



TFP Deficiency (Trifunctional Protein Deficiency)

What is it?

TFP deficiency stands for trifunctional protein deficiency. It is one type of fatty acid oxidation disorder. People with TFP deficiency have problems breaking down fat into energy for the body.

What causes it?

TFP deficiency occurs when a group of enzymes called trifunctional protein (TFP) are either missing or not working properly. The job of TFP is to break down foods we eat into energy. It also breaks down fat already stored in the body.

Energy from fat keeps us going whenever our bodies run low of their main source of energy, a type of sugar called glucose. Our bodies rely on fat when we don't eat for a stretch of time – like when we miss a meal or when we sleep.

When TFP is missing or not working well, the body cannot use fats for energy. Instead, it must rely solely on glucose. Although glucose is a good source of energy, there is a limited amount available. Once the glucose has been used up, the body tries to use fat without success. This leads to low blood sugar, called hypoglycemia, and to the buildup of harmful substances in the blood.

If TFP deficiency is not treated, what problems occur?

TFP deficiency can cause mild symptoms in some people or more serious health problems in others. There are three forms of TFP deficiency: early, childhood and mild.

Babies and children with early and childhood TFP deficiency have episodes of illness called metabolic crises. Some of the first symptoms of a metabolic crisis are:

- 1) Extreme sleepiness.
- 2) Behavior changes.
- 3) Irritable mood.
- 4) Muscle weakness.
- 5) Poor appetite.

Other symptoms then follow:

- 1) Fever
- 2) Nausea
- 3) Diarrhea
- 4) Vomiting
- 5) Hypoglycemia
- 6) Increased levels of acidic substances in the blood, called metabolic acidosis

If a metabolic crisis is not treated, a child with TFP deficiency can develop:

- 1) Breathing problems.
- 2) Seizures.
- 3) Coma, sometimes leading to death.

Periods of hypoglycemia can happen without other symptoms of metabolic crisis.

Hypoglycemia causes:

- 1) Weakness.
- 2) Shakiness.
- 3) Dizziness.
- 4) Clammy, cold skin.
- 5) If untreated, coma and sometimes death.

In children with TFP deficiency, either hypoglycemia or a metabolic crisis can happen:

- 1) After going too long without food.

- 2) After long periods of exercise.
- 3) During illness or infection.
- 4) During times of stress, such as surgery.

Early TFP Deficiency

Babies with early TFP deficiency usually show symptoms anywhere from birth through age 2.

The first symptoms are often:

- 1) Poor appetite.
- 2) Sluggishness.
- 3) Extreme sleepiness.
- 4) Muscle weakness.
- 5) Absent reflexes.
- 6) No response to pain.
- 7) Delays in walking and learning.

Babies with early TFP deficiency often have many episodes of metabolic crisis.

Other effects of early TFP deficiency can include:

- 1) Serious heart problems and enlarged heart.
- 2) Buildup of fat in the liver and other liver problems.
- 3) Breathing problems.

Infants with early TFP who remain untreated usually die of heart or breathing problems by age 3.

Childhood TFP Deficiency

Childhood TFP deficiency causes episodes of hypoglycemia and metabolic crisis. Between these episodes, children with TFP deficiency are usually healthy. However, repeated episodes can cause brain damage. This can result in learning problems or mental retardation.

Bouts of muscle weakness and pain happen in some children, especially after heavy exercise, stress or illness.

Mild/Muscle TFP Deficiency

The mild form of TFP deficiency has been reported in a small number of people. Symptoms can begin anywhere from age 2 to adulthood.

Episodes of muscle weakness are common. Breakdown of muscle fibers can occur. This usually happens:

- 1) After strenuous exercise or exertion.
- 2) During illness or infection.
- 3) After going without food for a long period of time.

Signs of muscle breakdown are:

- 1) Muscle aches.
- 2) Cramps.
- 3) Weakness.
- 4) Reddish-brown color to the urine.
- 5) Breathing problems.

If muscle symptoms are not treated, kidney failure can occur.

The mild form of TFP deficiency does not cause metabolic crises or heart or liver problems.

What is the treatment for TFP deficiency?

Your baby's primary doctor will work with a metabolic doctor and a dietician to care for your child.

Certain treatments may be advised for some children but not others. When necessary, treatment usually is needed throughout life. The following are treatments often recommended for children with TFP deficiency:

Avoid Going a Long Time Without Food

Babies and young children with TFP deficiency need to eat often to avoid hypoglycemia and metabolic crisis. They should not go without food for more than four to six hours. Some babies may need to eat even more often than this. It is important that babies be fed during the night. They need to be awakened to eat if they do not wake up on their own.

Young children with TFP deficiency should have a starchy snack before bed and another during the night. They need another snack first thing in the morning. Raw cornstarch mixed

with water, milk or other drink is a good source of long-lasting energy. This is sometimes suggested for children older than age 1. Your dietician can give you ideas for good nighttime snacks.

When they are well, most teens and adults with TFP deficiency can go without food for up to 12 hours without problems. They do need to continue the other treatments throughout life.

Diet

A low-fat, high-carbohydrate diet is often recommended. Carbohydrates give the body many types of sugar that can be used as energy. Any diet changes should be made under the guidance of a dietician. In fact, for children needing this treatment, most food in the diet should be carbohydrates (bread, pasta, fruit, vegetables, etc.) and protein (lean meat and low-fat dairy foods). Any diet changes should be made under the guidance of a dietician.

People with TFP deficiency cannot use certain building blocks of fat called long-chain fatty acids. A dietician can help create a food plan low in these fats. Much of the rest of the fat in the diet will likely be in the form of medium-chain fatty acids.

Ask your doctor whether your child needs to have any changes in his or her diet.

MCT Oil and L-carnitine

Medium chain triglyceride oil (MCT oil) is often used as part of the food plan for people with TFP deficiency. This special oil has medium chain fatty acids that can be used in small amounts for energy. Your metabolic doctor or dietician can guide you in how to use this supplement. You will need to get a prescription from your doctor to get MCT oil.

Some children and adults may be helped by L-carnitine. This is a safe and natural substance that helps body cells create energy. It also helps the body get rid of harmful wastes. Your doctor

will decide whether or not your child needs L-carnitine. Unless you are advised otherwise, use only L-carnitine prescribed by your doctor.

Do not use any supplements without checking with your doctor.

Call Your Doctor at the Start of Any Illness

Always call your doctor when your child has any of the following:

- 1) Poor appetite
- 2) Low energy or excessive sleepiness
- 3) Vomiting
- 4) Diarrhea
- 5) An infection
- 6) A fever
- 7) Persistent muscle pain or weakness
- 8) Reddish-brown color to urine

Ask your metabolic doctor if you should carry a special travel letter with medical instructions for your child's care.

Avoid Heavy Exercise and Extreme Cold

Long periods of heavy exercise can trigger symptoms in people with TFP deficiency. Effects of exercise can include muscle aches, cramps and weakness. Muscle fibers may break down. This can turn the urine a reddish-brown color.

If muscle symptoms occur, prompt treatment is needed to prevent kidney damage. Children or adults with muscle symptoms should:

- 1) Drink fluids right away.
- 2) Eat something starchy or sugary.
- 3) Get to a hospital for treatment.

To prevent muscle symptoms:

- 1) Avoid prolonged or heavy exercise.
- 2) Avoid extreme cold.
- 3) Eat starchy or sugary food before and during periods of moderate exercise.

What happens when TFP deficiency is treated?

Early TFP Deficiency

Most babies with early TFP deficiency die of heart or breathing problems, even when treated. However, treatment may help prolong life in some babies.

Childhood TFP Deficiency

With prompt and careful treatment, children with TFP deficiency can often live healthy lives with typical growth and development. Some children continue to have episodes of hypoglycemia or metabolic crisis, even with treatment. This can cause permanent brain damage and may result in learning disabilities or mental retardation.

Mild/Muscle TFP Deficiency

When treated, people with mild/muscle TFP deficiency usually remain healthy. This form does not affect intelligence.

What causes the trifunctional protein enzyme group to be absent or not working correctly?

Genes tell the body to make various enzymes. People with TFP deficiency have a pair of genes that do not work correctly. Because of the changes in this pair of genes, the TFP enzyme does not work properly or is not made at all.

Is TFP deficiency inherited?

TFP deficiency is inherited and affects both boys and girls equally.

Everyone has a pair of genes that make the TFP enzyme. In children with TFP deficiency, neither of these genes works correctly. These children inherit one nonworking gene for the condition from each parent.

Parents of children with TFP deficiency rarely have the disorder. Instead, each parent has a

single nonworking gene for TFP deficiency. They are called carriers. Carriers do not have TFP because the other gene of this pair is working correctly.

When both parents are carriers, there is a 25 percent chance in each pregnancy for the child to have TFP deficiency. There is a 50 percent chance for the child to be a carrier, just like the parents. And, there is a 25 percent chance for the child to have two working genes.

Can other members of the family have TFP deficiency or be carriers?

Having TFP Deficiency

The brothers and sisters of a baby with TFP deficiency have a chance of being affected, even if they haven't had symptoms. Finding out whether any other children in the family have TFP deficiency is important because early treatment may prevent serious health problems. Talk to your doctor or genetic counselor about testing your other children for TFP deficiency.

TFP Deficiency Carriers

Brothers and sisters who do not have TFP deficiency still have a chance to be carriers like their parents. Except in special cases, carrier testing should be done only in people older than 18.

Each of the parents' brothers and sisters have a 50 percent chance to be a TFP deficiency carrier. It is important for other family members to be told that they could be carriers. There is a small chance they are also at risk to have children with TFP deficiency.

When both parents are TFP deficiency carriers, newborn screening results are not sufficient to rule out TFP deficiency in a newborn baby. In this case, special diagnostic testing should be done in addition to newborn screening.

During pregnancy, women carrying fetuses with TFP deficiency are at risk to develop

serious medical problems. There is a small risk of:

- 1) Excessive vomiting.
- 2) Abdominal pain.
- 3) High blood pressure.
- 4) Jaundice.
- 5) Severe bleeding.
- 6) Abnormal fat storage in the liver.

All women with a family history of TFP deficiency should share this information with their obstetricians and other health-care providers before and during any future pregnancies. Knowing about these risks allows early treatment.

Can other family members be tested?

Diagnostic Testing

Brothers and sisters can be tested for TFP deficiency by DNA testing or special enzyme tests.

Carrier Testing

If both gene changes have been found in your child with TFP deficiency, other family members can have DNA testing to see if they are carriers.

How many people have TFP deficiency?

TFP deficiency is a very rare disorder. The actual incidence is unknown.

Does TFP deficiency happen more frequently in a certain ethnic group?

TFP deficiency does not happen more often in any specific race, ethnic group, geographical area or country.

Does TFP deficiency go by any other names?

TFP deficiency is sometimes also called mitochondrial trifunctional protein deficiency.

Where can I find more information?

Fatty Oxidation Disorders (FOD) Family Support Group

www.fodsupport.org

Organic Acidemia Association

www.oaanews.org

United Mitochondrial Disease Foundation

www.umdf.org

Children Living with Inherited Metabolic Diseases (CLIMB)

www.climb.org.uk

Genetic Alliance

www.geneticalliance.org

Children's Special Health Services (CSHS)

State Capitol Judicial Wing

600 E. Boulevard Ave., Department 301

Bismarck, ND 58505-0269

Toll Free: 800.755.2714

701.328.2436

Relay TDD: 701.328.3975

CSHS website: www.ndhealth.gov/CSHS

North Dakota Department of Health website:

www.ndhealth.gov

Family support resources available from CSHS:

- Guidelines of Care Info
- Family Support Packet
- Financial Help Packet
- Insurance Fact Sheet

Family Resources

Family to Family Network

Center for Rural Health

University of North Dakota

School of Medicine and Health Sciences

P.O. Box 9037

Grand Forks, ND 58202-9037

Toll Free: 888.434.7436

701.777.2359

Fax: 701.777.2353

E-mail: NDF2F@medicine.nodak.edu

www.medicine.nodak.edu/crh

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Pathfinder Family Center
1600 2nd Ave. SW, Ste. 19
Minot, ND 58701
Toll Free: 800.245.5840
701.837.7500
Relay TDD: 701.837.7501
E-mail: ndpath01@ndak.net
www.pathfinder.minot.com



North Dakota Department of Health
Newborn Screening Program
600 E. Boulevard Ave., Dept. 301
Bismarck, ND 58505-0200
800.472.2286 or 701.328.2493
www.ndhealth.gov/familyhealth

Family Voices of North Dakota, Inc.
P.O. Box 163
Edgeley, ND 58433
Toll Free: 888.522.9654
701.493.2634
Fax: 701.493.2635
www.geocities.com/ndfv

**This fact sheet has general information.
Every child is different and some of these facts
may not apply to your child specifically.
Certain treatments may be recommended for
some children but not others. All children
should be followed by a metabolic doctor in
addition to their primary-care provider.

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