to six weeks is not uncommon for patients at a poor or fair level of fitness. It is important to develop a good warm-up and cool-down routine during this stage. Most drop-outs occur in the first four to five weeks for a variety of reasons, not the least of which is an initial stage in which the exercise is too aggressive.

Patients at a good or excellent level of fitness may be able to spend only one week in the initial stage or even skip this stage altogether.

Improvement Stage

During the improvement stage, the patient begins to exercise within the prescribed training zone, and improvement occurs fairly rapidly.

Remember that training for fitness requires manipulation of frequency, intensity, and duration. To improve, therefore, one needs merely to increase one of the three factors: add a day, add minutes, or work harder. The guidelines for increasing one's level of fitness vary. For example, a 10% increase in weekly activity every one to two weeks is sometimes considered appropriate. Another method of improving fitness level is to add to the work every so many weeks, depending on the exerciser's age: every 2-3 weeks if under the exerciser is 30,

3-4 weeks if he or she is in the 30s, every 4-5 weeks if he or she is in the 40s, and so on. By following this method, our 50-year-old might progress as shown in Table 3. Say the goal will be to exercise for two hours per week. When this goal has been attained, the maintenance stage will begin. Observe that in this example, only one factor is changed. Never are two or three factors adjusted at the same time. Overuse injuries are most often related to training errors as improper progression demonstrates. Some physicians even go further by suggesting that temperature, altitude, shoes, and surface be mentioned in the guideline, which should suggest that the exerciser change only one factor at a time.

Maintenance Stage

The maintenance stage begins at various times, but six months after beginning training is not uncommon. By that point, a satisfactory level of fitness has been achieved. To maintain fitness, the exerciser must continue to exercise at the equivalent frequency, intensity and duration. Variation may occur because of family needs, illness, weather, business, vacations, or other factors. A consistent reduction in one or more of the exercise components will result in declining fitness.

Remember that exercise should be enjoyed. Enjoyment increases compliance with a fitness program. Above all else, it is desirable for the exerciser to enjoy the chosen activity and participate regularly in a lifetime of exercise. ●

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