



BKD **(Beta Ketothiolase Deficiency)**

What is it?

BKD stands for beta ketothiolase deficiency. It is one type of organic acid disorder. People with BKD have problems breaking down an amino acid called isoleucine from the food they eat.

What causes it?

In order for the body to use protein from the food we eat, it is broken down into smaller parts called amino acids. Special enzymes then make changes to the amino acids so the body can use them.

BKD occurs when an enzyme, called mitochondrial acetoacetyl-CoA thiolase (MAT), is either missing or not working properly. This enzyme's job is to help break down the amino acid isoleucine. When a child with BKD eats food containing isoleucine, harmful substances called organic acids build up in the blood and cause problems. Isoleucine is found in all foods that contain protein.

If PA is not treated, what problems occur?

Each child with BKD has slightly different effects. The first symptoms often start around age 1, although babies can have symptoms earlier or later than this.

BKD can cause episodes of illness called metabolic crises. Some of the first symptoms of a metabolic crisis are:

- 1) Poor appetite.
- 2) Vomiting.
- 3) Extreme sleepiness or lack of energy.
- 4) Fever.
- 5) Diarrhea.
- 6) Ketones in the urine (substances created during the breakdown of fat).

Other symptoms then follow:

- 1) Increased levels of acidic substances in the blood, called metabolic acidosis
- 2) Low blood sugar, called hypoglycemia
- 3) Coma, sometimes leading to death

Episodes of metabolic crisis can be triggered by:

- 1) Going too long without food.
- 2) Illness or infection.
- 3) Eating too much protein.

Other long-term effects of untreated BKD can include:

- 1) Mental retardation.
- 2) Enlarged heart with irregular heartbeat.
- 3) Poor growth.
- 4) Abnormal muscle tone (too floppy or too rigid).
- 5) Low platelets.
- 6) Low level of white blood cells (increasing the risk of infection).

Some people with BKD never have symptoms and are found to be affected only after a brother or sister is diagnosed.

What is the treatment for BKD?

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

Prompt treatment is needed to prevent metabolic crises and the health effects that follow. You should start treatment as soon as you know your child has this condition. When necessary, treatment is usually needed throughout life.

The following are treatments often recommended for babies and children with BKD:

Low-Protein Diet

Some children may be able to eat normal amounts of protein, but others will need to be on a low-protein diet.

Foods high in protein that may need to be limited include:

- 1) Milk and dairy products.
- 2) Meat and poultry.
- 3) Fish.
- 4) Eggs.
- 5) Dried beans and legumes.
- 6) Nuts and peanut butter.

Eating large amounts of these foods can cause protein levels to become too high, causing illness. However, do not remove all protein from the diet. Children with BKD need a certain amount of protein to grow properly.

If it is necessary for your child to eat a low-protein diet, your dietician can help you create a food plan that meets your child's needs. Any diet changes should be made under the guidance of a dietician.

Avoid Going a Long Time Without Food

Some babies and young children need to eat often to avoid a metabolic crisis. Your metabolic doctor will advise you as to whether your child needs to eat more often than usual and how to space your child's meals.

When they are well, most children older than 10 can go without food for up to 12 hours without problems.

Medication

Some children may be helped by taking L-carnitine by mouth. This is a safe and natural substance that helps body cells make energy. It also helps the body get rid of harmful wastes. Your doctor will decide whether or not your child needs L-carnitine supplements. Unless you are advised otherwise, use only L-carnitine prescribed by your doctor. Do not use any medication without checking with your metabolic doctor.

Certain antibiotics taken by mouth can help reduce the amount of propionic acid in the

intestines. Your doctor will decide if your child needs antibiotics and, if so, what type.

Children with symptoms of a metabolic crisis need to be treated in the hospital. During a metabolic crisis, your child may be given medications such as bicarbonate by IV to help reduce the acid levels in the blood. In addition, glucose is often given by IV to prevent the breakdown of protein and fat stored in the body. Ask your metabolic doctor if you should carry a special travel letter with medical instructions for your child's care.

Tracking Ketone Levels

Periodic urine tests should be done to test the level of ketones. This can be done at home or at the doctor's office. Ketones are substances formed when body fat is broken down for energy. This happens after going without food for long periods of time, during an illness, or during periods of heavy exercise. Ketones in the urine may signal the start of a metabolic crisis.

Call Your Doctor at the Start of Any Illness

In some children, even minor illness can lead to a metabolic crisis. In order to prevent problems, call your doctor right away when your child has any of the following:

- 1) Loss of appetite
- 2) Vomiting
- 3) Diarrhea
- 4) Infection or illness
- 5) Fever

When your child is ill, he or she needs extra fluids and carbohydrates to prevent a metabolic crisis. Whenever your child becomes ill, it is important to restrict protein and give him or her extra starchy or sugary foods.

What happens when BKD is treated?

If treatment is started early and metabolic crises do not occur, your child is likely to have normal growth and intelligence. Even with treatment, some children still have repeated episodes of metabolic crises, which can cause brain damage. This can result in learning disabilities, mental retardation or other problems.

Between episodes of metabolic crisis, people with BKD are usually healthy. Metabolic crises tend to happen less often as a child gets older. They are rare in children older than 10.

What causes the MAT enzyme to be absent or not working correctly?

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

Is BKD inherited?

BKD is inherited and affects both boys and girls equally.

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

Parents of children with BKD rarely have the condition themselves. Instead, each parent has a single nonworking gene for BKD. They are called carriers. Carriers do not have BKD 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 BKD. 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 BKD or be carriers?

Having BKD

Older brothers and sisters of a baby with BKD may have a small chance of being affected, even if they haven't had symptoms. Finding out whether other children in the family have BKD is important because early treatment may prevent serious health problems. Talk with your

metabolic doctor or genetic counselor about testing your other children.

BKD Carriers

Brothers and sisters who do not have BKD 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 has a 50 percent chance to be a 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 BKD.

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

Can other family members be tested?

Diagnostic Testing

Brothers and sisters can be tested using blood, urine or skin samples.

Carrier Testing

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

If DNA testing is not possible or is not helpful, other methods of carrier testing may be available. Your metabolic doctor or genetic counselor can answer your questions about carrier testing.

How many people have BKD?

BKD is thought to be rare. The actual incidence is unknown.

Does BKD happen more frequently in a certain ethnic group?

No, BKD does not happen more often in any specific race, ethnic group, geographical area or country.

Does BKD go by any other names?

BKD is sometimes also called:

- 1) Ketone utilization disorder.
- 2) Alpha-methylacetoacetic aciduria.
- 3) 2-methyl-3-hydroxybutyric academia.
- 4) Mitochondrial acetoacetyl-CoA thiolase deficiency.
- 5) MAT deficiency.
- 6) T2 deficiency.
- 7) 3-oxothiolase deficiency.
- 8) 3-ketothiolase deficiency.
- 9) 3-KTD deficiency.

Where can I find more information?

Organic Acidemia Association
www.oaanews.org

Children Living with Inherited Metabolic Diseases (CLIMB)
www.climb.org.uk

Save Babies Through Screening Foundation
www.savebabies.org

Genetic Alliance
www.geneticalliance.org

National Coalition for PKU and Allied Disorders
www.pku-allieddisorders.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

Pathfinder Services of ND
 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

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.

Acknowledgement

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Disclaimer

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