

# Multiple Sclerosis (MS)

## Central Nervous & Immune System

### What is MS?

NIH

Image:

### Multiple Sclerosis

Mayo Clinic

### What is multiple sclerosis?

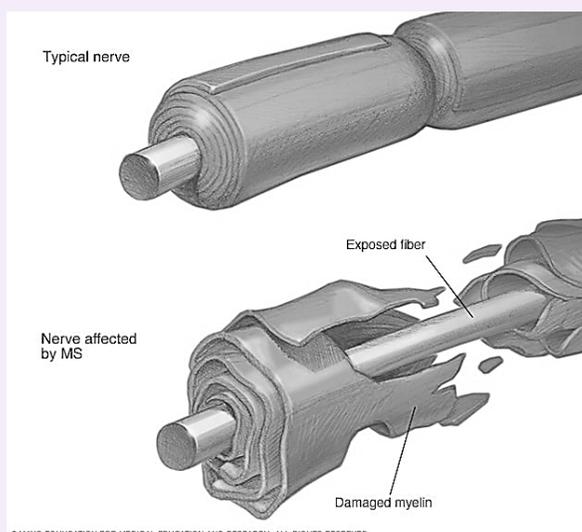
Multiple sclerosis (MS) is a chronic neurological disorder.

- It is an autoimmune disorder, meaning that in MS the immune system—which normally protects us from viruses, bacteria, and other threats—mistakenly attacks healthy cells.
- MS symptoms usually begin in young adults, between the ages of 20 and 40.
- MS affects people differently. A small number of people with MS will have mild symptoms with little disability, whereas others will experience worsening symptoms that will lead to increased disability over time.
- Most people with MS have short periods of symptoms that resolve fully or partially after they appear. These periods are followed by long stretches without noticeable symptoms.
- Most people with MS have a normal life expectancy.

### Myelin and the immune system

In MS, the immune system attacks myelin in the central nervous system.

- Myelin is a mixture of protein and fatty acids that makes up the protective cover (known as the myelin sheath) that coats nerve fibers (axons).
- Myelin is what gives the brain's white matter its whitish appearance and helps with communication between neurons.
- The central nervous system is made up of the brain, the spinal cord, and the optic nerves, which connect the eyes to the brain



In addition to causing damage to the myelin sheath, MS also damages the nerve cell bodies, which are found in the brain's gray matter, as well as the axons themselves.

- As the disease progresses, the outermost layer of the brain, called the cerebral cortex, shrinks. This process is known as cortical atrophy.
  - The way that cortical atrophy happens in MS may connect it with some neurodegenerative disorders.
- Sclerosis is a medical term for the distinctive areas of scar-like tissue (also called plaques or lesions) that result from the attack on myelin by the immune system.
  - These areas are visible on an MRI (magnetic resonance imaging). The patches of scar-like tissue can be as small as the head of a pin or as large as a golf ball.
- The symptoms of MS depend on the severity of the attacks as well as the location and size of the plaques.

## Types of Multiple Sclerosis

### Types of MS

*NIH*  
and  
**Multiple Sclerosis**  
*Mayo Clinic (MC)*

#### **Types of multiple sclerosis - (NIH)**

The course of MS is different for each person, which makes it difficult to predict how an individual will do with the disease.

While many different courses or progressions of MS have been used over the years, these are changing as the scientific and medical community better understands different ways the disease can progress.

Currently, the five courses used to describe MS are:  
(see both *NIH* and *MC*)

**CLINICALLY ISOLATED SYNDROME (NIH)**—Symptoms come from a single attack (also called "exacerbation" or "relapse") followed by complete or near-complete recovery.

- MRI and other tests, such as a spinal tap or electrical vision tests, may show "silent" damage in other places in the central nervous system.
- If this damage is identified, it could allow a full diagnosis of MS even after a single attack.

#### ***Clinically isolated syndrome - (MC)***

Clinically isolated syndrome refers to the first episode of a condition that affects the myelin.

- After further testing, clinically isolated syndrome may be diagnosed as MS or a different condition.

**RELAPSING-REMITTING MS (NIH)**—Symptoms come in the form of recurrent attacks with total or partial recovery.

- The periods of disease inactivity between MS attacks are referred to as remission.
- Weeks, months, or even years may pass before another attack occurs, followed again by a period of inactivity.
- Treatment with disease-modifying therapies can reduce the frequency of attacks or eliminate them entirely. Most people with MS are initially diagnosed with this form.

#### ***Relapsing-remitting MS - (MC)***

Most people with multiple sclerosis have the relapsing-remitting type.

- They experience periods of new symptoms or relapses that develop over days or weeks and usually improve partially or completely.
- These relapses are followed by quiet periods of disease remission that can last months or even years.

**SECONDARY-PROGRESSIVE MS**—Relapsing-remitting MS can gradually evolve into secondary-progressive MS.

- Attacks become less and less common but may still occur, and people gradually develop steady symptoms with deterioration in their functioning over time.
- Secondary-progressive MS with attacks is called "active," whereas secondary-progressive MS without attacks is called "non-relapsing."
- Disease-modifying therapy for relapsing-remitting MS can delay and sometimes prevent secondary progressive MS, but the transition can occur even with treatment.

<p><b>Types of MS</b></p> <p><i>Continued</i></p> <p><i>NIH</i> and <b>Multiple Sclerosis</b> <i>Mayo Clinic (MC)</i></p> <p><b>Rare MS Variants</b> Cleveland Clinic <i>Multiple Sclerosis</i> <i>(MS)</i></p>	<p><b><i>Secondary-progressive MS</i></b> (MC) At least 20% to 40% of people with relapsing-remitting multiple sclerosis can eventually develop a steady progression of symptoms.</p> <ul style="list-style-type: none"> <li>• This progression may come with or without periods of remission and happens within 10 to 40 years of disease onset. This is known as secondary-progressive MS.</li> <li>• The worsening of symptoms usually includes trouble with mobility and walking.</li> <li>• The rate of disease progression varies greatly among people with secondary-progressive MS.</li> </ul> <p><b>PRIMARY-PROGRESSIVE MS</b> (NIH) —This course of MS is less common and is characterized by progressively worsening symptoms from the beginning, with no noticeable acute attacks, although there may be temporary or minor worsening of, or relief from, symptoms.</p> <p><b><i>Primary-progressive MS</i></b> (MC) Some people with multiple sclerosis experience a gradual onset and steady progression of signs and symptoms without any relapses.</p> <ul style="list-style-type: none"> <li>• This type of MS is known as primary-progressive MS.</li> </ul> <p><b>RADIOLOGICALLY ISOLATED SYNDROME</b> (NIH)—This is the rarest course of MS in which a person has abnormal MRI results that look like MS, but doesn't have MS symptoms.</p> <ul style="list-style-type: none"> <li>• However, symptoms (attacks or progression) may occur in the future.</li> </ul> <p><b><i>Radiologically isolated syndrome</i></b> (MC) Radiologically isolated syndrome refers to findings on MRIs of the brain and spinal cord that look like MS in someone without classic symptoms of MS.</p> <p><b>Three rare MS variants include:</b> <i>(Cleveland Clinic)</i></p> <p><b><i>Tumefactive multiple sclerosis.</i></b> A characterization of this variant of MS is the formation of large areas of demyelination in your brain, which may appear similar to tumors.</p> <ul style="list-style-type: none"> <li>• Often, a sample of brain tissue is needed to differentiate this from other issues, like brain cancers.</li> </ul> <p><b><i>Balo's concentric sclerosis.</i></b> A characteristic of this variant of MS is lesions with the appearance of concentric rings (in the shape of a target) of myelin damage appearing on an MRI, which gives this condition its name.</p> <p><b><i>Marburg variant multiple sclerosis.</i></b> This is a very rare and aggressive form of MS characterized by rapid progression, which may result in death when left untreated.</p>
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## Symptoms

### Symptoms of MS NIH

### Symptoms (Image and Definition) Mayo Clinic

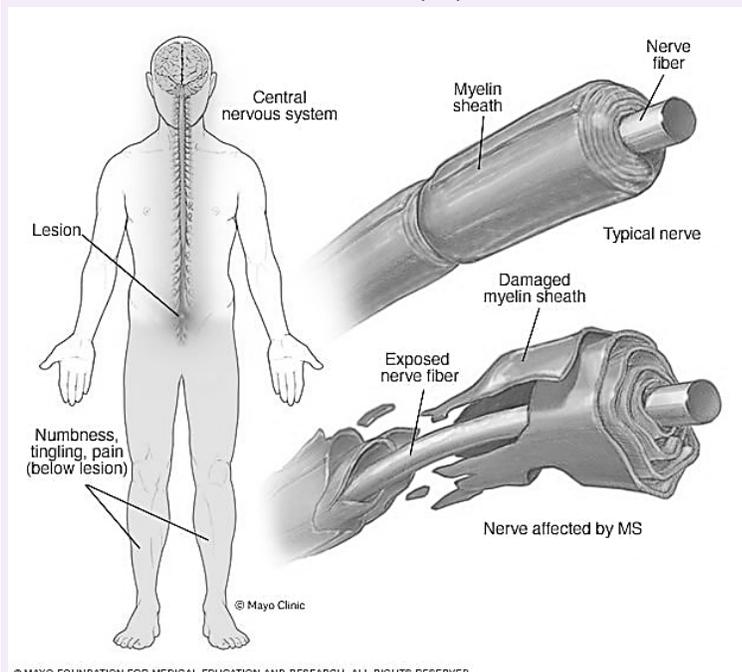
#### Symptoms of MS – (NIH)

Early MS symptoms often include:

- Vision problems, such as double vision or optic neuritis (inflammation of the optic nerve), which causes pain with eye movement and vision loss
- Muscle weakness, often in the arms and legs, and muscle stiffness with painful muscle spasms
- Tingling, numbness, or pain in the arms, legs, trunk, or face
- Clumsiness, especially difficulty staying balanced when walking
- Bladder control problems
- Intermittent or constant dizziness

MS may also cause other symptoms, such as:

- Mental or physical fatigue
- Mood changes such as depression or difficulty with emotional expression or control
- Cognitive changes, including problems concentrating, multitasking, thinking, or learning, or difficulties with memory or judgment
- Muscle weakness, stiffness, and spasms may be severe enough to affect walking or standing.
  - In some cases, MS leads to partial or complete paralysis.
  - The use of a wheelchair is not uncommon, particularly in individuals who are untreated or have advanced disease.
- Many people with MS find that their symptoms are worse when they have a fever or are exposed to heat or following common infections.
- Pain is rarely the first sign of MS, but pain often occurs with optic neuritis and trigeminal neuralgia.
  - Painful limb spasms and sharp pain shooting down the legs or around the abdomen can also be symptoms of MS.



#### Symptoms

Mayo Clinic (and Image)

Multiple sclerosis symptoms vary depending on the person. Symptoms may change over the course of the disease depending on which nerve fibers are affected.

Small increases in body temperature can temporarily worsen symptoms of MS. These aren't considered true disease relapses but pseudo-relapses.

<p><b>Symptoms</b></p> <p><i>Continued</i></p> <p><b>Symptoms of MS</b> <i>NIH</i></p> <p><b>Primary, Secondary &amp; Tertiary MS Symptoms</b> <i>WebMD</i></p>	<p><b>Primary MS Symptoms - (WebMD)</b></p> <p>The most common MS symptoms are:</p> <ul style="list-style-type: none"> <li>• <b>Bladder and bowel problems.</b> <ul style="list-style-type: none"> <li>○ You may have to pee more often, need to go during the night, or have trouble fully emptying your bladder.</li> <li>○ Bowel issues like constipation or trouble controlling when you poop are also common.</li> </ul> </li> <li>• <b>Walking problems.</b> MS can make it hard to get around. You might have: <ul style="list-style-type: none"> <li>○ Weakness in your leg muscles</li> <li>○ Trouble keeping your balance</li> <li>○ Changes in the way you walk, called your gait</li> <li>○ Numbness in your feet</li> </ul> </li> <li>• <b>Dizziness.</b> You may feel lightheaded. <ul style="list-style-type: none"> <li>○ Sometimes it can feel like the room is spinning. That’s called vertigo.</li> <li>○ Other conditions can also make you dizzy, such as a problem with your inner ear or medicines you take. Your doctor can do tests to find the cause of your dizziness.</li> </ul> </li> <li>• <b>Emotional changes and depression.</b> It’s hard to adjust to the idea that you have a chronic disease, especially one that you can’t predict. <ul style="list-style-type: none"> <li>○ Depression is common in people with MS. Fear of the unknown can make you anxious. Damage to nerve fibers in the brain also affects emotions.</li> <li>○ So can medicines like corticosteroids that treat MS.</li> </ul> </li> <li>• <b>Eye problems.</b> In addition to optic neuritis, MS can cause: <ul style="list-style-type: none"> <li>○ Fast eye movements that you can’t control, called nystagmus</li> <li>○ Double vision</li> </ul> </li> <li>• <b>Fatigue.</b> This is often the most common symptom of MS. <ul style="list-style-type: none"> <li>○ You may feel tired even after a good night’s sleep. MS fatigue is more severe than normal tiredness, and it can get worse later in the day.</li> <li>○ Fatigue can make it harder for you to work and do other daily activities.</li> </ul> </li> <li>• <b>Heat-related problems.</b> MS can make you more sensitive to heat. <ul style="list-style-type: none"> <li>○ Symptoms like blurred vision, tiredness, and muscle weakness may get worse when it’s hot outside or you have a fever.</li> <li>○ Once you rest and cool down, these symptoms should go away.</li> </ul> </li> <li>• <b>Muscle stiffness and spasms.</b> Your muscles might feel stiff or twitch. <ul style="list-style-type: none"> <li>○ These symptoms can make it hard to walk if the muscles are in your legs.</li> </ul> </li> <li>• <b>Sexual troubles.</b> MS can cause vaginal dryness in women and erection problems in men. <ul style="list-style-type: none"> <li>○ Both men and women may lose feeling in their genitals, have a lower sex drive, and have trouble reaching orgasm.</li> </ul> </li> <li>• <b>Swallowing problems.</b> MS can affect muscles in your mouth and throat. <ul style="list-style-type: none"> <li>○ Weakness in these muscles could make it harder for you to chew and swallow. You might feel like food is stuck in your throat, or you might cough when you eat or drink.</li> <li>○ If swallowing problems get worse, food or drinks could get into your lungs.</li> </ul> </li> </ul>
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<p><b>Symptoms</b></p> <p><i>Continued</i></p> <p><b>Primary, Secondary &amp; Tertiary MS Symptoms</b> <i>WebMD</i></p> <p><b>Symptoms of MS</b> <i>NIH</i></p>	<ul style="list-style-type: none"> <li>• <b>Thinking and speech problems.</b> It might be hard to learn new things, make plans, focus, and find the right words. <ul style="list-style-type: none"> <li>○ Your thinking may feel slow and your memory could be fuzzy. Most of these mental changes are mild.</li> <li>○ Less often, MS causes problems severe enough to get in the way of work or school.</li> </ul> </li> <li>• <b>Tremor.</b> Up to 60% of people with MS shake or make other movements with their arms, legs, body, or head that they can't control. That's called tremor, and it happens because of nerve damage. <ul style="list-style-type: none"> <li>○ Tremor can be mild or so intense that it's hard to write and do other activities.</li> </ul> </li> <li>• <b>Trouble walking.</b> Weakness, loss of balance, and muscle tightness can affect the way you walk. <ul style="list-style-type: none"> <li>○ Problems with your walk, or gait, could lead to a fall. Some falls are serious enough to cause fractures and other injuries.</li> </ul> </li> <li>• <b>Unusual feelings.</b> Along with the pins and needles feeling that's part of MS, you might also have severe itching, burning, stabbing, or electric shock-like pain from nerve damage. <ul style="list-style-type: none"> <li>○ You could feel a tightness around your ribs or upper belly known as the MS hug.</li> <li>○ The pressure sometimes gets so intense that it's hard to breathe.</li> </ul> </li> </ul> <p><b>Secondary Symptoms</b></p> <p>Primary MS symptoms like tiredness and trouble walking or emptying your bladder happen because of nerve damage.</p> <p>They can lead to other problems, called secondary symptoms, like these:</p> <ul style="list-style-type: none"> <li>• Urinary tract infections because you can't fully empty your bladder</li> <li>• Weak muscles and bones, or trouble breathing because you don't get enough exercise</li> <li>• Pressure sores when you sit or lie down for long periods of time</li> <li>• Pneumonia because food and fluid get into your lungs when you have trouble swallowing</li> </ul> <p><b>Tertiary Symptoms</b></p> <p>MS also causes these types of social, mental health, and work-related problems:</p> <ul style="list-style-type: none"> <li>• Job loss if it's hard for you to walk, drive, or do your job well</li> <li>• Trouble with your relationships because you're stressed from living with a chronic disease</li> <li>• Depression because of the way MS changes your brain and your life</li> </ul> <p>MS affects each person differently. Your symptoms may be different from those of other people with this condition. It is possible to manage MS symptoms and lead a full, active life.</p>
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## Managing MS Symptoms

### Managing Symptoms

#### Managing MS symptoms – (NIH)

MS causes a variety of symptoms that can interfere with daily activities. Fortunately, many of the symptoms of MS can usually be treated or managed. Neurologists with advanced training in the treatment of MS can prescribe specific medications to treat these problems.

### Managing MS Symptoms NIH

#### Eye and vision problems

Eye and vision problems are common in people with MS but rarely result in permanent blindness.

- Symptoms may include blurred or grayed vision, temporary blindness in one eye, loss of normal color vision, issues with depth perception, or loss of vision in parts of the visual field.
- Uncontrolled horizontal or vertical eye movements (nystagmus), “jumping vision” (opsoclonus), and double vision (diplopia) are common in people with MS.
- Vision therapy exercises, special eyeglasses, and resting the eyes may be helpful.

#### Muscle and mobility problems

Muscle weakness and spasticity are common in MS.

- It is very important that people with MS stay physically active because physical inactivity can contribute to worsening stiffness, weakness, pain, fatigue, and other symptoms.
- Stretching and exercising muscles through water therapy, yoga, or physical therapy (PT) can help manage mild spasticity.
- Medications can also help reduce spasticity.

**Tremor**, or uncontrollable shaking, develops in some people with MS.

- Assistive devices are sometimes helpful for people with tremor.
- Deep brain stimulation and medications may also help.

**Balance**: Many people with MS have difficulty with balance and walking.

- The most common walking problem is ataxia—unsteady, uncoordinated movements—due to damage to the areas of the brain that coordinate muscle balance.
- People with severe ataxia generally benefit from the use of a cane, walker, or other assistive device.
- Physical therapy can also reduce walking problems. Occupational therapy (OT) can help people learn how to walk using an assistive device or in a way that saves physical energy.
- The FDA has approved the drug *dalfampridine* to improve walking speed in people with MS.

#### Fatigue

Fatigue is a common symptom of MS and may be both physical (tiredness in the arms or legs) and cognitive (slowed processing speed or mental exhaustion).

- Daily physical activity programs of mild to moderate intensity can significantly reduce fatigue, although people should avoid excessive physical activity and minimize exposure to high temperatures. PT and OT can sometimes help manage fatigue.
- PT provides personalized treatments, while OT teaches ways to use energy wisely.
- They also help find the right changes in the person’s environment.
- Stress management programs or relaxation training may help some people.

#### Bladder control and constipation issues

Problems with bladder control and constipation may include problems with frequency of urination, urgency, or the loss of bladder control.

- A small number of individuals retain large amounts of urine.
- Medical treatments are available for bladder-related problems.
- Constipation is also common and can be treated with a high-fiber diet, laxatives, and stool softeners.

<p><b>Managing Symptoms</b></p> <p><i>Continued</i></p> <p><b>Managing MS Symptoms</b></p> <p><i>NIH</i></p>	<p><b>Sexual dysfunction</b></p> <p>Sexual dysfunction can result from damage to nerves running through the spinal cord.</p> <ul style="list-style-type: none"> <li>• Sexual problems may also stem from MS symptoms, including fatigue, muscle symptoms, and psychological factors.</li> <li>• Some of these problems can be corrected with medications. Counseling (therapy) may be helpful.</li> </ul> <p><b>Mental and emotional problems</b></p> <p>Clinical depression is frequent among people with MS.</p> <ul style="list-style-type: none"> <li>• MS may cause depression as part of the disease process and chemical imbalance in the brain.</li> <li>• Depression can intensify symptoms of fatigue, pain, and sexual dysfunction.</li> <li>• It is most often treated with cognitive behavioral therapy and selective serotonin reuptake inhibitor (SSRI) antidepressant medications, which are less likely than other antidepressant medications to cause fatigue.</li> </ul> <p><b>Pseudobulbar symptoms</b></p> <p>Inappropriate and involuntary expressions of laughter, crying, or anger—called pseudobulbar symptoms—are sometimes associated with MS, although this is not as common as in some other neurological disorders.</p> <ul style="list-style-type: none"> <li>• These expressions are often incongruent with mood; for example, people with MS may cry when they are actually happy or laugh when they are not especially happy.</li> <li>• The combination treatment of the drugs <i>dextromethorphan</i> and <i>quinidine</i> can treat pseudobulbar affect, as can other drugs such as amitriptyline or citalopram.</li> </ul> <p><b>Cognitive problems</b></p> <p>Cognitive impairment—a decline in the ability to think, learn, and remember—affects up to 75% of people with MS.</p> <ul style="list-style-type: none"> <li>• These cognitive changes may appear at the same time as the physical symptoms, or they may develop gradually over time.</li> <li>• Sometimes, cognitive impairment in people with MS is caused by depression.</li> <li>• It is important to rule out depression, first. If cognitive impairment is caused by depression, it can be treated.</li> <li>• Drugs such as <i>donepezil</i> may be helpful in some cases.</li> </ul> <p><b>Complementary approaches</b></p> <p>Some people with MS report improvement in their symptoms from complementary or alternative approaches.</p> <ul style="list-style-type: none"> <li>• These include acupuncture, aromatherapy, ayurvedic medicine, touch and energy therapies, physical movement disciplines such as yoga and tai chi, herbal supplements, and biofeedback.</li> <li>• Because of the risk of interactions between alternative and conventional therapies, people with MS should discuss all the therapies they are using with their doctor, especially herbal supplements. <ul style="list-style-type: none"> <li>○ Herbal supplements have biologically active ingredients that could have harmful effects on their own or interact harmfully with other medications.</li> </ul> </li> </ul>
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## Causes & Risk Factors

### Causes & Risk Factors

Mayo Clinic

#### Causes – (Mayo Clinic)

The cause of multiple sclerosis is not known.

- It's considered an immune-mediated disease in which the body's immune system attacks its own tissues.
  - In MS, the immune system attacks and destroys the fatty substance that coats and protects nerve fibers in the brain and spinal cord. This fatty substance is called myelin.
- Myelin can be compared to the insulation coating on electrical wires.
  - When the protective myelin is damaged and the nerve fiber is exposed, the messages traveling along that nerve fiber may be slowed or blocked.
- It isn't clear why MS develops in some people and not others. A combination of genetics and environmental factors may increase the risk of MS.

#### Risk factors - (Mayo Clinic)

Factors that increase the risk of multiple sclerosis include:

- **Age.** MS can happen at any age. However, onset most commonly happens between 20 and 40 years of age.
- **Sex.** Women are 2 to 3 times more likely than men to have relapsing-remitting MS.
- **Family history.** If one of your parents or siblings has had MS, you are at higher risk of developing the disease.
- **Certain infections.** A variety of viruses have been linked to MS, including Epstein-Barr. Epstein-Barr is the virus that causes infectious mononucleosis.
- **Race.** People with white skin, particularly those of Northern European descent, have the highest risk of developing MS. People of Asian, African or Native American descent have the lowest risk.
  - A recent study suggests that the number of Black and Hispanic young adults with multiple sclerosis may be greater than previously thought.
- **Climate.** MS is far more common in places with temperate climates. These include Canada, the northern United States, New Zealand, southeastern Australia and Europe.
- **Vitamin D.** Having low levels of vitamin D and low exposure to sunlight is linked to a greater risk of MS.
  - Your birth month also may affect the chances of developing MS. This has to do with levels of sun exposure when a mother is pregnant.
- **Obesity.** People who are obese or were obese in childhood have an increased risk of multiple sclerosis.
- **Certain autoimmune diseases.** You have a slightly higher risk of developing MS if you have other autoimmune conditions.
  - These may include thyroid disease, pernicious anemia, psoriasis, type 1 diabetes or inflammatory bowel disease.
- **Smoking.** People who smoke have a higher risk of relapsing-remitting MS than people who don't smoke.
- **Gut microbiome.** People with MS may have a different gut microbiome than people who don't have MS. More research is needed to understand this connection.

## Treatments

<p><b>Treatments</b></p> <p><b>Treating MS (Medications)</b> <i>NIH</i></p> <p><b>Treatments for MS Symptoms</b> <i>Mayo Clinic</i></p> <p><b>Complementary and Alternative Treatments for Multiple Sclerosis</b> <i>WebMD</i></p>	<p><b>Treating MS – (NIH)</b> There is no cure for MS, but there are treatments that can reduce the number and severity of relapses and delay the long-term progression of the disease.</p> <p><b>Corticosteroids</b>, such as methylprednisolone, are prescribed over for three to five days and are usually injected into a vein. Corticosteroids quickly and potently suppress the immune system and reduce inflammation. They may be followed by a tapered dose of oral corticosteroids. Clinical trials have shown that these drugs hasten recovery from MS attacks but do not alter the long-term outcome of the disease.</p> <p><b>Disease-Modifying Treatments</b> Current therapies approved by the U.S. Food and Drug Administration (FDA) for MS are designed to modulate or suppress the inflammatory reactions of the disease. They are most effective for relapsing-remitting MS or secondary-progressive MS with residual attacks.</p> <ul style="list-style-type: none"> <li>• They are also effective in some cases of radiologically isolated syndrome to prevent development of clinical MS. Radiologically isolated syndrome is a condition in which a person has abnormal MRI results that look like MS, but doesn't have MS symptoms.</li> </ul> <p><b>Infusion treatments include:</b></p> <ul style="list-style-type: none"> <li>• <b>Natalizumab</b> (brand name: Tysabri®) works by preventing cells of the immune system from entering the central nervous system. It is very effective but is associated with an increased risk of a serious and potentially fatal viral infection of the brain called progressive multifocal leukoencephalopathy (PML). Regular blood tests for antibodies to the virus that causes PML can help address this risk.</li> <li>• <b>Ocrelizumab</b> (brand name: Ocrevus®) treats adults with relapsing-remitting, active secondary-progressive, or primary-progressive MS. It is currently the only FDA-approved disease-modifying therapy for primary-progressive MS. The drug targets circulating immune cells ("B cells") that have many functions, including giving rise to the cells that produce antibodies. Side effects include infusion-related reactions and increased risk of infections. Ocrelizumab may slightly increase the risk of cancer and reduce the effectiveness of some vaccines.</li> <li>• <b>Alemtuzumab</b> targets proteins on the surface of immune cells. Because this drug increases the risk of autoimmune disorders, it is usually used in those who have not responded sufficiently to two or more MS therapies.</li> </ul> <p><b>Oral treatments include:</b></p> <ul style="list-style-type: none"> <li>• <b>Fingolimod</b> (brand name: Gilenya®) reduces the MS relapse rate in adults and children. It is the first FDA-approved drug to treat MS in adolescents and children age 10 and older. The drug prevents white blood cells called lymphocytes from leaving the lymph nodes and entering the blood, brain, and spinal cord. Fingolimod may result in a slow heart rate and eye problems when first taken. Fingolimod can also increase the risk of infections, such as herpes virus infections, or in rare cases be associated with PML. Siponimod has a similar mechanism of action to fingolimod. Siponimod has been approved by the FDA to treat secondary-progressive MS.</li> <li>• <b>Dimethyl fumarate</b> (brand name: Tecfidera®) is used to treat relapsing forms of MS. Its exact mechanism of action is not currently known. Side effects of dimethyl fumarate are flushing (temporary reddening of the skin), diarrhea, nausea, and lowered white blood cell count. Diroximel fumarate (brand name: Vumerity®) is a drug similar to dimethyl fumarate, but with fewer gastrointestinal side effects.</li> <li>• <b>Teriflunomide</b> (brand name: Aubagio®) reduces the rate of growth in the number of activated immune cells. Teriflunomide side effects can include nausea, diarrhea, liver damage, and hair loss.</li> <li>• <b>Cladribine</b> (brand names: Mavenclad® and Leustatin® DSC) targets certain types of white blood cells that drive immune attacks in MS. The drug may increase the person's risk of developing cancer.</li> </ul>
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<p><b>Treatments</b></p> <p><i>Continued</i></p> <p><b>Treating MS (Medications)</b> <i>NIH</i></p> <p><b>Treatments for MS Symptoms</b> <i>Mayo Clinic</i></p> <p><b>Complementary and Alternative Treatments for Multiple Sclerosis</b> <i>WebMD</i></p>	<p><b>Injectable medications include:</b></p> <ul style="list-style-type: none"> <li>• <b>Beta interferon drugs</b>, which were once the most commonly used treatments for MS but are rarely used now. Potential side effects of these drugs include flu-like symptoms (which usually fade with continued therapy), depression, or elevation of liver enzymes.</li> <li>• <b>Glatiramer acetate</b>, which can reduce the frequency of attacks in relapsing-remitting MS.</li> <li>• Clinical trials have shown that <b>cladribine, diroximel fumarate, and dimethyl fumarate</b> decrease the number of relapses, delay the progression of physical disability, and slow the development of brain lesions.</li> </ul> <p><b>Treatments for MS symptoms - (Mayo Clinic)</b> These treatments can help relieve some of the symptoms of MS.</p> <p><b>Therapy.</b> A physical or occupational therapist can teach you stretching and strengthening exercises.</p> <ul style="list-style-type: none"> <li>• The therapist also can show you how to use devices to make it easier to perform daily tasks.</li> <li>• Physical therapy and a mobility aid, when necessary, also can help manage leg weakness and help improve walking.</li> </ul> <p><b>Muscle relaxants.</b> You may experience muscle stiffness or spasms, particularly in your legs.</p> <ul style="list-style-type: none"> <li>• Muscle relaxants such as baclofen (Lioresal, Gablofen), tizanidine (Zanaflex) and cyclobenzaprine (Amrix, Fexmid) may help. Onabotulinumtoxin A (Botox) treatment is another option for muscle contractions.</li> </ul> <p><b>Medicines to reduce fatigue.</b> Amantadine (Gocovri), modafinil (Provigil) and methylphenidate (Ritalin, Concerta) have been used to reduce MS-related fatigue.</p> <ul style="list-style-type: none"> <li>• However, a recent study did not find these medicines to be better than a placebo in improving MS-related fatigue and caused more side effects.</li> <li>• Some medicines used to treat depression, including fluoxetine (Prozac) and bupropion (Wellbutrin), may be recommended.</li> </ul> <p><b>Medicine to increase walking speed.</b> Dalfampridine (Ampyra) may help to slightly increase walking speed in some people.</p> <ul style="list-style-type: none"> <li>• Possible side effects are urinary tract infections, vertigo, insomnia and headaches. People with a history of seizures or kidney dysfunction should not take this medicine.</li> </ul> <p><b>Other medicines.</b> Medicines also may be prescribed for depression, pain, sexual dysfunction, insomnia, and bladder or bowel control troubles that are linked to MS.</p> <p><b>Complementary and Alternative Treatments for Multiple Sclerosis – (WebMD)</b></p> <p>Many products claim to help with MS symptoms. Be wary of those that make claims that seem too good to be true and don't have scientific studies backing them. <b>Talk to your doctor about anything you're tempted to take. Some supplements can change the way your medicines work.</b></p> <p>Current research suggests these treatments are worth a try:</p> <p><b>Cranberry juice.</b> People with MS are prone to developing urinary tract infections (UTIs). Regularly drinking cranberry juice or eating foods rich in Vitamin C can help flush harmful bacteria out of your urinary system.</p> <p><b>Acupuncture.</b> This traditional Chinese treatment is based on the belief that energy called chi flows along your body in lines called meridians.</p> <ul style="list-style-type: none"> <li>• When your chi is out of whack, it results in illness or pain.</li> <li>• An acupuncturist slides thin needles into points along the meridians to change your energy flow.</li> <li>• Studies show it can help MS symptoms such as fatigue, pain, mood, spasticity, numbness, tingling, and bladder problems.</li> </ul>
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## Lifestyle Changes

### Lifestyle Changes

#### Lowering Risks of Flare-ups

*Cleveland Clinic*

#### Lifestyle and home remedies

*Mayo Clinic*

#### How can I lower my risk of multiple sclerosis symptom flare-ups? (*Cleveland Clinic*)

Disease-modifying therapies are the most effective way to reduce the number of flare-ups (also called relapses or attacks) you experience.

- Leading a healthy lifestyle is also important. The choices you make can help slow disease progression.

Your provider may recommend the following to stay healthy:

- Eating nutritious meals
- Getting enough sleep
- Participating in physical activities regularly
- Not using tobacco products
- Coping with a chronic condition can be emotionally challenging. MS can sometimes affect your mood and memory. Working with a neuropsychologist or a mental health provider is an essential part of managing the condition long term.

#### Lifestyle and home remedies – (*Mayo Clinic*)

To help relieve the symptoms of MS, try to:

- **Get plenty of rest.** Look at your sleep habits to make sure you're getting the best possible sleep.
  - If you have conditions such as obstructive sleep apnea, see a healthcare professional and get treatment.
- **Exercise.** If you have mild to moderate MS, regular exercise can help improve your strength, muscle tone, balance and coordination.
  - Swimming or other water exercises are good options if heat makes your symptoms worse.
  - Other types of mild to moderate exercise recommended for people with MS include walking, stretching, low-impact aerobics, stationary bicycling, yoga and tai chi.
- **Cool down.** In some people, MS symptoms may worsen as body temperature rises.
  - It helps to stay cool and use cooling scarves or vests.
- **Eat a balanced diet.** Research suggests that following the Mediterranean diet may be linked to a lower risk of worsening disability in MS.
  - The Mediterranean diet includes fruits and vegetables, whole grains, legumes, nuts, and olive oil.
  - It also means not eating large amounts of red meats, butter, sugar and other unhealthy foods.
  - Some research suggests that vitamin D may have potential benefit for people with MS.
- **Relieve stress.** Stress may trigger or worsen your symptoms.
  - Yoga, tai chi, massage, meditation or deep breathing may help.

## Walking (Gait) Difficulties, Fall Prevention & Spasticity

### National Multiple Sclerosis Society

**Walking (Gait) Difficulties:**  
**Walking**  
**Risk of Falls**  
**PT & Self-Management**  
*National Multiple Sclerosis Society*

**Spasticity and Multiple Sclerosis**  
*National Multiple Sclerosis Society*

#### **Walking (Gait) Difficulties - National Multiple Sclerosis Society**

##### **How Multiple Sclerosis Affects Gait and Walking**

Difficulty in walking is among the most common mobility limitations in multiple sclerosis. The term "gait" refers more specifically to the manner or pattern of walking (for example unsteady gait).

Difficulties in walking and abnormal gait are related to several factors:

- Ataxia: Loss of muscle control in ataxia can lead to a lack of control and balance.
- Balance: balance problems typically result in a swaying and unsteady gait.
- Fatigue: Many people will experience increased gait problems when fatigue increases.
- Foot drop: Foot drop is a specific kind of weakness that results from damage to the nerves of the muscles that flex the ankle. Foot drop can make it difficult to handle steps or uneven surfaces.
- Sensory deficit: Some people with MS have such severe numbness in their feet that they cannot feel the floor or know where their feet are. This is referred to as a sensory ataxia.
- Spasticity: Muscle tightness or spasticity can interfere with gait.
- Weakness: Weakness in your leg muscles can cause you to change your normal walking stride. This can then lead to pain, which can make your walking even more challenging.

A healthcare professional can analyze your gait to detect problems and propose treatments such as rehabilitation therapy, the use of assistive devices and/or medication. Not all walking problems are due to MS. Your healthcare team can help identify causes.

##### **Risk of Falling From MS**

Research from several countries suggests that 50-70% of people with MS report falls within a 6-month period. About 30-50% of those individuals report falling multiple times, with resulting injuries.

- Enhancing a person's ability to walk comfortably and safely, while preventing falls, is critical. Not only can falls cause injuries, but the time required to recover from broken bones or strained muscles can worsen mobility problems and reduce independence.
- In addition, fear of falling itself has been identified as an independent risk factor for future falls. Fear of falling can also lead to avoiding activities and social isolation.
- People with MS typically fall in or around their homes and neighborhoods, usually while doing basic activities such as bathing, preparing meals or walking in crowded areas.

##### **Risk factors for falls are complex and include:**

- Poor balance and slowed walking
- Reduced proprioception (the sensation of where your body parts are in space)
- Dizziness
- Incorrect use of assistive devices (canes and walkers) or use of inappropriate devices
- Some medications or certain combinations of medications

Learn about changes you can make to reduce your risk of falling with "Preventing Falls at Home: Room by Room" from the National Institute on Aging.

##### **Physical Therapy and Self-Management Strategies for MS**

Most gait problems can be helped to some degree by physical therapy (PT), stretching exercises, the use of appropriate assistive devices and, in some cases, medications for spasticity, fatigue, and walking speed.

- Your physical therapist may suggest exercises or gait training such as vestibular exercises. These exercises induce brief periods of loss of balance to help you learn to adapt.
  - Exercises may include eye or head movements, distorting or eliminating visual input, and changing or moving weight-bearing surfaces.
- If you're having difficulty walking, speak to your healthcare provider.
- Fall prevention is important for your mobility and accessibility, independence and safety.
- Falls can cause injuries and increase mobility issues while you recover.

***To reduce your risk of falling:***

- Wear safe, low-heeled shoes.
- Be conscious of where you are walking. For instance, stay away from a freshly washed floor.
- Get exercise, including aerobic and strengthening (including core strengthening) exercises.
- Review your medications.
- Make your home safe.
- Keep the areas where you walk clear.
- Move electric cords out of the way.
- Tack down loose carpets or remove them.
- Apply no-slip strips to tile and wooden floors.
- Install hand rails in the bathroom.
- Leave lights on at night or add nightlights to the path from the bedroom to bathroom.
- Avoid walking backwards.
- Check railings for stability.
- Install grab bars in the shower, near a toilet or near the sink.
- Modify your kitchen to avoid stooping or overhead reaching.

***Spasticity and Multiple Sclerosis - National Multiple Sclerosis Society***

If you live with multiple sclerosis, you may experience spasticity. It is one of the more common MS symptoms.

- Spasticity refers to feelings of stiffness and muscle spasms (sustained muscle contractions or sudden movements).
- Spasticity can range from tight muscles to painful, uncontrollable spasms. Although spasticity can occur in the arms, it is most common in the legs.

***Types of Spasticity in MS***

The 2 types of spasticity common in people living with MS are:

- ***Flexor spasticity:*** In this type of spasticity, the muscles are so tight that your limbs bend and you have difficulty straightening them.
- ***Extensor spasticity:*** With extensor spasticity, it's the opposite case. Your muscles are so tight that your limbs remain straight and are difficult to bend.

***What To Avoid If You Live With Spasticity***

Several things can trigger or aggravate spasticity, including:

- Sudden movements or position changes
- Extreme temperatures
- Humidity
- Infections
- Tight clothing

Some degree of spasticity can be beneficial, particularly for people who experience significant leg weakness. In these cases, spasticity gives legs some rigidity, making it easier to stand, transfer or walk.

- The treatment goal for these individuals is to relieve the spasticity enough to ensure comfort and prevent complications while leaving the rigidity needed to function.

***Manage Spasticity***

Spasticity and muscle tightness are commonly treated with medications as well as physical and occupational therapy.

- Because spasticity varies so much from person to person, it must be treated on an individual basis. Work closely with your healthcare team to treat spasticity.
- Left untreated, spasticity can lead to serious complications, including contractures (frozen or immobilized joints) and pressure sores.

# Exercise & Multiple Sclerosis (MS)

## Exercise

NCBI:  
PubMed.gov

According to *PubMed.gov*, exercise and physical activity have been associated with reduced relapse rate, mobility disability and its progression, lesion volume, and improved neuro-performance, particularly walking outcomes. This evidence provides a positive, yet preliminary, picture for exercise having possible effects on markers of disease modification and progression in MS. (NCBI: *PubMed.gov*)

## Latest on Exercise... US News

*US News*: Most MS patients don't exercise enough, according to a survey in the June 2015 issue of *Acta Neurological Scandinavia*.

- It's understandable since multiple sclerosis, an autoimmune disease that damages the myelin sheath (covering) around the neurons in the central nervous system, can cause symptoms such as fatigue, overheating, muscle weakness, tremors and other disabilities, all of which can make exercising especially challenging.
- That's why if you have MS, you'll want to choose an exercise routine you not only enjoy, but one that also fits your particular needs.
- "You should start by seeing a physical therapist who will help adjust exercises to fit your capabilities," suggests Dr. Michelle Fabian, assistant professor of neurology in the Corinne Goldsmith Dickinson Center for Multiple Sclerosis at Mount Sinai Hospital in New York. "An important rule in MS is to start out small and work up gradually," (*US News*)

## Exercise and MS WebMD

## Staying Active With MS National Multiple Sclerosis Society

For the most part, those with MS will follow an exercise routine outlined in this book, just as anyone else would. Aerobics, strengthening, stretching and balance exercises should be a regular part of your routine. Water aerobics, swimming, tai chi, and yoga are also exercises that often work well for people with MS.

***You should always consult with your doctor before starting an exercise routine and physical therapy to get you started, especially if you are new to exercising.***

### Things to consider or precautions: (*WebMD*)

- Making sure there are no slippery floors or tripping hazards is important in keeping a safe environment.
- Start slow and warm up prior to your exercise routine. Taking a walk may be a good way to start or may even be all you can do at that particular time. That is OK. Don't push yourself if you are just starting out a program.
- Grab bars or a solid surface to reach for may be needed if you have balance deficits
- If you feel sick, have exacerbations or pain, stop and do not push through the symptoms. Listen to your body.
- Some people with MS are sensitive to the heat. When your body temperature rises, the symptoms get worse.

### Here are some tips:

- Just like people without MS, you should not exercise outside in the hottest times of the day between 10 and 2, and not at all when the temperature and humidity are high.
- Drink plenty of cold water/liquids. Stay hydrated.
- Stop if symptoms worsen or cool down before continuing.
- Wear cooling collars, bandanas or vests or wrap a wet towel around your neck.
- If swimming, use a pool with a temperature in the low 80s.
- Take cool or tepid showers.

<p><b>Exercise</b></p> <p><i>Continued</i></p> <p>NCBI: <i>PubMed.gov</i></p> <p><b>Latest on Exercise...</b> <i>US News</i></p> <p><b>Exercise and MS</b> <i>WebMD</i></p> <p><b>Staying Active With MS</b> <i>National Multiple Sclerosis Society</i></p>	<p><b>Types of Exercise to Try:</b> <i>(WebMD)</i></p> <ul style="list-style-type: none"> <li>• <b>Aerobics.</b> Not only does it get your heartbeat up, it lifts your mood, too. Walking, running, and biking are all good. If you have leg weakness or other problems moving, try something like rowing or water aerobics.</li> <li>• <b>Stretches.</b> They're good for anyone with MS, but they're most helpful if you have painful muscle stiffness and spasms. Aside from regular stretches, yoga and tai chi are great ways to build strength and flexibility. They can also help you relax and fight stress.</li> <li>• <b>Strength training.</b> If your physical therapist says it's OK, use weights or resistance exercises to build your muscles. The stronger you are, the easier it'll be to move around.</li> </ul> <p><b>What If You Get Overheated?</b> <i>(WebMD)</i></p> <p>If you're sensitive to heat, your symptoms may show up or get worse when your body temperature rises. This will happen when you exercise.</p> <p>To avoid overheating:</p> <ul style="list-style-type: none"> <li>• Don't exercise during the hottest part of the day (10 a.m. to 2 p.m.). Try to work out in the morning or evening if you're exercising outside.</li> <li>• Drink plenty of cool water.</li> <li>• Be aware of your body. If you notice any symptoms you didn't have before you started exercising, slow down or stop until you cool down.</li> <li>• Swimming and water aerobics are good ways to stay cool while you work out. Just make sure there are nonslip floors in the locker room and around the pool.</li> </ul> <p><b>Staying Active With MS</b> <i>(National Multiple Sclerosis Society)</i></p> <p>Exercise doesn't have to be a rigorous, cardiovascular workout to provide benefits. Physical activity in general is beneficial and can include a variety of things you can do in the comfort of your home or community — such as gardening or walking your dog.</p> <ul style="list-style-type: none"> <li>• Water exercise also provides exceptional benefits to people with MS. This type of activity can help stretch tight muscles and improve flexibility.</li> <li>• Water can allow you to move in ways you may not be able to on land. And it keeps your body temperature cool. (Please note, people with MS should not be in water temperatures above 84 degrees Fahrenheit.)</li> </ul> <p><b>Benefits of Exercise for Multiple Sclerosis</b></p> <p>Studies of aerobic exercise for people living with MS show the perks of staying active. Benefits include improved:</p> <ul style="list-style-type: none"> <li>• Bladder and bowel function</li> <li>• Bone density</li> <li>• Cardiovascular fitness</li> <li>• Cognitive function</li> <li>• Energy levels</li> <li>• Flexibility</li> <li>• Mood</li> <li>• Strength</li> </ul> <p><b>Tips for Physical Activity</b></p> <p>To stay safe and get the most from your exercises:</p> <ul style="list-style-type: none"> <li>• Consult a medical professional before starting a new exercise routine.</li> <li>• Exercise in a cool room and, if outside, exercise at cooler times during the day.</li> <li>• Go slow.</li> <li>• Prioritize safety to reduce risk of injury.</li> <li>• Remember to stretch afterward.</li> <li>• Stay hydrated. Cold water will help keep your body temperature low.</li> </ul>
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## Multiple Sclerosis and Exercise

### *American Physical Therapy Association, Section On Neurology (APTA)*

#### **Multiple Sclerosis and Exercise**

APTA

#### **What types of exercises are beneficial for people with Multiple Sclerosis**

There are a wide variety of symptoms that can be experienced by someone with Multiple Sclerosis. Because no two people with Multiple Sclerosis present with the same symptoms, each person should be evaluated by a skilled Physical Therapist to determine their specific exercise needs.

Some components of a comprehensive exercise program are listed below.

#### **Stretching Program:**

- Should be performed daily, and helps manage spasticity and reduce risk of contractures
- Can be done individually or with a helper
- T'ai Chi, yoga, and Pilates have also been shown to improve range of motion

#### **Aerobic Conditioning:**

- Performed 3-5 times per week for 20-30 minutes, may need to gradually work up to 20 minutes
- Can be done by participating in walking programs over land or on a treadmill, using the Nu-Step, upper or lower body ergometer, elliptical, or stationary bike

#### **Strengthening:**

- Should be performed 3-5 times per week, 1-3 sets of repetitions to fatigue for each muscle group exercise
- Focus on specific muscle groups that are the weakest and contribute to decreased function; muscles that affect your walking, ability to go up and down stairs, as well as getting up from the floor

**Balance and coordination training** can decrease risk of falls and prevent injuries sustained as a result of a fall

- T'ai Chi, Swiss ball exercises, and task specific balance and coordination exercises performed with a Physical Therapist can improve balance and coordination

#### **Aquatic Exercise**

- Cool water exercise, in the 80-degree temperature range.
- Buoyancy of water makes it easier to move and perform exercises while the cool temperature combats hypersensitivity and reduces fatigue

#### **When should someone with Multiple Sclerosis Exercise?**

To get the most out of an exercise program and decrease the limiting factor of fatigue, choosing a time to exercise when they are less fatigued is beneficial; this is typically in the morning.

#### **How to combat heat sensitivity while exercising**

Around 85% of people with Multiple Sclerosis suffer from heat intolerance. Heat sensitivity can temporarily increase symptoms. It is important to plan ahead and keep core body temperatures down when participating in an exercise program.

#### **Some suggestions to keeping cool:**

- Keeping hydrated with cool water/iced drinks
- Using cooling garments such as cooling vests or neck wraps
- Using a fan or misting fan during exercise
- Using ice packs
- Exercising in an air-conditioned environment
- Avoid outdoor exercise during warm parts of the day
- Wear proper lightweight clothing and shoes
- Taking a cold shower or running hands under cold water post exercise

## The Role of Physical Exercise in Managing Multiple Sclerosis Symptoms *Cleveland Clinic*

### The Role of Physical Exercise in Managing Multiple Sclerosis Symptoms *(Cleveland Clinic)*

#### Why do patients with MS need to exercise, and is exercise effective?

- Exercise is recommended in the general population to maintain and improve fitness and general wellness, and this applies to individuals with MS as well.
- It has been demonstrated that persons with MS are significantly less physically active than the general population.
- Physical deconditioning due to low activity level contributes to fatigability and weakness.
  - In addition, there is a growing body of evidence suggesting that exercise decreases the severity of various MS symptoms, including fatigue and depressive symptoms, improves walking and balance, and enhances the quality of life.
- Several reviews and meta-analyses have been published, and generally, the magnitude of change attributed to exercise is small but significant, although methodological limitations of the exercise studies reviewed are noted.
  - In addition, a majority of exercise studies enroll patients with low to moderate levels of physical disability. Some studies suggest that exercise may improve cognitive performance, as shown in other populations.
- Comorbidities (e.g., obesity, cardiovascular and musculoskeletal comorbidities) were shown to be associated with higher disability level in individuals with MS.
  - Exercise is recommended in the management of many of these comorbidities, and may therefore indirectly help with MS management.

#### Are there safety issues regarding exercise in MS?

Published clinical trials of exercise in MS do not report significant safety issues.

- It is now well documented that exercise does not cause MS exacerbations. However, exercise may cause transient worsening of pre-existing MS symptoms, such as weakness, paresthesia's, or visual disturbance.
- This worsening could be explained in part by an increase in body temperature, which can be minimized by using fans or cooling garments.
- It may also be necessary to decrease the intensity and duration of exercise if it takes the person more than 2 hours to return to baseline after an exercise session.
- Exercise may also cause musculoskeletal pain, which may require a modification of the exercise routine. The exercise program should also be adapted to minimize the risk of falling.

#### What are barriers to exercise in MS?

It is important to acknowledge and address barriers to initiating and maintaining an exercise routine experienced by individuals with MS.

- Physical barriers include motor impairment, fatigue, pain/sensory symptoms, and heat sensitivity.
- Psychological barriers may include beliefs regarding the efficacy and safety of exercise in MS, such as the fear of triggering new MS activity (particularly if exercise generates a worsening of symptoms); depression; lack of self-efficacy.
- Environmental barriers include the lack of adequate transportation and accessible exercise facilities for people with mobility limitations. Online physical activity and exercise programs have been developed to help address this issue.
- Addressing these barriers involves education, information regarding community resources, and individualized assessment and guidance.
- As barriers to exercise are addressed, it is often helpful to use the acronym SMART when setting goals for exercise programs:
  - Specific: Set goals for exercise that are relevant and important for the individual
  - Measurable: Set goals that have a specific task in mind. For example, instead of a goal to "get stronger", set a goal to "improve leg strength to be able to safely walk up the stairs"
  - Attainable: Goals should be reasonable to achieve
  - Realistic: Goals should be realistic given constraints of time, transportation, etc.
  - Time-based: Allow enough time to achieve the goal, but not so much time that the client's attention to the goal loses focus.

# NUTRITION & DIETS

There is no evidence that a specific diet can prevent, treat or cure multiple sclerosis (MS), according to *Mayo Clinic*. Some special diets can actually be harmful because they contain too many of certain vitamins or not enough of others. (*Mayo Clinic*)

**Make sure you talk to your doctor or dietician before making significant changes to your diet.**

There is some research that says Vitamin D may have positive effects on the immune system and help with cell growth. Vitamin A, Biotin and omega-3 fatty acids have also been investigated, but there are no definitive studies that show any of these supplements can make a difference in symptoms.

It's important for people with MS to make healthy food choices (*Mayo Clinic*):

- Not getting enough vitamins and minerals can worsen MS symptoms.
- Skipping meals may contribute to low energy levels.
- Some MS symptoms such as depression and MS treatments such as steroids can cause weight gain.
- Weight gain can lead to more health concerns, such as joint stress and cardiac and respiratory problems.
- Alcohol can intensify common MS symptoms, such as imbalance and lack of coordination. (*Mayo Clinic*)

***There has been research on several diets listed below, but again, there is no evidence that any of these diets will make a difference.***

***Eat a healthy, balanced diet including low fat, high fiber, low sugar, unprocessed food and limit alcohol intake.***

**Is there a best diet for MS?** (*Medical News Today*)

Anyone following a specific diet needs to consume all the necessary daily nutrients. Before making large dietary changes, a person should speak with a registered dietitian to ensure they can replace any lost nutrients.

## **Gluten-free diet**

A 2020 review assessing the effectiveness of a gluten-free diet in people without celiac disease did not find enough evidence to support a link between gluten sensitivity and MS.

- However, people with MS may be more likely to develop celiac disease, which prevents the body from tolerating gluten. As a result, some people with MS may benefit from avoiding gluten.
- Gluten is a protein present in wheat, rye, and barley. Therefore, people avoiding gluten should avoid foods containing these grains.

***Foods that contain gluten include:***

- Wheat products such as bread and baked goods
- Many premade soups and salad dressings
- Barley products such as malt, soups, beer, and brewer's yeast
- Rye, which is often present in bread and cereals

People who follow a gluten-free diet may miss out on important nutrients, including fiber, which is present in whole grains.

- They can boost their fiber intake by eating plenty of fresh vegetables, fruits, nuts, seeds, and pulses.
- ***Anyone considering a gluten-free diet should consult a doctor first.***

## **Paleo diet**

Many people who follow the Paleolithic, or "paleo," diet believe that the human body has not evolved to eat the highly processed foods people now commonly consume.

- The diet involves switching to foods that hunter-gatherers likely ate. The first step is to choose natural foods over processed foods, emphasizing meat and plant-based foods but not grains.
- In a small 2017 study, people with relapsing-remitting MS who consumed a modified paleo diet reported improvements in fatigue severity and quality of life scales.
- However, the authors concluded that larger controlled studies are necessary to fully assess the benefit of a paleo diet for people with MS.

## Wahls diet

The Wahls diet, or Wahls protocol, is a modified version of the paleo diet. Dr. Terry Wahls developed the plan specifically to help people with MS.

- Like the paleo diet, the Wahls diet features nutrient-dense, minimally processed foods.
- A person following the Wahls diet will prioritize green, leafy, and sulfur-rich vegetables; intensely colored fruits; and minimally processed animal proteins.
- Some studies have linked the Wahls diet with an improvement in MS symptoms. However, larger, better-controlled randomized studies are necessary to fully examine the effectiveness of the diet.

## Swank diet

Doctors developed the Swank diet as an MS treatment in the 1950s.

- It reduces saturated fat intake to 15 grams (g) per day and recommends limiting unsaturated fat intake to 20–50 g per day.

People on this diet:

- Cannot eat processed foods or dairy fats
- Cannot eat red meat during the first year
- Can eat as much white fish and shellfish as they like
- Should eat at least 2 cups each of fruits and vegetables every day
- Should eat whole grain pasta
- Should take cod liver oil and multivitamins daily

While some consider the diet to be dated, others report that it helps.

- Possible risks include deficiencies in folic acid and vitamins A, C, and E.

## Can they help with MS?

In 2015, the National Multiple Sclerosis Society (NMSS) reviewed several diets and their impact on MS.

- The authors of the review concluded that there is not enough evidence to recommend one diet over another and acknowledged that most diets restrict or leave out the same types of food.

In general, a person with MS should avoid foods that:

- Are highly processed
- Are high in saturated fat
- Have a high glycemic index

## Foods to eat (*HealthLine*)

Here is a list of foods to include in an MS-friendly diet:

- Fruits and vegetables: all fresh fruits and vegetables
- Grains: all grains, such as oats, rice, and quinoa
- Nuts and seeds: all nuts and seeds
- Fish: all fish, especially fresh fish and fatty oily fish, such as salmon and mackerel, as they're high in omega-3 fatty acids and vitamin D
- Meats: all fresh meats, such as beef, chicken, lamb, and more, especially beef liver, which is particularly high in vitamin D and biotin
- Eggs: good source of biotin, vitamin D, and other important nutrients
- Dairy products: such as milk, cheese, yogurt, and butter
- Fats: healthy fats, such as olive, flax seed, coconut, and avocado oils
- Probiotic-rich foods: such as yogurt, kefir, sauerkraut, and kimchi
- Beverages: water, herbal teas
- Herbs and spices: all fresh herbs and spices

In short, the guidelines for an MS-friendly diet are similar to an overall nutrient-rich, well-balanced diet.

- That's because plant-based foods and grains are higher in fiber, vitamins, minerals, and fluid, which can help with MS symptoms, such as constipation.
- They're also higher in compounds that function as antioxidants, which are molecules that help defend your cells against free radical damage and inflammation.
  - These compounds may help fight inflammation and potentially slow MS progression.

## Examples Of Possible Diets

<b>Diet</b> <i>(Multiple Sclerosis News Today &amp; Healthline)</i>	<b>Food to Eat</b>	<b>Foods to Avoid</b>	<b>Questionable or Decrease</b>
<p style="text-align: center;"><b>Paleo</b></p> <p>The Paleo diet takes as its inspiration, as its name implies, the diet of our hunter-gatherer ancestors (i.e., Paleolithic times).</p> <ul style="list-style-type: none"> <li>Basically, it is founded on the concept that the human body cannot handle the highly processed foods of today and is better adapted to eating foods that are found naturally.</li> </ul> <p>These include fresh meat (lean game meats), fish, nuts, vegetables and fruits, but exclude dairy, grains, pulses (certain types of legumes, like dried beans, chickpeas and lentils), potatoes, and all processed food.</p> <p>Adjusting to a Paleo diet might not be bad for a person with MS, but extra effort is needed to ensure all necessary nutrients are being supplied, as cutting dairy and grains can result in deficiencies in folic acid, thiamine and vitamin B6 (from cereals), calcium and vitamin D (from dairy).</p>	<p>Fruits</p> <p>Vegetables</p> <p>Nuts and seeds</p> <p>Lean meats, especially grass-fed animals or wild game</p> <p>Fish, especially those rich in omega-3 fatty acids, such as salmon, mackerel and albacore tuna</p> <p>Oils from fruits and nuts, such as olive oil or walnut oil</p>	<p>Grains, such as wheat, oats, and barley</p> <p>Legumes, such as beans, lentils, peanuts, and peas</p> <p>Dairy products</p> <p>Refined sugar and high fructose corn syrup</p> <p>Salt</p> <p>Potatoes</p> <p>Highly processed foods in general</p> <p>Artificial sweeteners: Aspartame, sucralose, cyclamates, saccharin, acesulfame potassium. Use natural sweeteners instead</p> <p>Some vegetable oils: Soybean oil, sunflower oil, cottonseed oil, corn oil, grapeseed oil, safflower oil and others.</p>	<p>Avoid most dairy, especially low-fat (some versions of paleo do include full-fat dairy like butter and cheese).</p> <p>You can also use the paleo diet as a starting point, adding in a few other healthy foods like grass-fed butter and gluten-free grains.</p> <p><i>(Healthline)</i></p>

<b>Diet</b> <i>(Multiple Sclerosis News Today)</i>	<b>Food to Eat</b>	<b>Foods to Avoid</b>	<b>Questionable or Decrease</b>
<p style="text-align: center;"><b>Mediterranean</b></p> <p>People with multiple sclerosis may benefit from this diet. A large, population-based study, published in 2012, reported that older adults who followed this diet — rich in fruits and vegetables, fish and grains — showed less damage to the brain's small vessels, damage that occurs as a normal part of aging and that also can be caused by diseases such as MS.</p>	<p>Fruits</p> <p>Vegetables</p> <p>Grains (mostly whole)</p> <p>Olive oil</p> <p>Beans</p> <p>Nuts</p> <p>Legumes</p> <p>Seeds</p> <p>Herbs</p> <p>Spices</p> <p>Seafood</p>	<p>Sugar-sweetened beverages</p> <p>Added sugar</p> <p>Processed meat</p> <p>Refined grains</p> <p>Refined oils</p> <p>Highly processed foods</p> <p>Fast Foods</p>	<p>Red Meat</p> <p>Salt</p> <p>Cheese and yogurt</p> <p>Milk</p> <p>Crème</p> <p>Poultry</p> <p>Eggs</p> <p>Sweeteners, such as honey</p> <p>Wine</p>

<b>Diet</b> <i>(Multiple Sclerosis News Today)</i>	<b>Swank Diet</b> <b>Quick Reference</b> <a href="http://www.swankmsdiet.org/the-diet">www.swankmsdiet.org/the-diet</a>
<p style="text-align: center;"><b>Swank</b></p> <p>The Swank diet is probably the best known of all diets associated with multiple sclerosis, having been the subject of MS research for more than 50 years. This low-fat diet is named after Dr. Roy Swank, who developed it in the 1940s.</p> <p>The Swank diet is focused on reducing saturated and regulating unsaturated fats: it allows no more than 15 grams of saturated fat a day (animal fat, and vegetable or other processed oils like coconut oil), and between 20 and 50 grams of unsaturated fats, oils like olive or sesame oil, sunflower, flaxseed or peanut oil. (In general, 5 grams equals 1 teaspoon.)</p>	<p>No processed foods containing saturated fat and/or hydrogenated oils.</p> <p>Saturated fat should not exceed 15 grams per day.</p> <p>Unsaturated fat (oils) should be kept to 20-50 grams/day.</p> <p>Fruits and vegetables are permissible in any amount.</p> <p>No red meat for the first year, including pork. After the first year, 3 oz. of red meat is allowed once per week.</p> <p>White-meat poultry (skinless) and white fish are permissible but avoid dark-meat poultry and limit fatty fish to 50 grams (1.75 oz)/day.</p> <p>Dairy products must contain 1% or less butterfat unless otherwise noted. Use egg whites only, no yolks.</p> <p>Cod liver oil (1 tsp. or equivalent capsules) and a multi-vitamin and mineral supplement are recommended daily.</p> <p>Whole-grain breads, rice, and pastas are encouraged.</p> <p>Daily snacks of nuts &amp; seeds are good sources of natural oil and help maintain a good energy level.</p>

Diet <i>(Multiple Sclerosis News Today)</i>	Food to Eat	Foods to Avoid	Questionable or Decrease
<p><b>Gluten Free</b></p> <p>Gluten sensitivity or intolerance is suggested in a few studies to be associated with autoimmune diseases such as MS, so that adopting a gluten-free diet may be of benefit to some people with this disease.</p> <p>A gluten-free diet (GFD) is a diet with absolutely no products derived from cereals — wheat, barley, rye and triticale (a cross between wheat and rye) — that contain gluten.</p>	<p>Rice Cassava Corn (Maize) Soy Potato Tapioca Beans Sorghum Quinoa Millet Buckwheat Groats (Also Known As Kasha) Arrowroot Amaranth Teff Flax Chia Yucca Gluten-Free Oats Nut Flours <i>(Celiac Disease Foundation)</i></p> <p>Beans, seeds and nuts in their natural, unprocessed form</p> <p>Fresh eggs</p> <p>Fresh meats, fish and poultry (not breaded, batter-coated or marinated)</p> <p>Fruits and vegetables</p> <p>Most dairy products <i>(Mayo Clinic)</i></p>	<p>Wheat Wheat germ Rye Barley Bulgur Couscous Farina Graham flour Kamut Matzo Semolina Spelt Triticale Durum flour</p> <p><b>Possible to Avoid or Other Names</b></p> <p>Avena sativa Cyclodextrin Dextrin Fermented grain extract Hordeum distichon Hordeum vulgare Hydrolysate Hydrolyzed malt extract Hydrolyzed vegetable protein Maltodextrin Phytosphingosine extract Samino peptide complex Secale cereale Triticum aestivum Triticum vulgare Tocopherol/vitamin E Yeast extract Natural flavoring Brown rice syrup Modified food starch Hydrolyzed vegetable protein (HVP) Hydrolyzed soy protein Caramel color (frequently made from barley)</p>	<p>Malt/Malt Flavoring Soups Commercial Bullion Broths Cold Cuts French Fries (Often Dusted With Flour (Before Freezing)) Processed Cheese (E.G., Velveeta) Mayonnaise Ketchup Malt Vinegar Soy Sauce Teriyaki Sauces Salad Dressings Imitation Crab Meat Bacon Egg Substitute Tabbouleh Sausage Non-Dairy Creamer Fried Vegetables/Tempura Gravy, Marinades Canned Baked Beans Cereals, commercial Chocolate Milk Breaded Foods Fruit Fillings Puddings Hot Dogs Ice Cream Root Beer Energy Bars Trail Mix Syrups Seitan Wheatgrass Instant Hot Drinks Flavored Coffee/Tea Blue Cheeses Vodka Wine Coolers Meatballs, Meatloaf Communion Wafers Veggie Burgers Roasted Nuts Beer Oats &amp; Oat Bran (Unless Certified Gf)</p>

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*Author: Maria Rundell, PT, DPT, MSCS*

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