

## MUSCLE FATIGUE: STIFF AFTER IMMENSE WORKLOAD

\*<sup>1</sup>Kushal Nandi, <sup>1</sup>Saroni Saha, <sup>1</sup>Amrita Chakraborty, <sup>1</sup>Dr. Dhrubo Jyoti Sen and <sup>2</sup>Dr. Dhananjay Saha

<sup>1</sup>Department of Pharmaceutical Chemistry, School of Pharmacy, Techno India University, Salt Lake City, Sector-V, EM-4, Kolkata-700091, West Bengal, India.

<sup>2</sup>Deputy Director, Directorate of Technical Education, Bikash Bhavan, Salt Lake City, Kolkata-700091, West Bengal, India.

**Corresponding Author: Kushal Nandi**

Department of Pharmaceutical Chemistry, School of Pharmacy, Techno India University, Salt Lake City, Sector-V, EM-4, Kolkata-700091, West Bengal, India. **Email id:** [Yahoo\\_dhrubosen69@yahoo.com](mailto:Yahoo_dhrubosen69@yahoo.com), [kushal.nandibwn@gmail.com](mailto:kushal.nandibwn@gmail.com).

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### ABSTRACT

Muscle fatigue is a symptom that makes it harder to move as normal. Some people experience a dull aching in the muscles. They may also feel constantly tired and lack the energy to perform everyday tasks. Exercise is a common cause of muscle fatigue. Some health conditions can also prompt muscle fatigue, including muscle dystrophy. Several remedies are available to relieve muscle fatigue, including nutritional supplements or caffeine. In this article, we review possible causes and treatments for muscle fatigue. Strenuous activity and aging are two causes of muscle fatigue. But several health conditions can also produce muscle fatigue.

These medical conditions include:

- Cancer
- Stroke
- Rhabdomyolysis
- Obesity
- Inflammatory diseases, such as arthritis
- Sepsis
- Burns
- HIV
- Chronic Kidney Failure
- Muscular dystrophies

**KEYWORDS:** Exercise, Obesity, Aging, Nutritional supplements, Fibromyalgia.

### Primary or true muscle weakness

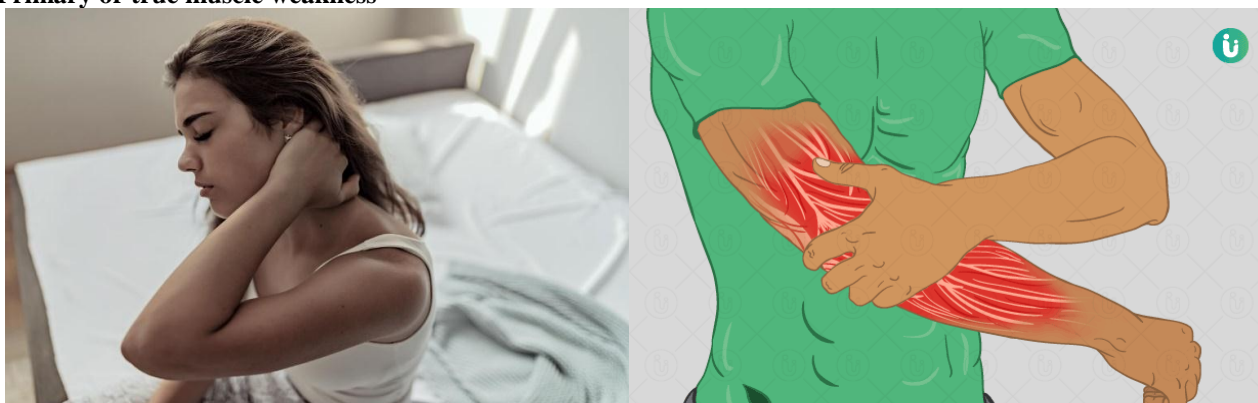


Figure-1: Primary Muscle Weakness.

This shows itself as an inability to perform what you want to do with a muscle, even the first time you try. There is a reduction in the force which the muscle can exert, however hard you try. The muscle is not working properly - it has become abnormal.<sup>[1]</sup>

When this kind of weakness occurs the muscles are often floppier than usual and reduced in bulkiness. It can happen, for example, following stroke. It is also seen in a condition called muscular dystrophy (discussed further below). Both of these conditions result in weakened muscles which cannot move the usual load. It's a real change in muscle power.

#### Muscle tiredness

This is sometimes called asthenia. It is a sense of weariness or exhaustion that you feel when using the

muscle. The muscle isn't genuinely weaker, it can still do its job but it takes you more effort to manage it. This type of weakness is often seen in people who have chronic fatigue syndrome, sleep disorders, depression, and chronic heart, lung, and kidney disease. It may be due to a reduction in the speed with which the muscle can get its energy supply.<sup>[2]</sup>

#### Muscle 'fatigability'

Some muscle tiredness is mainly muscle 'fatigability' - the muscle starts off normally but tires very quickly and takes longer than normal to recover. This often goes with muscle tiredness but is particularly seen in some uncommon conditions such as myasthenia gravis and moronic dystrophy.

## NEUROMUSCULAR FATIGUE

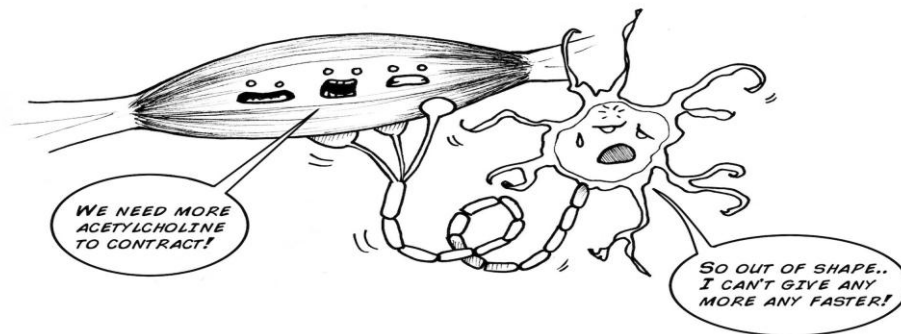


Figure-2: Muscular Fatigue.

The difference between these three types of muscle weakness is often vague and you can have more than one of them. You can also progress from one to another. However, working out which one is the main problem can help doctors work out what is causing it. This is because some conditions tend to cause one type of weakness rather than another.

**Causes of muscle weakness:** Muscle weakness is commonly due to lack of exercise, ageing, muscle injury or pregnancy. It can also occur with long-term conditions such as diabetes or heart disease. There are many other possible causes, which include stroke, multiple sclerosis, depression, fibromyalgia and chronic fatigue syndrome (ME).

- **Lack of use:** Lack of muscle fitness (reconditioning) is one of the most common causes of muscle weakness. It may occur as a result of an inactive (sedentary).
- **Ageing:** As we age, our muscles tend to lose strength and bulk and they become weaker. Whilst most people accept this as the natural consequence of age - particularly great age - it is frustrating to be unable to do the things you could manage when younger.
- **Infections:** Infections and illnesses are amongst the most common causes of temporary muscle fatigue.

This is usually through muscle inflammation. Even though recovery is usual, if inflammation is severe (such as a bad bout of influenza), the weakness can last quite a while. This can sometimes trigger chronic fatigue syndrome (CFS).

- **Pregnancy:** During and just after pregnancy, high levels of steroids in the blood, together with a tendency to be relatively lacking in iron (anemia), can cause a feeling of muscle tiredness.<sup>[3]</sup>

#### Conditions affecting brain 'drive' to muscles

- **Anxiety:** Generalized tiredness can be caused by anxiety. This is due to over activity of the body's adrenaline (epinephrine) system.
- **Depression:** General weariness and a feeling of generalized tiredness can also be caused by depression.
- **Chronic pain:** A general effect on energy levels can result from chronic pain. Like anxiety, it stimulates the production of chemical substances (hormones) in the body which respond to pain and injury. These chemicals lead to feelings of tiredness or fatigue. In chronic pain, true weakness can result, as muscles may not be used due to pain and discomfort.

### Muscle damage through injury

There are many ways in which your muscles can be directly damaged. The most obvious is injury or trauma such as sporting injuries, pulls and sprains. In any muscle injury, bleeding from damaged muscle fibers occurs inside the muscle, followed by swelling and inflammation. This makes the muscle less strong and also painful to use. Localized pain is the primary symptom but weakness also results.

### Medicines

Many medicines can cause muscle weakness and muscle damage as a side-effect or an allergic reaction. Usually this begins as tiredness or fatigue. It can progress to permanent changes if the medicines are not stopped. Medicines in common use which can occasionally do this include statins (used to lower cholesterol levels),

some antibiotics (including ciprofloxacin and penicillin and anti-inflammatory painkillers such as naproxen and diclofenac Long-term use of prescribed oral steroids also causes muscle weakness and wasting. This is an expected side-effect which anyone on long-term treatment is likely to experience. It's one of the reasons doctors try to avoid putting patients on long-term steroids if possible.<sup>[4]</sup>

Less commonly-used medicines which can cause muscle weakness and damage to muscles include Some heart medicines (for example, amiodarone).

- Chemotherapy medicines.
- Anti-HIV medications.
- Interferon - used in some cancers and for multiple sclerosis (MS).
- Medicines used to treat an overactive thyroid gland.

### Uncommon causes of muscle weakness

- **Chronic fatigue syndrome (CFS)**

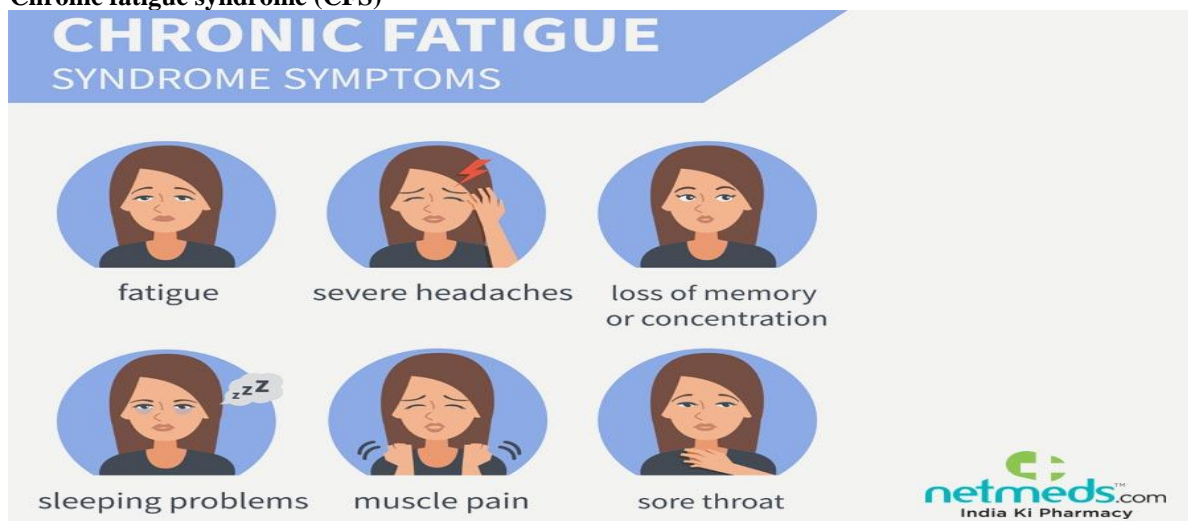


Figure-3: Chronic Fatigue.

CFS is sometimes triggered by certain viral infections such as glandular fever (Epstein-Barr virus) and flu (influenza) but it is poorly understood. Muscles are not inflamed but tire very easily. Patients often feel enormous effort is needed for muscle activity which they would previously have found easy.

In CFS, muscles are not usually wasted and they may have normal strength on testing. This is reassuring, as it means the chance of recovery to completely normal function is very high. CFS also causes psychological weariness, with other activities like reading and socializing also becoming exhausting. Patients often show signs of depression and poor sleep.<sup>[5]</sup>

- **Fibromyalgia**

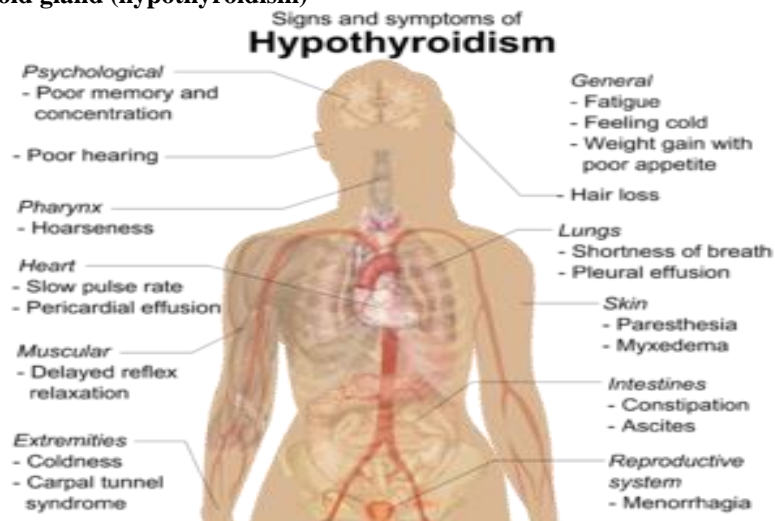


Figure-4: Fibromyalgia.

This condition resembles CFS. However, in fibromyalgia the muscles also become very tender to touch and they tire extremely easily. They are not usually wasted and can demonstrate normal (although uncomfortable)

strength on formal testing. People with fibromyalgia tend to complain more of the pain than the tiredness or weakness.<sup>[6]</sup>

- **Underactive thyroid gland (hypothyroidism)**



**Figure-5: Hypothyroidism.**

In this condition a shortage of thyroid hormone leads to generalized tiredness. In untreated hypothyroidism, muscle degeneration and wasting can develop. This can be severe and difficult to reverse. Hypothyroidism is a common condition but it is usually picked up early and treated before long-lasting muscle problems can result.

- **Electrolyte disorders and lack of fluid in the body (dehydration)**

Problems of the balance of salts in the body, including dehydration through not drinking enough, cause muscle tiredness. This may be severe in extreme cases, such as dehydration during a marathon. Muscles work less well when there is an imbalance in the salts in the blood.

#### **Treatments for muscle fatigue**

When muscle fatigue is the result of strenuous activity or aging, treatment is usually unnecessary. In other cases, a doctor will try to identify the underlying cause of muscle fatigue and offer treatment.

An example of this is when a doctor recommends a healthy diet and regular exercise if obesity is causing muscle fatigue. As a person loses weight, they should notice their muscle fatigue getting better over time.

There are no formal guidelines for treating muscle fatigue as a symptom. But there are several possibilities for people experiencing muscle fatigue from strenuous activity or aging.<sup>[7]</sup>

**Synthetic products: Amphetamines, ephedrine, and caffeine** are synthetic products that promote resistance to muscle fatigue. These products are sometimes common in sport for enhancing performance. In 2005, the World Anti-Doping Agency reported Trusted Source that more than half of substance abuse cases in sport involve either amphetamines or ephedrine. On the other hand, caffeine is still legal in sports and has a similar effect on muscles. High doses of caffeine can enhance Trusted Source athletic performance during exercise. Caffeine can help to reduce muscle fatigue after several types of exercise, such as running or weight training.



**Figure-6: Amphetamines, Ephedrine & Caffeine Medication.**



**Natural products:** Several natural products can also help when a person experiences muscle fatigue from exercising or aging. **Ginseng** is a herb with several possible health benefits, such as relieving muscle fatigue. One 2017 review of research on the subject reports that red ginseng can improve muscle performance in people during weight training. Garlic may also reduce muscle fatigue. The same 2017 review reports Trusted Source that raw garlic increases how long mice can run on a treadmill and how fast they recover.

**Nutritional supplements**

There are three main categories of nutritional supplements for muscle fatigue:

- **Dietary supplements:** Dietary supplements include products such as multivitamins or fish oil. Lacking certain nutrients in the diet can lead to muscle problems. For example, a lack of vitamin Trusted Source can cause muscle fatigue. Dietary supplements can help provide enough nutrition to keep muscles healthy.<sup>[8]</sup>



Figure-7: Dietary Supplements.

- **Ergogenic aids:** Many people use ergogenic aids, such as creatine, in sport to improve muscle performance. This is a naturally occurring acid that helps to provide

muscles with energy during movement. Creatine is in foods such as red meat and seafood. It is also available as a supplement.<sup>[9]</sup>

### Timing of Ergogenic Aids and Micronutrients on Muscle and Exercise Performance

Acute supplements with documented timing benefits	Chronic supplements with documented timing benefits	Chronic supplements with mostly unexplored, but potential timing effects	
<p><b>Caffeine</b></p> <p>Benefits: Increased performance via ↑ fat utilization, mental drive, force production, and muscle endurance, and ↓ perceived fatigue</p> <p>Absolute dose: 300-500 mg Relative dose: 3-6 mg/kg body mass</p> <p>Timing: 0-1 hour pre-exercise</p>	<p><b>Creatine</b></p> <p>Benefits: Increased high-intensity exercise capacity, muscle mass, and strength via ↑ PCR and ATP synthesis</p> <p>Absolute dose: 5 g/day Relative dose: 0.1 g/kg body mass/day</p> <p>Timing: Close proximity to training for 1-3 weeks</p>	<p><b>β-Alanine</b></p> <p>Benefits: Increased high-intensity and resistance exercise performance via ↑ carnosine production &amp; muscle buffering</p> <p>Dose: 1.3-1.6 g 6-7 g/day total</p> <p>Timing: 4x/day</p>	<p><b>Calcium</b></p> <p>Benefits: Increased bone resilience and muscle contraction efficiency via ↑ bone density &amp; ↓ parathyroid hormone</p> <p>Dose: 1000 Ull/day</p> <p>Timing: 60 min pre-exercise</p>
<p><b>Nitrate</b></p> <p>Benefits: Increased endurance and intermittent exercise performance via ↑ blood flow and muscle contractility</p> <p>Dose: Manufacturer's recommendation</p> <p>Timing: 2-3 hours pre-exercise</p>	<p><b>Iron</b></p> <p>Benefits: Increased endurance performance via ↑ oxygen carrying capacity of the blood</p> <p>Dose: 100 mg/day</p> <p>Timing: For 3-6 weeks</p>	<p><b>Sodium Bicarbonate</b></p> <p>Benefits: Increased high-intensity and repeated high-intensity exercise performance via ↓ muscle acidosis</p> <p>Dose: 0.3 g/kg body mass; Split into smaller doses throughout the day to ↓ GI distress</p> <p>Timing: 1-3 hours pre-exercise; Consume for multiple days leading up to competition</p>	

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Figure-8: Ergogenic Aids.

• **Sports foods:** Sports foods contain a variety of substances that provide energy to muscles and improve performance. For example, the energy drink Red Bull contains a mixture of carbohydrates, taurine, and

caffeine. These products may suggest that they help reduce muscle fatigue, but the scientific evidence for these claims is lacking.<sup>[10]</sup>



Figure-9: Energy Drinks.

#### When to see a doctor?

A healthcare professional can perform tests to identify the cause of muscle fatigue. Anyone with muscle fatigue should speak to a doctor if it is not the result of exercising or aging. Healthcare professionals can assess

medical history and perform tests to identify the cause. In some cases, muscle fatigue may be a sign of an underlying health condition. Without medical attention, the condition could worsen and cause further problems.

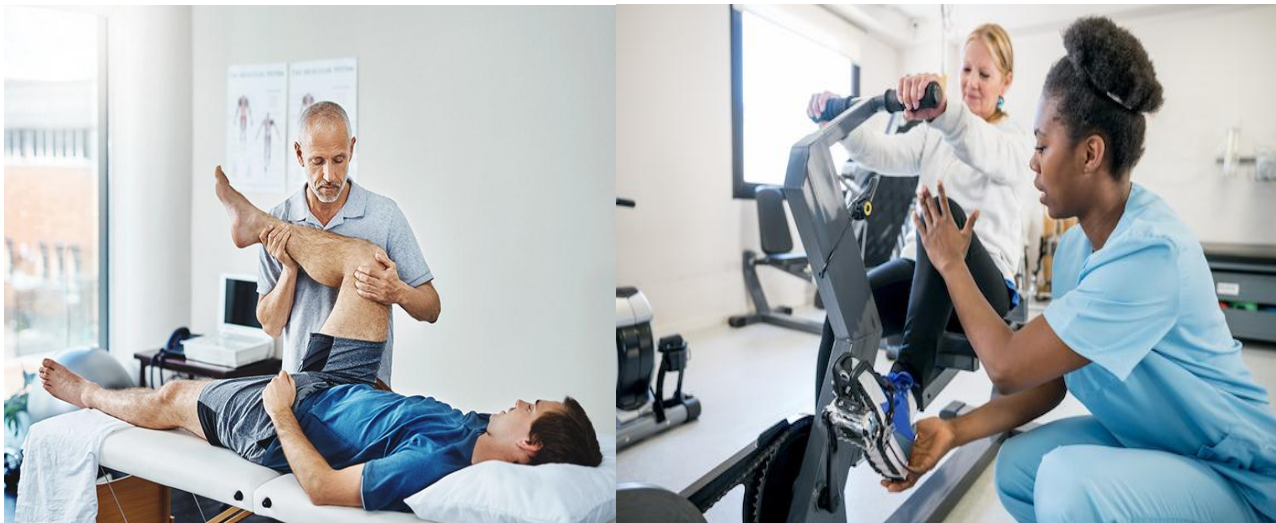


Figure-10: Doctor's Checking Muscle Fatigue Patient

#### CONCLUSION

Muscle fatigue can be uncomfortable and disrupt a person's daily life. Strenuous activity or aging are common causes of muscle fatigue. Sometimes, muscle fatigue is a sign of an underlying medical condition. In these cases, it is important to see a doctor. Many types of treatment exist for muscle fatigue. Doctors will aim to treat the underlying cause of the problem. They may also recommend a range of other treatments that can improve muscle performance and prevent fatigue. There are many possible causes of muscle weakness. Fortunately, most cases of muscle weakness which lack obvious cause are

reversible. Muscle weakness is rarely the only sign of serious underlying disease. If you have persisting muscle weakness, particularly if it is severe, localized, painful or present for more than two to three weeks, you should discuss this with your doctor. Once your doctor has talked to you about your symptoms, they will be able to offer some guidance as to the likely cause. They will also be able to tell you if there are any serious concerns about your symptoms and will be able to refer you for further testing if required.

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