Physical Exercise and Health, 4:

The Health Care Professional and Patient's Guide to Understanding What to Do, How, and Why—Part 2

Chittaranjan Andrade, MD

Abstract

This article is the fourth in a series on physical exercise and health. The article addresses health care professionals, patients, and the public and provides practical guidance on how to exercise with emphasis on understanding what to do, how, and why. Subjects covered include how cardiorespiratory, muscle-strengthening, load-bearing, balancing, and other exercises benefit the heart, strengthen muscles and bones, improve balance and stability, and reduce the risk of falls and fractures while providing both current and long-term gains related to health, mobility, independence, and quality of life. Examples are provided for each type of exercise. Guidance is provided on how to perform the exercises, how to organize an exercise session from warming up and loosening exercises to cooling down and stretching exercises, what to do during different kinds of exercise sessions, how to organize sessions across the course of a week, at what level of exercise to start, how to gradually increase the intensity of exercise, what targets to aim for, and how to avoid exercise-related injury. The use of exercise equipment, interval training, long continuous exercise, isometric exercise, the role of the mind in exercise, and other subjects are briefly discussed. Model exercise sessions and model programs for the week are also presented. It is hoped that this series of articles will help readers change their attitudes toward exercise, start exercising, and benefit from longer and healthier lives.

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Author affiliations are listed at the end of this article.

This article is the fourth in a series on physical exercise and health. The first two articles[1,2] focused on the underlying science and discussed terminology, guidance, benefits, and risks as well as benefits associated with different levels and patterns of activity. Readers who have not seen the articles are encouraged to at least skim through their contents. The third article considered what one needs to do when exercising, why, and how; it provided practical points related to matters such as motivating oneself for exercise, creating opportunities for exercise, setting targets, and avoiding exercise-related risks.[3]

Although much of the content of the present article can be read as standalone material, for better and more complete understanding, this article is best read as a continuation of the previous one.[3] As stated there, please keep in mind that even single sentences or paragraphs in the article may be of disproportionately large value to you, depending on your specific needs.

This article focuses on down-to-earth, practical aspects of exercise for present and future health and longevity and not on exercise for physical appearance, competitive sports, or goals of a similar nature. The article addresses what can be done, how, and why. Dos and don'ts are considered with a view to reaching exercise targets with minimal risk of exercise-related injury. These exercise targets were summarized in the earlier articles[1,3] and are described in more detail in a World Health Organization Guideline.[4]

There is much material on this subject that is publicly available at many health websites. Please refer to such other sources, as well, for your unique needs and interests; for discussions on subjects not covered here; and, most especially, for tips on how to do different exercises correctly.

There is a little repetition of content within this article and between this and earlier articles. This is to emphasize important content and to explain context without requiring the reader to go back and forth within and between articles.

General Notes on Exercise: 1

If a limb bone fractures, the limb may be set in a plaster cast. Limb muscles atrophy (become thinner, lose bulk) inside the cast. This is because the muscles are not being used. People with limbs in casts are therefore advised to repeatedly flex fingers or toes to exercise the muscles the movements of which are restricted by the cast. This helps keep the muscles in condition.

In the same manner, whatever activity is done during the day helps keep the muscles and joints of the body in condition. This will maintain or improve movement, functionality, and independence in everyday life, and hence quality of life. These are ongoing gains of exercise.

In this regard, any movement of limbs and joints, or tensing of muscles, including swinging of limbs, bending, and twisting, can contribute to range of movement, flexibility, balance, muscle strength, and cardiac fitness; the more the better.

If you slacken your diet, you will gain weight. If you slacken your exercise schedules, you will gradually lose fitness. Happily, if the slacking is not marked in intensity and duration, it is reasonably easy to catch up again.

Walking and cycling are easy forms of exercise; so are sports and games. Do what you like. What is "best" if you have many equally acceptable options depends on the heart rate and respiratory rate attained. The higher the better; this is explained in greater detail later.

Electronic wearables, smartwatches, and smartphone apps are not necessarily accurate ways to measure your workout. The readings that they provide vary across devices, manufacturers, where the device is sited on your body, the way you exercise, how much you sweat, and other factors. The accuracy that these devices provide may not be necessary. It suffices for your workout to seem energetic to you; if your heart beats fast and you are breathing heavily, that's a good workout. How to measure your workout is discussed in greater detail later in this article.

General Notes on Exercise: 2

Playing chess and solving cryptic crosswords both exercise the mind. Whereas both could improve your ability to concentrate on a task, becoming good at chess will not make you good at crosswords.

Likewise, exercising the lower limbs won't strengthen the upper limbs. This is why you need to do different exercises to strengthen different muscle groups in the body. This is also why you need to do different kinds of exercise, such as cardiorespiratory exercise, muscle-strengthening exercise, load-bearing exercise, balancing exercise, and others.

When you do muscle-strengthening exercise, to some extent the heart muscle also receives a workout. When you do cardiorespiratory exercise, to some extent muscle groups also receive a workout. Nevertheless, you need to do specifically different exercises to strengthen the heart just as you need to do specific exercises that strengthen specific muscles in the body.

The heart beats all through your life, without rest. Therefore, it is important to strengthen the heart more than the muscles elsewhere in the body. Therefore, you need to do more cardiorespiratory exercise than muscle-strengthening exercise.

As a side note, older persons, such as those who are > 60 years old, need to increase the muscle-strengthening component in their workouts to address the thinning of muscle that accompanies aging.

In sum, you need to do an all-round workout within a session or across the week.

An All-Round Workout

Workouts have different elements, all of which are necessary, though in different proportions.

As a reminder from earlier articles, cardiorespiratory sessions should cumulate to 150–300 min per week if moderate in intensity, and 75–150 min per week if vigorous. Moderate intensity is a rating of 5–6 on a 0–10 scale where 10 represents maximum capacity and vigorous intensity is a rating of 7–8.

Again as a reminder, muscle-strengthening exercise sessions should exercise all major muscle groups in the body to the point of at least moderate fatigue. There should be at least 2 muscle-strengthening sessions per week (3 sessions per week if you are an older adult).

A vigorous cardiorespiratory workout or a muscle-strengthening workout should be preceded by brief warming up. It is not necessary to warm up before light exercise such as walking. This is true even if the walk is brisk.

About 80% of exercise during the week should be cardiorespiratory in nature, and the remaining 20% should be muscle-strengthening exercise. This can be done, for example, by having long cardiorespiratory sessions on 3–4 days, short muscle-strengthening sessions on 2 or more days, and rest from exercise on 1–2 days during the week.

All-round workouts can also be done by working out on 5–6 days in a week with about 80% of each session being cardiorespiratory and about 20% being muscle-strengthening in nature.

Do balancing workouts, such as standing on one leg, in bits and pieces of time that you get across the day. You can also do muscle-strengthening workouts, such as a set of back exercises, or floor planks and wall squats, in bits and pieces of time. And, you can climb stairs in your home or workplace or walk briskly between buildings at your workplace. That is, you do not need to do exercise in designated exercise sessions.

As an aside, whatever you do as bursts of movement, whenever you do it, counts as exercise that adds up to your weekly goals.

After a vigorous cardiorespiratory or muscle-strengthening exercise session, you need to cool down. For example, if you have run hard during the session, at the end of the session jog or walk for a few minutes.

After a vigorous cardiorespiratory or muscle-strengthening exercise session, it is wise to stretch your muscles at all joints; else, you could progressively lose joint flexibility.

Cooling down and stretching after a vigorous exercise session also reduces the risk of the delayed-onset muscle soreness (DOMS) syndrome.

Designated exercise sessions are typically 15–60 min in duration, typically 5–6 days a week. Exercise does not need to be done in a single session a day. The 15–60 min of scheduled exercise can be split into 2 or more sessions, depending on individual convenience and comfort.

Depending on how vigorous the exercise is, 1–2 days a week can be allotted for rest. The rest is not just a mental break from exercise; it allows the body to recover when the workouts on previous days have been hard. Rest days can be consecutive or interspersed between days of exercise.

Use of Equipment

Other than a good pair of shoes and sensible clothing, no equipment is necessary if you just walk, jog, or run slowly.

Whereas you can do push-ups, squats, floor planks, wall squats, and other muscle-strengthening exercises that do not require equipment, owning dumbbells is useful for exercising the upper limbs and shoulders.

There is no need for expensive gym equipment, or a personal trainer, if you exercise at lower intensities and for health, as opposed to higher intensities, such as for competition or other reasons.

There is no need to sign up for an expensive gym membership unless you want to do vigorous exercise under supervision or need companionship and supervision to set you into a routine and to keep you externally motivated.

If you do wish to use equipment, possibilities include a geared bicycle for outdoor use and an elliptical trainer, treadmill, or exercise cycle for indoor use. An elliptical could be the best choice; it allows you the best range of possibilities for light to intense workouts. A treadmill is best reserved for warming up, or if you want to just walk but cannot walk outdoors. An exercise cycle is suitable for warming up or for light exercise. A pair of light dumbbells, or even just a single dumbbell (weight, 2–5 kg), is also useful to own.

Note that all ellipticals, treadmills, exercise cycles, and other items of equipment are not the same. If you are purchasing equipment, try out the equipment before the purchase. Find the instrument, setting, height, angle, posture, grip, and other finer details and settings that are right for you.

Whatever the items of equipment you use, even the humble dumbbells, learn how to use them properly from manuals, a trainer or gym instructor, or YouTube videos.

Stretching and Warming Up

Stretching before exercise is not essential. However, dynamic stretching or loosening exercises are desirable before vigorous exercise. That is, the head, limbs, and trunk should each be moved by bending, straightening, or rotation through their full range across all joints: neck, shoulders, elbows, wrists, spine, hip, knees, and ankles. Loosening exercises can be done in 2–3 min. Do not jerk or force during stretches; stretching and loosening movements should be controlled and not sudden, swift, or forced.

Loosening exercises are performed after warming up; that is, they serve as a bridge between warming up and a vigorous workout.

Warming up before exercise is important to prevent muscle injury during exercise sessions that are planned to be vigorous. Warming up increases blood flow and prepares the muscles for hard, fast, or long workouts. Warming up is not necessary if the planned activity, such as walking or cycling, is mild to moderate in intensity.

Warming up also helps reduces muscle soreness if the previous day's workout was hard.

Examples of warming up are

- jogging slowly before gradually increasing the pace of running,
- jogging for a few minutes followed by a few short sprints before a serious session of running,
- walking on a treadmill for a few minutes followed by a few squats and back and shoulder exercises before a serious session of lifting weights.

If You Merely Walk

Walking is a perfectly acceptable form of cardiorespiratory exercise. Almost everybody can walk. There are well-established health benefits associated with walking.

If you mean to walk for health and are not used to long walks, plan on walking for about 15–20 min a day for the first few days. When you are comfortable, increase the duration to 30 and then 40 min a day. A good target could be 60 min a day or longer either in a single session or spread across 2 or more sessions.

Walking at a speed of 80 steps a min is leisurely; 100 steps a min is medium to brisk; and 120 steps a min is visibly brisk.[5] Most people can walk at 100 steps a minute; so, walking for 40 min a day gives a step count of 4,000 steps and walking for 60 minutes gives a count of 6,000 steps.

For most people, walking at a speed of 120 steps a minute is not hard; so, walking for 40 min a day gives a step count of 4,800 steps and walking for 60 min gives a step count of 7,200 steps.

A target of 6,000–8,000 steps a day is good; because the benefits of exercise are dose-dependent, aim for the higher rather than the lower number, and exceed this count if you can. Because walking faster exercises the heart more, walk faster rather than slower, if you can.

Some people walk in short steps; others walk with long strides. A different metric, therefore, would be to aim to walk for 4–6 km a day, covering this distance in 60 min or less. The best strategy would be to walk this distance as briskly as is comfortable; taking longer strides will help you cover longer distances.

Other Suggestions for Those Who Walk

- Carry a backpack that weighs 5–10 kg (whatever you are comfortable with). This won't slow you much but will help strengthen your trunk muscles while you walk.
- Walk uphill. This gives you a better workout.
- Walk on uneven surfaces. This will strengthen the muscles of the sides of your legs. Your sense of balance will also improve. Do this workout carefully; you should not lose balance and fall.
- If you get bored, interrupt your walk to do other exercises such as squats, going up and down on the balls of your feet, etc.
- Walk outdoors, if possible. This is less boring than walking on a treadmill or walking up and down in your house or garden. Walk indoors only if there are no suitable places nearby to walk outdoors, or if the outdoor air is polluted.

Walk on a treadmill only if you are warming up in the gym, or if you have a treadmill at home and are exercising in bits and pieces of time, or if this is the only option available to you. Walking on a treadmill is not a natural way of walking; you expend less energy because the ground is moving (you are moving only your legs, not your body); and you risk being thrown off if you lose concentration, especially when walking at faster speeds.

On the subject of treadmills: Do not run on a treadmill unless you have no other options. Running on a treadmill is not a natural form of running; you are not running, you are merely bobbing up and down in the same place while the ground moves beneath you. So, you're not really carrying your body forward. Furthermore, you can set the treadmill at a faster pace without really exercising harder if you jump a little higher as you run. That is, the faster treadmill pace gives a false impression of more vigorous exercise. Last but not least, if you run on a treadmill, you can get thrown off if you lose concentration for even a fraction of a second.

Other Cardiorespiratory Workouts

Indoor and outdoor sports that are played on courts or fields are enjoyable forms of cardiorespiratory exercise, especially when you win. Examples are badminton, basketball, tennis, hockey, and soccer.

Climbing stairs, hopping, skipping, jumping jacks, jogging, and running are forms of moderate to vigorous cardiorespiratory exercise. These are all potentially high impact exercises; the body lands heavily on the knees and ankles at every step. The more vigorous (faster) the activity, the greater the impact on the joints. This can be especially problematic among older and heavier persons and those with existing joint disease.

The risks associated with impact on joints can be reduced in many ways, such as by using shoes with soles that absorb impact, by going downstairs slowly, by avoiding running downhill, by keeping the knees slightly flexed always so that the impact is borne by the muscles of the thigh and not by the knees, etc. These were discussed in greater detail in the earlier article.[3]

Conscious effort is necessary to keep the knees slightly flexed especially when walking or running downhill and when going down stairs. This is because, in such situations, the knees tend to straighten fully, loading the body weight on the knee joint.

Cycling, swimming, and rowing are also cardiorespiratory activities. These are not weight-bearing exercises and so will not help strengthen bones. Use gears when cycling uphill to lessen the strain on the knees.

Note that swinging your arms around is a loosening or cooling down activity; it is negligibly cardiorespiratory or muscle-strengthening.

Moderate to Vigorous Exercise: Starting and Escalation

This section is meant especially for those who are new to exercise and those who are exercising for health. However, some points could be useful to all.

When starting a new exercise program, always start at a low intensity, perhaps at about 40% or 50% effort. When you discover what you are comfortable with, and what you are capable of, gradually increase the intensity.

How gradual must this gradual increase be? Different people have different levels of baseline motivation and fitness and so the answer is subjective; base it on your own comfort level and not on urging by others. There is no hurry. Raising intensity by a few percentage points at intervals of 1–2 weeks is reasonable.

What does increase in intensity imply? It implies doing the workout at higher speeds or for longer durations. Or, it could mean doing more repetitions, as when you lift weights or do interval training (discussed later).

What should the target be? When exercising for health, aim to reach 60%–80% of what you are capable of doing and stay at those levels. Try to reach 70%–80% on any given day and to not drop below 60%.

Although exercising at > 80% capacity could be good, it is not necessary when exercising for health. Exercising at > 90% capacity increases the musculoskeletal and other risks that were discussed in the preceding article.[3]

Moderate to Vigorous Exercise: General Notes

You can do whatever you want to do at the spur of the moment, at the start of the exercise session and during the session. However, it is better to plan workouts in advance because it is good to have an exercise program; you should preferably not do the same workout every day.

During a planned workout, you would know what you need to do from start to end. Pace the workout; don't exhaust yourself in the first few minutes.

During a planned workout, you may feel tired and sore in the initial minutes; this is especially likely if the workout on the previous day was hard. You may feel discouraged and want to quit. However, if you persist with the workout, you will notice that the fatigue and soreness diminish and that the workout becomes comfortable.

While doing a vigorous workout, pay attention to your body rather than to your surroundings. Observe your breathing, note how your muscles and joints feel during the workout. Listening to your body helps you pace yourself, identify when fatigue sets in, recognize what hurts and where, and notice the onset of pain, should this happen. This will allow you to make adjustments in your workout, or even stop the workout to avoid injury.

Listening to the body becomes automatic over time.

Finding the Sweet Spot

Lifting a 20 kg weight 5 times, a 5 kg weight 20 times, and a 1 kg weight 100 times are not the same. This applies to other forms of exercise, too.

Find the sweet spot that is not so hard as to risk injury nor so easy as to be no exercise at all and just right to allow an intensity that is moderately challenging to perform. This sweet spot is actually a range; it depends on what workout you do and how you feel at the time of the workout.

When varying the workout, criteria could be the weight that you lift, the number of repetitions in a set, the rest between sets, and the number of sets that you perform.

Or, criteria could be the distance that you run, the speed at which you run, the number of repetitions that you perform for this distance and at this speed, and the interval between repetitions.

Special Notes About Cardiorespiratory Workouts

The heart is the only muscle that works without resting all through your life. It is important, therefore, that this muscle be kept fit and strong. Cardiorespiratory workouts strengthen the heart muscle by making the heart beat faster and more strongly so that blood is pumped across the body to meet the demands of the exercise session.

Just as doing biceps curls with a dumbbell makes the biceps muscle stronger, cardiorespiratory workouts that make the heart beat faster and more strongly make the heart muscle stronger.

Additionally, just as exercise improves blood flow to the muscles, exercise improves the blood flow to the heart. Importantly, cardiac blood supply is improved not just during an exercise session but even in between exercise sessions. This is because exercise improves collateral circulation in the heart; that is, it improves networking of arteries.[6] This is important because if one artery in the heart gets blocked, other arteries can continue to supply blood to the heart muscle. The risk of a heart attack therefore reduces.

As already stated, because the heart muscle is more important than muscle elsewhere in the body, strengthening the heart muscle through cardiorespiratory workouts is more important than strengthening the rest of the muscles of the body. A good ratio is that, averaged, exercise should be about 80% cardiorespiratory and 20% muscle-strengthening in nature.

Regular exercise reduces arterial stiffness.[7] This helps lower blood pressure and reduces the load on the heart. This also improves circulation to the heart and brain.

Breathing and Sweating

Cardiorespiratory workouts are intended to increase the heart rate. Increase in the respiratory rate during exercise does not improve health. However, increase in the respiratory rate is a reasonably good proxy for determining the intensity of a cardiorespiratory workout. It is easier to observe faster breathing than to observe a faster heart rate.

When exercising, should you breathe through your nose or mouth? Breathing supplies you with oxygen, and it does not matter whether the oxygen comes through the nose or the mouth. So, breathe in any way that comes naturally to you; there is no need to think about it. Breathing through the mouth is inevitable when the workout is vigorous and you need more oxygen.

People sweat during cardiorespiratory workouts. Increased sweating does not improve health. Increased sweating is a poor proxy for the intensity of a cardiovascular workout because sweating depends not just on the intensity of the workout but also on season of the year, time of the day, ventilation (indoors), wind (outdoors), clothing, and other factors that are irrelevant to the workout. Therefore, it is acceptable to work out under a fan or with the air conditioning; discomfort is less and a better quality of workout may then be possible.

Sweating results in loss of fluid. If the workout is going to be hard and long, drink water before the workout and take sips during the workout, if necessary. Dehydration can result in electrolyte imbalance, cramps, and irregular heartbeat. Consuming electrolyte drinks is unnecessary unless you are engaging in a long and grueling workout that results in much sweating. Consuming energy beverages is undesirable.[3]

Keeping yourself well hydrated may also reduce the dryness in your throat that can result from rapid respiration, through the mouth, during a vigorous workout.

As a counterpoint, note that it could be hard to do a comfortable workout with a lot of water sloshing around in the stomach. So, don't drink too much before and during a workout.

Types of Cardiorespiratory Sessions

Cardiorespiratory sessions can be long continuous workouts or interval training.

In long continuous workouts, you perform the same activity at a uniform rate for a long period, such as 20–30 min or longer, depending on what you do and how fast you do it. Examples of long continuous workouts are walking briskly, cycling, or jogging for 30 min or longer.

Interval training involves doing repeated short and fast bursts of activity with short periods of rest in between repetitions. An example is sprinting a short distance, walking for a minute to catch your breath, turning around and sprinting back, walking for a minute to catch your breath, turning around and sprinting the distance again, and so on, for a planned number of repetitions.

A long continuous workout trains the heart to beat harder and faster, and to sustain the effort for a long time. Interval training prepares the heart for sudden high demands. Both forms of workout are helpful because both kinds of demand on the heart can occur in other contexts in normal life.

Long Continuous Workouts

Long walks or long sessions of cycling are examples of long continuous workouts. However, a long session of pedaling on an elliptical or a long session of jogging or running are even better because both increase the heart rate more than walking or cycling do.

Stretching and warming up are not necessary before a long continuous workout. This is because if the session starts at an easy pace and then builds up in speed, the initial minutes of the session constitute the warming up.

When exercising on an elliptical or when running, the long continuous workout should reach cruising speed in about 2–5 min. Cruising speed, ideally, is the speed at which the workout can be continued, almost monotonously, for the entire duration of the session. However, the cruising speed does tend to differ during different parts of the session. For those who are new to exercise, the cruising speed may decrease as the session progresses; for those who are experienced, the cruising speed may progressively increase and the session may end with an exhilarating sprint.

Finding the cruising speed is intuitive, and it will depend on a composite of what the mind, muscles, heart, and breathing rate allow.

If the cruising speed cannot be maintained within a reasonable range, it is better to take very short breaks (to recover) and then resume the workout than to perform the workout at a snail's pace; the latter will tire the body without exercising the heart, much as just standing does. Completing the workout is a good habit; it also builds mental strength. Quitting a workout may start a bad habit.

Long continuous workouts give the heart a longer workout, train the heart to endure prolonged stress, and train skeletal muscles and the mind to push through boredom and fatigue.

Interval Training

Interval training is best performed by people who are at least moderately fit. This is because people who are not fit, and those who have medical conditions, especially cardiac or orthopedic conditions, would find it hard (or inadvisable) to perform even short bursts of vigorous exercise.

An interval training session should be performed only after warming up and loosening exercises.

During interval training, a planned distance is covered at a planned speed for a planned number of repetitions with planned intervals of rest in between repetitions. On different days of interval training, each of these planned values can be varied so that the same workout is not repeated, session after session.

If the distance covered per repetition is short, the speed can be greater. If the number of repetitions is large, the speed will need to be less. The interval between repetitions should be short, usually not more than 1–2 min; else, the muscles will become "cold." During the interval, it is better to walk at a slow pace, to keep the muscles warm, rather than to stand or sit.

From the above, it will be clear that interval training is best performed on an elliptical or exercise cycle indoors or while running outdoors. Nevertheless, even when merely walking or cycling outdoors, interval training can be performed by walking or cycling a little faster in bursts so that the heart receives a varied workout.

Interval training gives the heart a harder workout than long continuous training. Interval training improves the ability of the heart to deal with situations in which there are sudden demands. Because interval training makes the heart beat at different rates at different times during the session, it also improves the adaptability of the heart to fluctuating demands.

Speed of Cardiorespiratory Workouts

Standing is tiring but is not exercise. It does not meaningfully increase the heart rate and it does not meaningfully strengthen muscles. Likewise, doing a very slow workout is tiring and achieves less. It is therefore best to find a cruising speed for long continuous workouts or to work out in bursts with very short intervals for recovery.

Among those who are experienced, long continuous workouts commonly start at a moderately fast pace, when the body is fresh. The pace then slows to cruising speed after 15–30 s. The last 30–60 s usually comprise a final burst of speed, ending the workout on a triumphant note. This pattern can also characterize repetitions in interval training, with different durations and speeds

Box 1.

Weekly Schedule for a Model Elliptical Program

Day 1: Interval training. Pedal fast for 120 s, counting the number of steps you complete. Get off the elliptical and walk for 60 s. Repeat this cycle 6 times. The total duration on the elliptical is therefore 12 min. The total duration of the session is 18 min. The score for the day is the average number of steps pedaled per repetition during the 6 repetitions.

Day 2: Interval training. Pedal moderately fast for 5 min, counting the number of steps you complete. Get off the elliptical and walk for 120 s. Repeat this cycle 3 times. The total duration on the elliptical is therefore 15 min. The total duration of the session is 21 min. The score for the day is the average number of steps pedaled per repetition during the 3 repetitions.

Day 3: Muscle-strengthening. Do pushups, pull ups, crunches, sit ups, squats, planks, dumbbells, weights, and other muscle-strengthening exercises in repetitions and sets for about 15 min.

Day 4: Long continuous workout. Pedal moderately fast and at a reasonably uniform rate for 15 min. The score for the day is the number of steps pedaled during the 15 min session.

Day 5: Long continuous workout. Pedal at a slow to medium rate for 30 min. The score for the day is the number of steps pedaled during the 30 min session.

Day 6: Muscle-strengthening. Do pushups, pull ups, crunches, sit ups, squats, planks, dumbbells, weights, and other muscle-strengthening exercises in repetitions and sets for about 15 min.

Day 7: Recovery. Just stretch, warm up, and cool down. Or, do nothing; enjoy a day of rest and relaxation to allow your muscles to recover from the efforts of the week.

for the initial and final bursts depending on distance, number of repetitions, and other variables.

Going fast initially, then slower, then still slower, and finally fading out is inefficient.

When exercising for health, there is no need to shoot for the moon; this may even be harmful because it increases the risk of injury. It may be better to do more repetitions at a slower rate than fewer repetitions at high speeds. Whatever the workout, it is best to aim for 60%–80% of subjective peak capacity.

Note that doing too hard a workout on one day can make muscles sore and can reduce what you are able to do the next day.

Note that a higher resistance setting on an exercise cycle or elliptical increases the strengthening part of the workout. This may slow down the speed of the workout without necessarily reducing the aerobic part. So, when rating the intensity of the workout, don't rate based on the difficulty that the muscles experience; rate based on the heart rate and respiratory rate observed during the workout.

In a fartlek workout, you exercise for a planned number of steps, or a planned distance, or a planned period of time; however, you vary the speed during the workout. That is, you speed up when you can, you slow down when you tire, you speed up again when you feel better, and so on. Fartlek workouts are good if you're exercising for health; they give the heart a varied workout and you may find them enjoyable because they are associated with less mental pressure.

A Model Session for the Elliptical

Organize the session as follows:

- Start by warming up with slow pedaling for about 3 min.
- Get off the elliptical, loosen up at all joints for 2–3 min.
- Get back on the elliptical, do a warming up burst: pedal at high speed for about 10–15 s and then gradually slow down for about 30 s.
- Rest for about 30 s.
- Perform the workout for the day (see the next section).
- Cool down by walking or pedaling at a moderate pace for about 3 min.
- Stretch at all joints.

If you cannot do everything listed above, adapt this session to whatever suits you best.

A Model Elliptical Program for the Week

Organize the week as described in Box 1. For the purpose of counting, each half turn on the elliptical counts as 1 step. That is, a rotation with first the left foot and then the right foot counts as 2 steps. For the purpose of timing, use a watch or any other timer on which the display of time in seconds is clearly visible.

Tailor this program to your capacity, interests, and comfort. For example, you can yourself decide how long each repetition will be, what the interval of rest between repetitions is, and how many repetitions you will perform. Or, for example, instead of counting how many steps you pedal in 5 min, you may choose to see how many minutes and seconds it takes you to pedal 1,000 steps (followed by a 2-min break, 3 repetitions).

On any of the days, if you wish, you can do any other workout that you want, such as walking, cycling, jogging, or running. As a part workout, you can also do repetitions of going up and down stairs; go faster when going up, go slowly (and hold the railings) when coming down, and remember to keep the knees bent so that your body weight is taken by the muscles of the thigh rather than by the knee joint.

Other Notes on the Model Elliptical Program

Shorter repetitions are performed at a faster pace. When you count steps or time the workout, you can keep track of how well you are doing. Try to improve on your personal records (discussed in greater detail later).

You don't need to do a 7-day cycle as described in the previous session. However, if you do shorter or longer cycles, it can be hard to keep track. Keeping track is easier when you have sessions allotted to days of the week.

You can rest on 2 days of the week, if you wish, especially if your workouts on the other days are vigorous rather than light.

If you are running rather than using an elliptical, use distance covered and time rather than steps pedaled and time as the measures. You will do interval training on some days, long continuous workouts on some days, and muscle-strengthening exercises on some days; the general principles remain the same.

You don't need to allot separate days for muscle-strengthening exercises. You can end every cardiorespiratory session with 5–10 min of muscle-strengthening exercise. The extra 5–10 min will not seem to be an additional burden because it is short; and, you will get extra days for interval or long continuous workouts (or rest and relaxation) during the week.

Repeat this program every week with variations that you choose. Do not do the same workout daily. Keep a record of your scores and try to improve the scores.

Choose the time of day that is most comfortable for you to work out. If you work out in the morning, don't rise earlier to make time for the workout; that is, don't cheat your body of necessary sleep. Adequate sleep is necessary not only for a good workout but also for good health.

Other Exercise Programs

If you work long hours, you may not be able to exercise daily. You can then do VILPA and weekend warrior workouts; both have been shown to have health benefits.

VILPA refers to vigorous intermittent lifestyle physical activity. VILPA includes climbing stairs, walking briskly inside or between buildings at the workplace, doing housework and gardening, and any other activity that is brisk or exertional during daily life. VILPA may require conscious effort, such as in choosing to climb stairs rather than use the elevator, and in choosing to lunch in a different building rather than in the same building.

Weekend warrior workouts refer to longer and harder sessions of cardiorespiratory and muscle-strengthening activity during the weekend to compensate for the absence of exercise sessions on weekdays.

Muscle-Strengthening Workouts

Muscle-strengthening exercises are performed as repetitions and sets. For example, a dumbbell may be raised and lowered vertically 10 times, forward 10 times, sidewards 10 times, and behind 10 times as part of a set with each hand. After a short break, during which some other activity is performed, the set is repeated with each hand.

Muscle-strengthening exercises should exercise all important muscle groups of the body. In the upper body, these are the muscles of the hands, forearms, arms, shoulders, and neck. In the trunk, these are the muscles of the chest, abdomen, and back. In the lower body, these are the muscles of the buttocks, thighs, and calves.

Larger muscles should be exercised harder. Smaller muscles, such as those of the hand, should never be exercised too hard or for too long; injury can result.

Need for Muscle-Strengthening Exercise

Muscle-strengthening exercises strengthen muscles. This improves your ability to perform cardiorespiratory workouts.

Muscle-strengthening exercises strengthen specific muscles. For example repeatedly squeezing a rubber ball strengthens your grip.

Stronger muscles in the trunk and lower limbs give strength to the body as a whole. This improves stability of the body and reduces the risk of accidental falls. This is especially beneficial in older persons who are vulnerable to falls.

The stronger the muscle group for a particular movement the less likely it is to get sprained or strained by severe and sudden or prolonged engagement in that movement in ordinary life.

Muscle-strengthening exercises maintain or increase muscle mass. When muscle mass is greater, more calories are burned (as part of general metabolism) even during periods of rest.

Muscle-strengthening exercises strengthen the bones to which these muscles are attached. Many muscle-strengthening exercises are load-bearing; these exercises contribute even more to strengthening bones. Stronger bones are less likely to fracture with impact or other injury. This is especially important in older persons who are vulnerable to falls and fractures.

Stronger muscles keep older persons mobile and independent for longer. Quality of life is improved.

Examples of Muscle-Strengthening Exercises

Some muscle-strengthening exercises, such as using dumbbells, have a low cardiorespiratory element. Some muscle-strengthening exercises, such as climbing stairs, have a high cardiorespiratory element. Because measuring the heart rate can be difficult during exercise, you can assess the cardiorespiratory element based on your respiratory rate.

Examples of muscle-strengthening exercises include lifting dumbbells or barbells, doing push-ups, pull-ups, sit-ups, crunches, squats, and planks, climbing stairs, and going up and down on the balls of the feet. Different muscle-strengthening exercises strengthen different groups of muscles.

Pay attention to the body to understand which groups of muscles are participating in the exercise. For example, lifting weights strengthens the upper limbs but also the muscles of the shoulders and trunk. Cycling, which is generally viewed as a cardiorespiratory exercise, strengthens the muscles of the legs.

Use dumbbells in different ways to strengthen different muscle groups in the upper body. When exercising for health, a pair of dumbbells weighing 2–5 kg each (depending on personal comfort) suffices; in fact, owning even a single dumbbell in this weight range suffices.

Remember that using weights that are too light may not exercise the muscles much; and that weights that are too heavy increase the musculoskeletal risks associated with exercise. Older persons should use lighter weights and lower resistance settings.

It is important to learn how to use weights correctly partly to benefit from the exercises but more to avoid musculoskeletal risk. As an example, when lifting weights, the back should be held straight and rigid, the weights should be picked up from a half-squatting position, and the knees and hips should then be straightened. Thus, the load is taken by the muscles of the lower limbs rather than by the muscles of the back. Afterward, the weights should be raised and lowered with smooth movements; jerking can result in muscle injury.

Initial muscle-strengthening sessions are best conducted with guidance from somebody who is experienced. Guidance is also available in the form of YouTube videos.

Ankle Weights

Using ankle weights is acceptable for indoors workouts. For example, with the weights around the ankles, you can raise and lower your legs while seated in a chair.

Ankle weights are best not used while walking and especially not while running. This is because you will not walk or run naturally with weights around your ankles, and so you will be at risk of musculoskeletal injury. Ankle weights could especially impair recovery of balance if you stumble.

Strengthening the Muscles of the Legs

Cycling, besides being a cardiorespiratory exercise, strengthens the muscles of the legs.

An exercise that can be performed almost anywhere, almost anytime during waking hours, and especially during bits and pieces of time, or as a break from work, is rising and descending on the balls of the feet, performed as repetitions.

Rise and descend slowly; that is, in a controlled fashion, so that the tension in the calf muscles is noticeable during both raising and lowering phases.

Do this to a set count or for a set number of minutes or for whatever time is available.

If you do this with your eyes closed, it will serve as a balancing exercise besides also strengthening the muscles of the side of the legs. These muscles play an important role in body stability when upright, and hence in balance.

Isotonic and Isometric Exercises

An isotonic exercise produces a movement at a joint. The muscles shorten when they contract and lengthen when they relax. For example, biceps curls with dumbbells are isotonic. Cardiorespiratory exercises and exercises with weights are generally isotonic exercises. Otherwise expressed, isotonic exercises can be cardiorespiratory or muscle-strengthening in nature.

An isometric exercise is one where the muscles tense but neither shorten nor lengthen; that is, they hold the limb or body in a specific position. Isometric exercises are generally muscle-strengthening in nature.

Push-ups and sit-ups are isotonic; the body moves at joints. Planks and wall squats are isometric; the body is held in positions. Many yoga exercises are also isometric because they hold the body in specified positions.

Isometric exercises strengthen muscles but may not have benefits for movements in real life unless the held positions are relevant to the individual's real-life activities (an unlikely scenario).

An advantage of isometric exercises is that, by avoiding movement at joints, they strengthen muscles without causing repetitive stress at joints. Thus, isometric exercises may be recommended by physiotherapists.

Like other muscle-strengthening exercises, isometric exercises are also, usually, performed in repetitions and sets.

Isometric exercises need to be correctly performed to avoid muscle injury due to overstrain.

As a special note, yoga postures need to be correctly performed because some postures can strain muscles and ligaments or risk other injuries such as intervertebral disk prolapse.

Load-bearing Exercise

Load-bearing exercise helps strengthen bones.

Lifting weights is an example of load-bearing exercise. You don't need to actually lift weights in the gym to do load-bearing exercise. Carrying bags of groceries or carrying a loaded backpack when you walk are load-bearing. In fact, walking and climbing stairs are also load-bearing because your body acts as the load.

Note that when your body is the load, only the muscles and bones of the spine and lower limbs are strengthened. When you carry weights or grocery bags, the muscles and bones of the upper limbs are additionally strengthened.

Balancing Exercises

Good balance and the ability to quickly recover balance are important to avoid falls and injuries related to falls. This is especially important among the elderly because muscles weaken and reflexes slow down with age and because bones become more fragile and are more vulnerable to fracture.

Balance is automatically improved by exercises that strengthen the muscles of the lower limbs and trunk.

Balance can also be improved by performing balancing exercises. Tai chi and yoga, systems of exercise that involve slow movement and holding positions, can improve balance.

There are other, simpler, ways of performing balancing exercises, especially in bits and pieces of time

across the day. For example, you can go up and down on the balls of your feet with your feet close together; doing this with your eyes shut is even better. Or, you can practice standing on one foot; alternate feet periodically when performing this exercise. And, doing this exercise with your eyes shut is harder but is worth trying.

Improving Performances

It is wise to start an exercise program at well below peak capacity; for example, at about 40%–50% of capacity. This is like testing the waters. When you are comfortable, such as after a week or two, you can move to a higher level. This was discussed in an earlier section.

Capacity, here, is your subjective view of what you feel you can do. Capacity increases as your fitness improves. So, in order to maintain or further improve fitness, you will necessarily need to move to higher levels of exercise in terms of what you objectively do (see the next point).

Moving to a higher level could involve increasing the number of steps you walk or pedaled in a fixed time, increasing the distance you run in a fixed time, increasing the speed at which you walk or pedal or run a fixed number of steps or a fixed distance, increasing the number of repetitions you perform, or combinations of these; whatever you are comfortable with.

You are unlikely to improve steadily, week by week. You are more likely to improve in a stepladder fashion. That is, you hit a plateau for a few weeks, then suddenly improve a little, then hit another plateau, and so on. How fast you improve depends on how much you put into your workout and how regular you are. Remember that, when exercising for health, you don't need to push hard; just doing what you can is itself of value.

Initially, you will improve in large steps. That is because there is plenty of room for improvement. Later, you will improve in smaller steps. This is because there is less room for improvement. Thus, improvement in terms of distance, speed, and other objective parameters follows the law of diminishing returns. This probably applies to the health benefits, too, so your target should be exercising at 80% capacity during an exercise session and reaching 80% of what you might eventually be capable of. If you are ambitious, do exercise harder, but, to guard against exercise-related risks, avoid exercising at > 90% capacity as the average for the session.

Everybody has a ceiling above which improvement is not possible. A rule of thumb for speed is that you can improve capacity by about 20% from baseline. With regard to number of steps or distance covered, or number of repetitions performed, it is possible to improve by 100% and more.

Note that your capacity and performance on a given day will vary depending on adequacy of sleep, food intake before the workout, caffeine intake before the workout, time of day, ambient temperature, clothing, footwear, equipment, setting on the equipment, frame of mind, and a range of other factors.

Exercise and the Mind

Some mental strength is necessary to start exercising, to begin the workout for the day (especially if what is planned is hard), and to perform and complete the workout as planned.

Motivating yourself for exercise is a matter for the mind. This was discussed in greater detail in the preceding article.[3]

If you do easy workouts, try to push the speed just a little above your comfort zone. Or, do a little extra, beyond your target. Even if it is by only a few percent, that little extra can give you much satisfaction.

If you plan to do vigorous exercise, you need to be mentally prepared for the workout. Focus on the present moment, focus on keeping on going, focus on taking just the next few steps rather than on the mountain ahead. Remember that you can push through fatigue (but don't push through pain). This is because the mind tends to give up long before the body is exhausted.

Slow down or take a short break, if you need, but don't quit. Quitting is mentally demoralizing and can become a habit.

Do what you hate or dread; this will make you mentally stronger.

Special Purpose Workouts

So far, the discussion has focused on working out for health and on doing a bit more for those who are more ambitious. What if you want to train for a special purpose? Then, your workouts should prepare you for what you plan to do. This is rather obvious; yet, it is surprising how many people plan to go on long hikes, or high-altitude treks, with insufficient preparation.

In order to help you understand, imagine that you want to trek or climb at high altitude. Because mountaineers require to tolerate rapid heart rate and rapid respiration associated with exercise and with oxygen starvation at high altitude, you need to perform high intensity interval training where your heart rate rises high and you gasp for breath during repetitions.

Because mountaineers must climb for long periods carrying loaded backpacks, your trunk and lower limbs require strength training such as through climbing steps for at least 1–2 hours with a loaded backpack.

Because mountaineers need to balance on rocks and irregular surfaces, you need to perform leg and foot strengthening exercises as well as balancing exercises.

Because mountaineers need to go on for long hours with only short breaks for rest, you need to perform long continuous cardiorespiratory workouts.

If people cannot walk for 12 hours in a day after a good night's sleep at sea level, how could they expect to go for 30 hours or longer without sleep in oxygen-depleted air at high altitude, doing a long and grueling summit climb that starts at night followed by a careful descent to camp!

Parting Notes

If you want to stay at the weight that you have reached through dieting you must continue with the diet; this is so with exercise, as well. You need to be regular with exercise to maintain fitness and health.

If you work out conscientiously and regularly, missing the occasional day will not be a problem.

If you have less time for your session, try to compensate by doing a more vigorous workout.

If you are tired, overworked, short of time, or just not in the mood for any reason, you can do a cheat workout; that is, do whatever you can in the time that you have. Anything is better than nothing.

When exercising for health, whatever you do, whenever you do it, and wherever you do it all counts toward ensuring not just your health and well-being in the moment but your health, independence, and quality of life in the future.

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Author Affiliations: Department of Clinical Psychopharmacology and Neurotoxicology, National Institute of Mental Health and Neurosciences, Bangalore, India (candrade@psychiatrist.com).

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