CONDITION

# Type V glycogen storage disease

An inherited muscle condition that prevents stored glycogen from being used normally during exercise.

**WHAT IT IS**
Inherited condition affecting muscle energy use during exercise

**BODY SYSTEM**
Skeletal muscles

**MAIN SYMPTOMS**
Exercise intolerance, muscle pain, cramps, dark urine

**WHAT CAUSES IT**
Inherited PYGM gene changes

**HOW IT IS DIAGNOSED**
PYGM genetic testing; sometimes muscle biopsy and enzyme testing

**MAIN TREATMENT**
Tailored aerobic training and exercise-energy planning

**CAN IT BE CURED?**
No - the gene change remains lifelong

**IS IT AN EMERGENCY?**
Sometimes - severe muscle breakdown with reduced urine

**LONG-TERM OUTLOOK**
Usually normal lifespan with careful activity management

## Overview

Type V glycogen storage disease is an inherited condition affecting how skeletal muscles obtain energy. Skeletal muscles are the muscles you use to walk, lift, climb, and perform other voluntary movements.

Your muscles normally store glucose as glycogen. During activity, an enzyme called muscle glycogen phosphorylase helps release this stored energy. In this condition, the enzyme does not work properly or is missing. As a result, muscles cannot easily use their glycogen during exercise.

Symptoms are most noticeable during the first minutes of activity or during sudden, intense effort. Muscle pain, early fatigue, and cramps may make exercise difficult. Some people develop muscle breakdown after strenuous activity.

The condition does not usually affect the liver's control of blood glucose. Many people can remain active once they learn how to pace exercise, warm up gradually, and recognise their limits.

## Symptoms

Symptoms often begin in childhood, but diagnosis may not happen until adulthood. Their severity differs between people and may change according to fitness, activity, illness, hydration, and other factors.

Common symptoms include:

A distinctive feature is the second-wind effect . After slowing down or resting briefly, you may find that the same activity becomes easier. This happens because the muscles begin receiving more energy from glucose carried in the blood and from fat.

Activities involving sudden or forceful effort are often the hardest. Examples include sprinting, lifting a heavy object, pushing a stalled vehicle, or holding a muscle tightly contracted. Longer activity may be better tolerated when it begins gently and remains at a manageable pace.

Some adults develop ongoing weakness, particularly around the shoulders or hips. This is not experienced by everyone and is more often reported later in life.

- Muscle pain, heaviness, or burning soon after exercise begins
- Rapid muscle fatigue during climbing, running, lifting, or walking uphill
- Painful cramps or muscles that temporarily become stiff and difficult to move
- Needing to slow down or stop after a short burst of activity
- Dark brown, red, or tea-coloured urine after muscle injury

## Causes and risk factors

Type V glycogen storage disease is caused by harmful changes in the PYGM gene. This gene provides instructions for making muscle glycogen phosphorylase, the enzyme needed to release glucose from glycogen inside muscle cells.

The condition has an autosomal recessive inheritance pattern. This means you usually need to inherit one altered copy of the gene from each biological parent. Parents who each carry one altered copy generally do not have the condition themselves.

If both parents are carriers, each pregnancy has:

These probabilities start again with every pregnancy. They do not predict what will happen across a particular family.

The main risk factor is having biological parents who both carry a disease-causing PYGM change. A known family history increases the chance, but the condition can also be diagnosed without one. It is not caused by diet, lack of exercise, or anything a parent did during pregnancy.

- A 1 in 4 chance of the child having the condition
- A 1 in 2 chance of the child being a carrier
- A 1 in 4 chance of the child inheriting neither altered copy

## Diagnosis

Symptoms such as exercise-related pain and cramps can have many causes. A healthcare professional will usually ask when symptoms begin during activity, what types of effort trigger them, and whether slowing down produces a second wind. Dark urine and a family history are also important clues.

Blood testing often measures creatine kinase , or CK. CK is an enzyme released from muscle. It may remain above the usual range even when you feel well, and it can rise much further after muscle injury. A raised CK supports the need for investigation but does not confirm this condition by itself.

Diagnosis is usually confirmed through genetic testing that finds disease-causing changes in both copies of the PYGM gene.

If genetic results are uncertain, additional testing may include:

A genetic counsellor can explain what results mean for you and your biological relatives. Relatives should not assume they have the condition based on symptoms alone.

- A controlled exercise test that measures the body's response to activity
- A muscle biopsy, in which a small tissue sample is examined
- Testing muscle tissue for glycogen phosphorylase activity

## Treatment and management

There is currently no established treatment that replaces the missing muscle enzyme or removes the underlying gene changes. Management focuses on improving exercise tolerance

and preventing severe muscle injury.

Regular, moderate aerobic exercise can help your muscles use energy from blood glucose and fat more efficiently. Walking, gentle cycling, and swimming may be suitable examples. An exercise plan is usually built up gradually with guidance from a clinician or physiotherapist familiar with metabolic muscle conditions.

A gradual warm-up is important. Starting slowly gives blood flow and alternative energy sources time to reach the muscles. If pain or marked fatigue begins, slowing down or pausing may allow a second wind. Trying to push through severe pain can increase muscle injury.

Sudden, high-intensity or sustained muscle effort carries more risk. Sprinting, heavy lifting, forceful pushing, and holding a heavy object still may need to be limited or adapted. This does not mean avoiding all physical activity. Long-term inactivity can reduce fitness and make ordinary tasks harder.

A specialist dietitian may help plan food around activity. A small amount of simple carbohydrate shortly before planned exercise can improve tolerance for some people by providing glucose in the bloodstream. It is not a cure and is not appropriate in the same way for everyone, especially for someone with diabetes, dental concerns, or weight-management needs. High-protein diets, supplements, and vitamins have not been shown to restore the missing enzyme.

If serious muscle breakdown occurs, hospital treatment may include fluids through a vein, urine monitoring, and repeated blood tests. These measures help protect the kidneys and identify changes in body salts such as potassium.

Before surgery, tell the surgical and anaesthetic team about the condition. Fasting, physical stress, and some procedures may require additional planning.

Useful parts of ongoing care can include:

- Review by a metabolic or neuromuscular specialist
- A personalised exercise and pacing plan
- Dietetic advice linked to activity needs
- Genetic counselling for family or pregnancy planning
- A written plan for episodes of dark urine or severe muscle pain

## Complications

The main acute complication is rhabdomyolysis , meaning rapid breakdown of injured muscle.

Damaged muscle releases a protein called myoglobin into the blood and urine. This can turn urine brown or red.

Large amounts of myoglobin can damage the kidneys. Severe muscle breakdown can also disturb potassium and other body salts, which may affect the heart. Early assessment and fluids can reduce these risks.

Repeated pain may lead some people to avoid activity. Over time, reduced activity can lower aerobic fitness and make symptoms occur with less effort. A carefully supervised exercise programme can help interrupt this cycle.

Falls, strains, or other injuries can happen if muscles suddenly cramp or stop responding during activity. Some older adults develop lasting muscle weakness, although this is not inevitable.

## Prevention

The inherited gene changes cannot currently be prevented or reversed.

Genetic counselling can explain inheritance and reproductive options, but it cannot change whether an affected person already has the condition. Carrier testing may be available for adult biological relatives when the family's PYGM changes are known.

Although the condition itself cannot be prevented, muscle injury can often be reduced. Gradual warm-ups, regular aerobic conditioning, pacing, adequate hydration, and avoiding sudden maximal effort are central parts of risk reduction.

## Living with it and what to expect

Type V glycogen storage disease is lifelong, but it is not usually progressive in the way many muscle-wasting conditions are. The enzyme problem remains, yet fitness and day-to-day function can improve when activity is planned around how the muscles obtain energy.

You may continue to have difficulty with sudden, intense effort even when well conditioned. Learning to recognise early pain and the second-wind effect can make work, travel, school, and recreation more manageable.

Many people can take part in regular aerobic activity. Practical adjustments may include allowing time for a gentle warm-up, using lifts for several flights of stairs, breaking up carrying tasks, or avoiding jobs that require repeated maximal lifting. Schools and workplaces may be able to provide reasonable adjustments.

Symptoms may become more troublesome after inactivity, illness, injury, or a major change in

routine. Returning to exercise gradually is safer than trying to restart at a previous level immediately.

Some people have occasional episodes of muscle breakdown, while others rarely or never have one. Keeping a record of triggers can help identify safer activity patterns. A medical identification card or emergency information stored on your phone may be helpful.

Life expectancy is generally not reduced when severe complications are recognised and treated. However, no individual course can be guaranteed. Regular follow-up is useful for reviewing exercise tolerance, muscle weakness, episodes of dark urine, and changes in daily function.

## When to get medical help

Arrange a routine medical appointment if you have repeated exercise-related muscle pain, cramps, or unusual fatigue, particularly if symptoms improve after briefly slowing down. These symptoms have several possible causes and need proper assessment rather than self-diagnosis.

If you already have the condition, arrange follow-up when:

Seek urgent same-day medical care for dark brown or red urine after exercise. This may be myoglobin from muscle breakdown, even if the muscles no longer feel painful.

Go to an emergency department or call emergency services if dark urine occurs with very little urine, severe or worsening muscle pain, major swelling, profound weakness, fainting, confusion, persistent vomiting, or an irregular or racing heartbeat. These features may indicate severe muscle breakdown, kidney injury, dehydration, or abnormal body salts.

While waiting for help, stop exercising. Do not try to "work through" severe pain.

- Symptoms are becoming more frequent or limiting daily activities
- You develop new, lasting weakness
- Your usual exercise plan is no longer manageable
- You have repeated mild episodes of dark urine
- You are planning pregnancy, surgery, or a major change in training

## Common questions

Is type V glycogen storage disease a form of diabetes?

No. Both involve glucose, but they are different conditions. Type V glycogen storage disease affects the release of glucose stored inside skeletal muscle. Diabetes mainly affects blood glucose control because of problems with insulin.

Why does exercise sometimes get easier after a few minutes?

This is the second-wind effect. At first, your muscles try to use stored glycogen and cannot do so effectively. After you slow down, increased blood flow supplies glucose and fat that the muscles can use as alternative fuels.

Can I exercise with this condition?

Usually, yes. Regular moderate aerobic activity is an important part of management. Exercise should begin gently and increase gradually. Sudden maximal effort and sustained heavy muscle contractions are more likely to cause pain or injury.

Does dark urine always mean kidney damage?

No, but it can mean that damaged muscle has released myoglobin. Myoglobin can injure the kidneys, and you cannot judge the risk from urine colour alone. Dark urine after exercise needs urgent medical assessment.

Can changing my diet cure it?

No diet can restore the missing enzyme or change the PYGM gene. Food planning may improve exercise tolerance, particularly when carbohydrate intake is timed around planned activity. This should be tailored to your overall health and activity level.

Will my children inherit it?

An affected person passes one altered PYGM copy to each biological child. Whether a child develops the condition also depends on the other biological parent's genes. If that parent is not a carrier, the children are expected to be carriers rather than affected. Genetic testing and counselling can clarify the chances for a particular family.

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