# Life lies in movement

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**Abstract:** Exercise is an important means of maintaining health and occupies a vital position among factors affecting lifespan. Cases of long-lived populations in mountainous areas also confirm that long-term labor activities are beneficial to longevity. Insufficient physical activity among residents worldwide has become a prominent issue, causing a huge disease burden and economic losses. Moderate exercise can improve cardiopulmonary and skeletal functions, regulate blood lipids and glucose, reduce the risk of chronic diseases such as cardiovascular and cerebrovascular diseases, tumors, diabetes and depression, and enhance cognitive ability. Exercise should follow the individualized principle and be carried out in accordance with exercise prescriptions covering elements including exercise type, intensity, duration, timing and frequency. Aerobic exercise is suitable for the general population. Heart rate can be used to simply control exercise intensity. Afternoon or evening exercise is preferred, with at least 3 to 4 sessions per week. Meanwhile, exercise carries certain risks. Medical evaluation should be completed before exercise. People should proceed step by step, act within their capacity, pay attention to physical responses, regularly monitor relevant indicators, control weight loss speed, abide by various safety precautions, and carry out exercise scientifically and persistently to obtain health benefits.

**Keywords:** Exercise, Exercise Prescription, Aerobic Exercise, Chronic Diseases, Health, Physical Activity

## 1. Introduction

### 1.1. Mountain longevity: labor fosters longevity

"Life lies in movement" is the second of the "Four Cornerstones of Health" recommended by the World Health Organization. Studies show that the five major factors affecting lifespan are mindset, exercise, diet, environment and genes, with exercise ranking second. Among the three elements of healthy living proposed by American expert Strand Rd — aerobic exercise, healthy diet and nutritional supplementation, exercise ranks first. This demonstrates the great importance of exercise to health.

Farmers in rural areas, especially mountainous regions, have far poorer economic, nutritional, material and living conditions than urban residents, yet there are far more centenarians among them. Though multiple factors are involved, "being active" is the primary contributor to longevity. I once met a 97-year-old Hani woman in Honghe Prefecture, Yunnan Province. She carried a wicker basket and supported a 105-year-old elderly woman as they walked along a rural path. In ethnic minority areas of southwestern Guizhou, villagers in one village have an average age of 86. Many seniors still work in farmlands and carry dozens of jin of agricultural products to markets for sale. Chengkou County in Chongqing was once a poor county. The government relocated farmers from high mountains to lower areas to improve living conditions, but an 87-year-old woman refused to move. She often descended the mountain and climbed back up carrying goods weighing more than 30 jin, sometimes twice a day. I estimate her residence stands over 300 meters above the foot of the mountain, equivalent to climbing more than 100 floors of stairs. I have witnessed many similar cases.

### 1.2. Global physical inactivity and its health and economic burden

Data released by the World Health Organization in 2016 showed that over 80% of adolescents and 23% of adults worldwide had insufficient physical activity. Sufficient physical activity could prevent 300,000 cases of dementia globally each year. Across 142 countries (representing 93.2% of the global population),

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healthcare systems spent 53.8 billion International Dollars (INT$) on the problem of insufficient physical activity in 2013. In addition, deaths related to insufficient physical activity caused a loss of 13.7 billion in the labor market and 13.4 million Disability-Adjusted Life Years (DALYs) worldwide.



Figure 1

## 2. Benefits of exercise

In the 1980s, the US Surgeon General issued a statement pointing out that the benefits of moderate exercise include weight reduction, blood pressure lowering, increased bone mass and reduced osteoporosis, elevated levels of "good" high-density lipoprotein, lowered levels of "bad" low-density lipoprotein, reduced triglyceride (fat) levels, improved physical fitness and coordination, lower risk of falls, enhanced insulin sensitivity, strengthened immune system and improved general well-being. The World Health Organization states the health benefits of adequate physical activity: regular and moderate physical activity can improve muscular and cardiopulmonary function, boost bone and functional health, reduce the risks of hypertension, coronary heart disease, stroke, diabetes, breast cancer, colorectal cancer and depression, cut the risk of falls and hip or vertebral fractures, and play a vital role in energy balance and weight control.

Published online in the British Medical Journal on August 9, 2016: Physical activity of 3000 MET (metabolic equivalent) minutes per week can reduce the risks of cancer, heart disease, stroke and diabetes (MET refers to the ratio of metabolic rate during exercise to that at rest). When physical activity increases by 600 to 3600 MET minutes per week, the combined risk of five diseases including ischemic heart disease, stroke, diabetes, breast cancer and colorectal cancer decreases by 19%. Weekly physical activity of 3000 MET minutes can be achieved by combining several types of daily activities within a day: 10 minutes of stair climbing, 20 minutes of running, 25 minutes of walking or cycling, 20 minutes of gardening and 15 minutes of vacuuming. The study indicates that 3000 to 4000 MET minutes per week (5 to 6 times the WHO recommendation, equivalent to 150 minutes of brisk walking or 75 minutes of jogging daily) is more helpful for preventing chronic diseases. Moderate-intensity physical activity (60–75 minutes per day) can offset the elevated mortality risk caused by sedentary behavior. A study from the University of Illinois found that brisk walking three times a week for 50 minutes each time sharpens thinking. Aerobic exercise accelerates heart rate, and some movements require limb coordination, which can activate the cerebellum, facilitate thinking and raise the speed of cognition and information processing.

## 3. How to exercise moderately

Since individual conditions vary by gender, age, physical fitness and underlying diseases, exercise requires prescriptions (guidance), especially exercise for therapeutic purposes. Assessment prior to exercise is a prerequisite for formulating an exercise prescription, covering evaluations of physiological function, psychological status and social function. It should be recognized that exercise is a double-edged sword: it offers substantial benefits yet carries risks if performed improperly.

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### 3.1. Exercise prescription

Forms of exercise: aerobic exercise, resistance exercise, and balance, coordination and flexibility training;exercise intensity;exercise duration; exercise frequency.

Exercise therapy requires moderation and perseverance.

### 3.2. Five basic components of exercise prescription

Exercise type, exercise intensity, duration, timing and frequency.

Attention should be paid to individual conditions. For the elderly in particular, prior baseline activity levels and the functional status of the heart, lungs, brain and other organs of exercisers shall be considered. The principles of individualization and gradual progression should be followed, with consideration of one's job nature and general physical condition.

### 3.3. Exercise type

It is divided into aerobic exercise and anaerobic exercise. Aerobic exercise is characterized by low intensity, rhythmicity, continuity and long duration. The oxygen consumption during exercise equals 40%–60% of the maximum oxygen uptake, or the exercise heart rate reaches 70%–80% of the maximum heart rate. Aerobic exercise is a very convenient and inexpensive form of training, such as brisk walking, jogging or cycling, which generally requires no fitness equipment. Muscle tissues use free fatty acids at a relatively high proportion during aerobic exercise, which exerts marked effects on strengthening cardiovascular and respiratory functions and improving glucose and lipid metabolism.

Anaerobic exercise refers to short-duration, high-intensity physical activity where oxygen consumption exceeds oxygen intake, and the body relies mainly on anaerobic metabolism for energy supply.



Figure 2

### 3.4. Exercise intensity

Diet therapy and exercise form the foundation for weight reduction. A reduction of 7,700 kilocalories in calorie intake leads to a loss of 1 kg of fat. With daily exercise consuming 300 kilocalories, 4.5 kg of body weight can be lost within four months. Each 1% reduction in body weight lowers serum transaminase levels by 10%, and a 10% weight loss can improve the histological changes of fatty liver. However, rapid weight loss exceeding 5 kg per month may induce steatohepatitis. Aerobic exercise should last over 30 minutes per session, 3 to 5 times weekly. For young and middle-aged patients, more than 6 hours per week is recommended whenever possible. Exercise at an intensity of 60% of maximum oxygen uptake yields the most prominent effects in weight and lipid reduction, while exercise below 40% of maximum oxygen uptake fails to produce weight-loss effects.

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Since maximum oxygen uptake is closely correlated with maximum heart rate, heart rate or pulse is commonly used to gauge intensity targets. The target heart rate for patients during exercise should be maintained at "170 minus age" and shall not exceed "200 minus age". For example, for a 50-year-old person, 170-50=120 beats, meaning the post-exercise heart rate (pulse) should stay below 120 beats per minute. If the post-workout heart rate is close to the predicted value, the exercise volume is appropriate. A reading more than 5 beats below this value indicates insufficient exercise intensity; more than 5 beats above it means excessive intensity. Another viewpoint suggests that proper exercise leads to accelerated pulse lasting over 30 minutes, with fatigue fading within 10–20 minutes after exercise. Alternatively, suitable exercise can be judged by accelerated breathing and slight sweating, followed by continued activity for a period.

### 3.5. Exercise duration

It may start with 10 minutes and gradually extend to 30–40 minutes, with necessary intervals inserted. The duration of exercise is related to the consumption of energy substrates. During prolonged moderate-intensity exercise, the proportion of energy supplied by lipid oxidation rises. For instance, when exercise lasts 30 minutes, free fatty acid oxidation accounts for 50% of energy expenditure; with 2 hours of exercise, free fatty acid oxidation contributes 62% of energy, while carbohydrate oxidation drops to approximately 30%.

### 3.6. Timing of exercise

Studies show that with identical exercise types and intensity, afternoon or evening workouts burn 20% more energy than morning sessions. Therefore, afternoon or evening is the preferred time for exercise. The optimal walking time is 45 minutes after dinner, when calorie consumption peaks and weight loss effect is the best.

Patients with diabetic fatty liver should avoid exercising on an empty stomach or immediately after meals. Exercise is suitable shortly after meals. When exercising postprandially, they should also steer clear of the peak effect of medications to prevent hypoglycemia.

### 3.7. Exercise frequency

Regular weekly exercise is recommended. Due to various factors, physical activity should be performed at least 3 to 4 times per week. If the exercise interval exceeds 3 to 4 days, the cumulative benefits of exercise will diminish, and desired outcomes are hard to achieve. Noticeable effects can only be obtained after at least 6 to 8 weeks of training. Patients need to persist to maintain exercise benefits. The US Centers for Disease Control and Prevention and the American College of Sports Medicine recommend that accumulating total exercise time and volume through low-volume, short and multiple sessions can also achieve favorable effects.

### 3.8. Precautions for exercise

A medical examination must be conducted before exercise to assess the functional status of the heart, lungs, brain and other organs, as well as the presence of underlying diseases and related complications.

Strictly abide by the basic principles of exercise: gradual progression, acting within one’s capacity, individualization and tailored management.

Hypoglycemia should be prevented during exercise.

Pay attention to exercise volume. Signs of appropriate exercise volume include slight sweating and mildly accelerated breathing during exercise, mild fatigue after activity, heart rate returning to pre-exercise levels within 5–10 minutes, good mental state and sound sleep. Severe fatigue, limb soreness and poor appetite after exercise indicate excessive exercise volume.

Regularly measure body weight, waist circumference, body fat, blood lipids, blood glucose and liver function to evaluate the efficacy of exercise therapy.

Weight loss for patients with obese fatty liver should not be too rapid; weekly weight reduction should be less than 0.5 kg. Rapid weight loss may instead aggravate hepatic steatosis. Fat accumulation in the body occurs gradually, and effects generally appear after at least six weeks of exercise.

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Patients should prepare a medical card before exercise, stating name, address, telephone number, emergency contact, medical history and disease diagnosis, and wear it during exercise for timely rescue in case of accidents.

Avoid cold or hot baths immediately after heavy sweating from exercise.

## 4. Conclusion

In summary, regular and moderate physical activity is of great significance for disease prevention, life extension, and the improvement of body metabolism and cognitive function, while insufficient physical activity significantly raises the risk of various chronic diseases. Exercise is a double-edged sword; more exercise does not always mean better outcomes. An individualized exercise prescription should be formulated according to age, physical fitness and underlying diseases, with proper selection of exercise types and control over exercise intensity, duration, time and stable exercise frequency. Health assessment shall be completed before exercise. Physical sensations should be monitored during exercise, and indicators such as body weight, blood lipids, blood glucose and liver function should be reviewed regularly. By following exercise safety rules, exercising step by step and persisting in scientific physical activity, people can fully realize the health benefits of exercise, avoid injuries caused by improper exercise, and achieve the goals of maintaining physical health as well as preventing and treating chronic diseases.

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