



## Newborn Screening ACT Sheet

### Increased Leucine Maple Syrup (Urine) Disease

**Differential Diagnosis:** Maple syrup urine disease (MSUD); hydroxyprolinemia.

**Condition Description:** In MSUD, leucine, isoleucine, and valine (branched chain amino acids) cannot be metabolized further than their  $\alpha$ -ketoacid derivatives. The amino acids and organic acids accumulate and produce severe toxicity.

#### Medical Emergency: Take the Following IMMEDIATE Actions

- Contact family to inform them of the newborn screening result and ascertain clinical status (poor feeding, vomiting, lethargy, tachypnea).
- Consult with pediatric metabolic specialist. (See attached list.)
- Evaluate the newborn (poor feeding, lethargy, tachypnea, alternating hypertonia/hypotonia, seizures).
- If any sign is present or infant is ill, transport to hospital for further treatment in consultation with metabolic specialist.
- Initiate timely confirmatory/diagnostic testing and management, as recommended by specialist.
- Initial testing: plasma quantitative amino acids and urine organic acids.
- Repeat newborn screen if second screen has not yet been done.
- Provide the family with basic information about MSUD and dietary management.
- Report findings to newborn screening program.

**Diagnostic Evaluation:** In MSUD, plasma amino acid analysis reveals elevations of leucine, isoleucine, alloleucine, and valine (the branched chain amino acids) and urine organic acid analysis reveals abnormal branched-chain hydroxyl- and ketoacids. In expanded screening, leucine/isoleucine and hydroxyproline can not be differentiated, so if the baby has hydroxyprolinemia, confirmatory amino acid analysis will show only increased hydroxyproline.

**Clinical Expectations:** MSUD presents in the neonate with feeding intolerance, failure to thrive, vomiting, lethargy, and maple syrup odor to urine and cerumen. If untreated, it will progress to irreversible mental retardation, hyperactivity, failure to thrive, seizures, coma, cerebral edema, and possibly death. Hydroxyprolinemia is probably benign.

#### Additional Information:

##### New England Metabolic Consortium – Emergency Protocols

<http://www.childrenshospital.org/newenglandconsortium/NBS/MSUD.html>

[http://www.childrenshospital.org/newenglandconsortium/NBS/MSUD/MSUD\\_protocol.htm](http://www.childrenshospital.org/newenglandconsortium/NBS/MSUD/MSUD_protocol.htm)

##### Gene Tests/Gene Clinics

<http://www.genetests.org/servlet/access?db=geneclinics&site=gt&id=8888891&key=HWrct-uSq-Lup&gry=&fcn=y&fw=FjdM&filena me=/profiles/msud/index.html>

##### Genetics Home Reference

<http://ghr.nlm.nih.gov/condition=maplesyrupurinedisease>

##### STAR G FELSI

<http://www.newbornscreening.info/Parents/aminoaciddisorders/MSUD.html>

<http://www.newbornscreening.info/Pro/aminoaciddisorders/MSUD.html>



## Newborn Screening FACT Sheet

### Maple Syrup Urine Disease (MSUD)

#### What is MSUD?

MSUD is a type of amino acid disorder. It is named for the sweet maple syrup smell of the urine in untreated babies. People with MSUD have problems breaking down certain amino acids from protein in food.

#### What Causes MSUD?

Enzymes help start chemical reactions in the body. The most common form of MSUD is caused by the lack of a group of enzymes called “branched-chain ketoacid dehydrogenase” (BCKAD). This enzyme group breaks down three different amino acids. These are called “branched chain amino acids” (BCAA). When the body can’t break them down, they build up in the blood and cause problems.

#### What Symptoms or Problems Occur with MSUD?

*[Symptoms are something out of the ordinary that parents notice.]*

Symptoms start as soon as a baby is fed protein, usually right after birth. Some of the first are:

- poor appetite
- weak suck
- weight loss
- high-pitched cry
- urine that smells like maple syrup or burnt sugar

Babies with MSUD have periods of illness called Metabolic Crises. Some first symptoms are:

- too much sleepiness
- tiredness
- irritable mood
- vomiting

Brain damage can occur if untreated. This can cause mental retardation. Some babies become blind. Most babies die within a few months if not treated. There are milder forms that may cause mental retardation.

#### What is the Treatment for MSUD?

The following treatments are often used for children with MSUD:

**1. Medical Formula** – The doctor may prescribe a

special medical formula with the right amount of protein. This will help keep your child’s BCAA levels in a safe range.

**2. Diet low in BCAAs** – The right diet is made up of foods that are very low in the BCAAs. This means your child will need to not eat foods such as cow’s milk, regular formula, meat, fish, cheese, and eggs. Regular flour, dried beans, nuts, and peanut butter also must be highly limited or not eaten. Many vegetables and fruits can be eaten in the right amounts. Your child should use this diet for life.

**3. Checking BCAA levels** – Your child will have regular blood tests to measure amino acid levels. The diet and formula may need to be changed based on blood test results.

#### Things to Remember

For children with MSUD, even minor illness such as a cold or flu can cause a Metabolic Crisis. Call your doctor right away when your child has any of the following:

- poor appetite
- low energy or too much sleepiness
- vomiting
- an infection or illness
- a fever
- behavior or personality changes (such as crying too much)
- difficulty walking or balance problems

Children with MSUD need to eat more starchy foods (such as rice, cereal, bread) and drink more fluids during any illness or they could have a Metabolic Crisis. Children who are sick may not want to eat. If they can’t eat, or if they show signs of a Metabolic Crisis, they may need to be treated in the hospital.