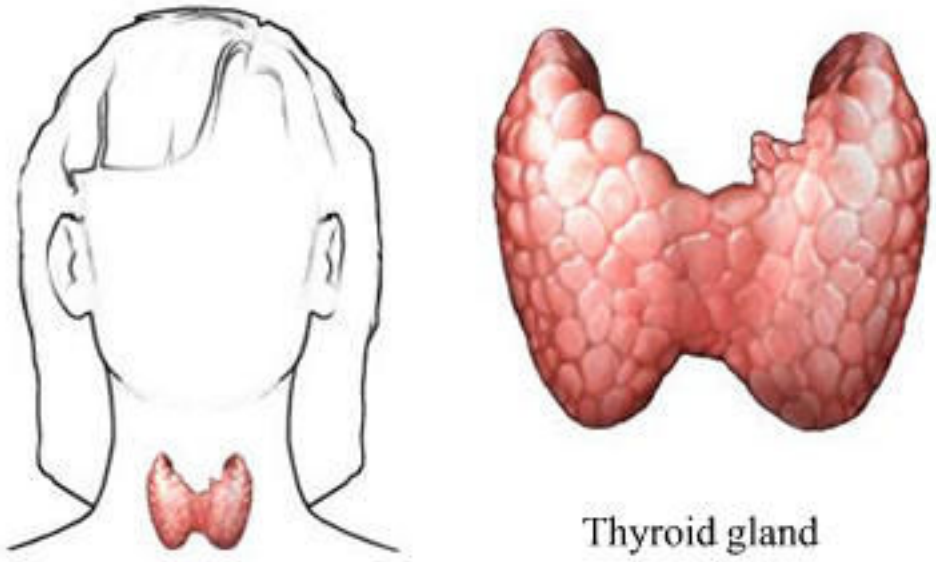
Hypothyroidism in Children

Hypothyroidism in children is a condition in which there is too little thyroid hormone in the bloodstream. The thyroid gland, which produces the thyroid hormones, is said to be "underactive," because it produces too little thyroid hormone needed for the body to function normally. Hypothyroidism can affect adults as well.

- Infants and small children affected by hypothyroidism may have significant problems with growth and development if it not diagnosed and treated promptly.
- In older children and young adults, hypothyroidism can cause diverse symptoms due to lack of thyroid hormone, including slowed heart rate, chronic tiredness, inability to tolerate cold, mental fatigue and difficulty in learning, and constipation.

Hypothyroidism can develop at any point in the lifespan. Infants can be born with hypothyroidism, and hypothyroidism can develop in children and adults of any age.



Thyroid gland

The thyroid is a small, butterfly-shaped gland that lies just under the *Adam's apple* in the neck. There are two lobes to the gland, and they lie just in front and at either side of the windpipe (trachea). The thyroid is part of the body's endocrine system, which consists of glands that secrete hormones into the bloodstream.

The thyroid gland secretes thyroid hormones, which control the speed at which the body's chemical functions proceed (metabolism). To produce thyroid hormones, the thyroid gland needs iodine, an element contained in many foods. The thyroid gland also produces a hormone, called calcitonin, which may be involved in the metabolism of bones.

Hormones are chemical messengers released into the bloodstream by specialized glands called endocrine glands. A hormone circulates through the body in the bloodstream, delivering messages to other parts of the body. The 'message' causes effects far from the gland that produced the hormone.

Thyroid hormone is produced in the thyroid gland, which is located in the front of the neck. It is released by the thyroid gland into the bloodstream and circulates throughout the body. Almost every cell in the body, from those in the brain to those in the feet, responds to the hormone.

There are two different forms of thyroid hormone present in the bloodstream. The two forms of thyroid hormone differ in the number of iodine units or atoms attached to the hormone. Iodine is a very important component of thyroid hormone.

- Thyroid hormone with four iodine units is abbreviated as T4
- Thyroid hormone with three iodine units is abbreviated as T3
- Most thyroid hormone in the blood is T4.
- T3 is the form that is active in the body, not T4.
- Certain cells in the body convert T4 to T3.

Just about all the iodine we consume in food is used by the body for the production of thyroid hormone.

In developed and many developing countries, iodine is added to regular table salt to ensure that individuals get enough iodine in their diets. Salt boxes are usually labeled 'iodized salt.'

This is one of the biggest scams that exist in the modern world. Because, while iodine is available in sufficient quantities from the foods that we normally eat, we are denying our self of 84 minerals that we would obtain from the sea salt that people used to add to the food. Thus we become deficient in trace minerals and have to depend on supplements.

Further, the iodine added to the salt (that has been stripped of all important minerals except sodium and chloride to make it free flow) is invariably the wrong kind. Also please not that the iodine add to the salt will shortly disappear from it by the time the salt is used by the consumer.

The consumer of this new fangled salt looses on all counts and will become trace mineral deficient.

In the mean while both the MNCs making the salt and the sellers of mineral supplements laugh all the way to the bank. Get rid of the processed 'iodized' table salt and go back to sea salt if you care for your health; do not worry about the 'iodine' because you have plenty of other sources for it from the food that you eat.

Thyroid Hormone

Cells respond to thyroid hormone with an increase in metabolic activity. Metabolic activity, or metabolism, is a term used to describe the processes in the body that produce energy and the chemical substances necessary for cells to grow, divide to form new cells, and perform other vital functions.

If you think of each cell in the body as a motorcar, then thyroid hormone acts as if you were tapping on the accelerator pedal. Its message is 'go.'

- Because thyroid hormone stimulates cells, cells grow and divide and major body functions go a bit faster.
- Use of proteins, fats, and carbohydrates increases, heart rate and breathing rate increase, and muscle tone becomes more brisk in both skeletal muscles and muscles in the digestive system.

If there is not enough thyroid hormone, the body slows down.

Normally, the body functions at a steady rate. This steady state is known as homeostasis. The body's control system that regulates the cells to function at a steady, appropriate metabolic rate may be explained as follows:

- Special 'detector' cells in the brain monitor the level of thyroid hormone in the blood.
- When the level of thyroid hormone drops, these cells send signals to a nearby organ in the brain known as the *pituitary gland.*
- These signals stimulate the pituitary gland to release a substance called thyroid-stimulating hormone (TSH) into the bloodstream.
- TSH signals cells in the thyroid gland to release more thyroid hormone into the bloodstream.
- When the blood level of thyroid hormone has increased enough, the detector cells in the brain detect the increase in thyroid hormone level.

These detector cells send signals to the pituitary gland to stop release of TSH.

In children:

- *Growth and development are delayed;* in some areas, such as brain development, hypothyroidism may cause severe, permanent effects.
- In older children and young adults, the decrease in organ function associated with hypothyroidism causes noticeable symptoms**:**

  The heart beats more slowly, muscle tone slows, the child may feel physically tired and mentally fatigued, and learning may be impaired.

Facts about hypothyroidism in children

- In North America, hypothyroidism present at birth is found in about 1 in every 4,000 newborns.
- In about 10% of newborns with hypothyroidism, it is a temporary condition that will resolve within days or months.
- About 95% of cases of childhood hypothyroidism are caused by a problem within the thyroid gland or by lack of a thyroid gland.
- Less than 5% of cases are caused by a problem in the brain or pituitary gland.

In the developing world, most cases of congenital hypothyroidism are due to iodine deficiency in the mother and the baby.

The symptoms of hypothyroidism will vary depending on the age of the child.

Hypothyroidism that occurs in infancy or early childhood is called cretinism. Babies born with hypothyroidism classically show a number of symptoms in the first weeks to months of life. At birth, many symptoms are subtle, though, and can be missed. They include the following:

- Prolonged newborn jaundice (a yellow discoloration of the skin and the whites of the eyes)
- Poor feeding and constipation
- Cool, mottled skin
- Increased sleepiness
- Decreased crying
- Larger-than-normal soft spots on the skull
- Umbilical hernia (a soft protrusion around the navel)
- A large tongue

Over time, if untreated, other symptoms typically become apparent in older infants, toddlers, and young children. The most obvious symptoms observed in these youngsters reflect insufficient thyroid hormone for growth and development:

- Short stature for age and delayed eruption of baby teeth
- Delays in major developmental milestones
- Puffy facial features
- Severe mental retardation
- Protruding abdomen and umbilical hernia (a soft protrusion around the navel)
- Dry skin and sparse hair

Symptoms in Older Children

When hypothyroidism develops in older children before growth and development are complete, they may have a shorter-than-average height or puberty may be delayed. They also may have symptoms that are more like those found in adults:

- Slow heart rate
- Tiredness
- Inability to tolerate cold
- Dry, flaky skin
- Puffiness in the face, especially around the eyes
- Impaired memory and difficulty in thinking (which may appear as a new learning disability)
- Emotional depression
- Drowsiness, even after sleeping through the night
- Heavy or irregular menstrual periods (in girls at the age of puberty)
- Constipation

Some symptoms, such as inability to tolerate cold environments, are directly due to the decrease in heat generated within the body by slowed metabolic activity. Other symptoms, such as lower heart rate, tiredness, poor memory or difficulty in thinking, even constipation, are due to inadequate organ stimulation by thyroid hormone.

Normal levels of thyroid hormone are vital for proper growth and development. Consequently, hypothyroidism, especially in infants and

young children, can lead to serious, sometimes permanent, developmental problems if not detected and treated promptly.

For infants born with hypothyroidism, diagnosis and treatment within the first month or so of life may prevent any irreversible problems with the child's development.

On the other hand, if diagnosis or treatment is delayed until after the first two or three months of life, permanent problems with the child's development, most noticeably mental retardation may be unavoidable.

The older the child when hypothyroidism develops, the less the chances of permanent effects on the child. Consequently, older children who develop hypothyroidism may show many of the symptoms associated with inadequate organ stimulation (such as slowed heart rate, difficulties in thinking and learning, and constipation) but little, if any, permanent abnormality in growth or development.

Diagnosis

In much of the Western world, newborns are routinely screened for thyroid hormone deficiency. Infants with abnormal screening tests receive follow-up evaluation for hypothyroidism. Such testing commonly leads to the correct diagnosis within the first four weeks of age, and treatment can begin immediately.

Diagnosis later in childhood is usually based on information from blood tests, which check levels of thyroid hormones T4, T3, and TSH, among other related substances. Abnormally low levels of T4 and T3 indicate hypothyroidism is present.

- If TSH is present at a higher-than-normal level, the abnormality is within the thyroid gland. It is not responding properly to TSH.
- If TSH is low, the abnormality is within the brain or pituitary gland. The pituitary is not releasing TSH despite levels of thyroid hormone low enough that it should do so.

Among babies with hypothyroidism, roughly 95% or more of cases represent problems in the thyroid gland. In less than 5% of cases, the abnormality is found in the brain or in the pituitary gland, the small gland at the base of the brain, almost always the pituitary gland.

This is the same for hypothyroidism that develops in older children and young adults, although the exact causes of hypothyroidism are different for the different age groups.

Causes

The vast majority of cases of childhood hypothyroidism (95% or more) are caused by a problem within the thyroid gland or by lack of a thyroid gland. A much smaller number of cases (less than 5%) are caused by a problem in the brain or pituitary gland, the small gland at the base of the brain that releases the hormone that stimulates the thyroid gland to produce thyroid hormone.

Specific causes of hypothyroidism vary for different age groups.

In Newborns

- *Abnormal thyroid gland development* includes babies born without a thyroid gland and those whose thyroid is not functioning (roughly 80% to 85% of cases).
- *Abnormal thyroid hormone production* is much less common (roughly 10% to 15% of cases). It is often inherited. In the typical instance, both parents have normal thyroid function but are carriers for the defective gene. In such cases, the odds are one in four for each pregnancy that the baby will have CH.
- *Abnormal development of the brain or pituitary gland* is the least common cause of permanent CH (fewer than 5% of cases). Some of these rare conditions are inherited, whereas others show no familial pattern. In all of these cases, TSH is not produced or released, and the resultant hypothyroidism is due to lack of thyroid gland stimulation.

About 10% of newborns with CH have a temporary hypothyroidism that will resolve within days or months, depending on the specific cause. In almost all of these cases, the hypothyroidism is due to antithyroid substances that crossed from the mother's bloodstream into the unborn baby's blood.

In rare cases, if the mother has *Graves' disease*, an autoimmune disorder affecting the thyroid gland in which too much thyroid hormone is produced, a thyroid-blocking antibody may cross from the mother's bloodstream into the baby's blood. This causes the baby's thyroid gland to temporarily stop producing thyroid hormone. More commonly, the antithyroid drug being taken by the mother for the treatment of her hyperthyroidism, affects the normal functioning of the baby's thyroid gland.

During Childhood

Hypothyroidism that develops during childhood has a number of causes. In general, the older the child, the more likely it is that the cause will be similar to the causes of hypothyroidism in adults.

Causes of hypothyroidism that develops during childhood include:

- *Late appearance of a congenital problem* - A congenital problem is a problem with which a baby is born. But sometimes these problems may only become apparent later, after the newborn period. These children may have small or poorly formed thyroid glands that could not meet the demands of the growing child.

- *Inhibition of thyroid hormone production in the thyroid gland* - Inability to produce enough thyroid hormone may reflect poor function of an apparently normal thyroid gland. In many cases, a cause is eventually determined, such as too little iodine in the diet or drug side effect. Fortunately, iodine deficiency does not exist in North America, but it continues to be a major public health problem in other, less developed areas of the world.

Some drugs intended for a nonthyroid condition can cause hypothyroidism by inhibiting production of thyroid hormone. These include lithium (used for psychiatric disorders) and iodine-containing drugs such as amiodarone (used for heart disorders).

In older children especially, antithyroid drugs used to treat those who have hyperthyroidism can actually cause hypothyroidism. This happens when the drugs inhibit hormone production too much, and the child moves from having an overactive thyroid gland to having an underactive one.

In virtually all cases, drug-related hypothyroidism is reversible. If the dosage of the drug is lowered or the drug discontinued, the hypothyroidism will disappear. In some cases, however, there may not be a reasonable alternative drug, and it becomes simpler to treat the hypothyroidism with thyroid hormone and having the child remain on the original, hypothyroidism-causing drug.

- *Permanent thyroid cell loss as a consequence of a medical treatment* - A permanent loss of functional thyroid tissue may develop after treatment of hyperthyroidism with either radioactive iodine or surgery (the latter is more commonly used in children with severe or unresponsive hyperthyroidism). It may also develop after radiation therapy for cancers of the neck or chest, such as lymphomas or Hodgkin's disease.
- Autoimmune disease - Autoimmune disorders are the most common cause of thyroid problems.

The immune system is a complex network that normally defends the body against 'invading' organisms and other foreign substances. When the immune system detects a foreign substance in the body, it responds to this by producing antibodies against the invaders. These antibodies will recognize and attack this foreign substance when they next encounter

An immune disorder is one in which the immune system mistakenly directs an immune 'attack' against its own healthy cells. Antibodies are manufactured and misdirected against some of the body's own cells. Any

condition in which the body's immune system attacks its own cells is called an autoimmune disease.

Specifically, the immune system makes antibodies (or attack proteins) that can affect the function of the thyroid. In Hashimoto's thyroiditis, the antibodies directly attack and destroy thyroid cells.

In Graves' disease, these antibodies mimic the action of TSH on thyroid cells. The antibodies act like a switch put into a permanent 'on' position. Thyroid cells are continually stimulated to produce and release thyroid hormone, even after blood levels become excessive.

Parents should check for a family history of autoimmune disorders and thyroid disease, especially Graves' disease or Hashimoto's thyroiditis, and tell their child's endocrinologist at the first visit. It is also critically important for mothers to tell their child's doctor about any history of thyroid trouble in themselves, especially Graves' disease or Hashimoto's thyroiditis.

Problems outside the thyroid gland - Hypothyroidism can develop due to a problem in a nonthyroid part of the endocrine system (namely the brain or pituitary gland). This type of hypothyroidism, which does not originate in the thyroid gland, is much less common (perhaps 5% of cases). Almost all of these cases are due to failure of the pituitary gland to produce or release TSH.

Treatment

The treatment for hypothyroidism is simple: Supply the body with the thyroid hormone that is not being produced and released by the thyroid gland. Synthetic (artificially produced) thyroid hormone (T4) is manufactured in a wide range of strengths so that dosage can be individually tailored for each person.

It is important that an experienced physician oversee treatment, because the body's need for thyroid hormone varies over the course of childhood and puberty. A child will usually be started on a daily dose of thyroid

hormone, have it adjusted until a healthy level of hormone in the blood is reached, and then be monitored with regular blood tests.

Almost all children with hypothyroidism will require thyroid hormone replacement therapy for the rest of their lives. Fortunately, thyroid hormone is simple to take, and the success of therapy is easily monitored by blood tests for T4 and TSH that can be done throughout adulthood.

Hypothyroidism is a common endocrine condition in adults and a relatively common endocrine condition in infants and children. It can be treated relatively easily and inexpensively with a daily dose of synthetic (artificially manufactured) thyroid hormone.

This treatment supplies the hormone missing in the body. Organs return to a proper level of stimulation and the child's body can resume growth and development. In many cases, symptoms that had been distressing improve or disappear after hormone therapy has been begun.

An exception involves growth or organ development that has been delayed due to severe hypothyroidism. In some of these cases, developmental problems that occurred before treatment was begun cannot be reversed (these include mental retardation, shortened body stature, or both).

Older children should learn that treatment for hypothyroidism becomes easier as they move into adulthood. After the growth and development of childhood and puberty end, most adults enter a long phase of life when their thyroid hormone needs remain relatively stable. Monitoring of thyroid hormone status does not need to be as frequent, and the individual becomes more able to live life without thinking about the hypothyroidism.

Here is a summary of the important facts and information related to hypothyroidism in children.

- Hypothyroidism is the condition marked by too little *thyroid hormone* in the blood. Growth and development are slowed, and children

have symptoms due to inadequate stimulation of organs by thyroid hormone.

- Hypothyroidism can occur at any age, from birth well into the senior years.
- Correct levels of thyroid hormone are necessary for proper growth and development.
- Newborns with hypothyroidism have symptoms that reflect delays in prenatal development (such as larger-than-normal soft spots on the skull) and symptoms due to inadequate organ stimulation (such as sleepiness and constipation).
- Small children also may have symptoms that reflect slowed development (short stature for age and mental retardation) and inadequate organ stimulation.
- Symptoms in older children usually reflect inadequate organ stimulation (dry skin, inability to tolerate the cold, and difficulty learning).
- The seriousness of hypothyroidism in any given child usually relates to the age at which hypothyroidism developed and the delay (if any) in beginning treatment.
- Diagnosis is always through blood testing, which detects the abnormally low thyroid hormone levels.
- *Congenital* hypothyroidism (hypothyroidism present at birth) can be temporary or permanent.
- Hypothyroidism can result from a diet too low in *iodine*, the use of certain drugs, as a side effect of radiation therapy, as a result of treatment for *hyperthyroidism,* or from an *autoimmune disorder*. A small percentage of hypothyroidism cases are due to problems in the brain or *pituitary gland*.
- Hypothyroidism is treated with daily doses of synthetic (artificially manufactured) thyroid hormone that replaces the *hormone* missing in the body.
- Regular monitoring via blood testing provides the means for ensuring appropriate hormone replacement therapy.
- Thyroid hormone treatment may be needed for life, but fortunately treatment is simple, inexpensive, and easily monitored.

Glossary

Here are definitions of medical terms related to hypothyroidism in children.

Adam's apple: This part of the cartilage that forms the larynx, or voice box, can be felt at the front of the neck. It is more prominent visually and by touch in men than in women.

Antibody: A protein made by the body's immune system to defend the body against a foreign substance like a virus, bacterium, or other foreign bodies, most often a foreign protein. Rarely, the body's immune system may mistakenly make antibodies against a part of the person's own body. This is an abnormal or autoimmune response.

Antithyroid drug: Any one of several agents used to treat hyperthyroidism that hinders production of thyroid hormone within the thyroid gland.

Autoimmune disorder: An autoimmune disorder is one in which the body's immune system mistakenly "attacks" its own healthy tissue.

Congenital: A term meaning 'present at birth'.

Cretinism: A general term for hypothyroidism that occurs in infants.

Endocrine gland: A gland that releases a chemical messenger, known as a hormone, directly into the bloodstream, that will affect other parts of the body. The thyroid is an endocrine gland.

Endocrinology: The subspecialty within the field of internal medicine devoted to disorders of the endocrine glands; the specialist is called an endocrinologist.

Gene: The structure within a cell's nucleus that carries inheritable information from one generation to the next.

Graves' disease: An autoimmune disorder in which the immune system attacks the cells of the thyroid gland causing hyperthyroidism.

Hyperthyroid eye changes and skin changes are sometimes associated with it.

Growth hormone: A chemical substance produced in the pituitary gland that, along with thyroid hormone, supports proper growth and development during childhood.

Hashimoto's thyroiditis: An autoimmune disorder of the thyroid gland in which the body's immune system attacks the thyroid gland, destroying the cells of the thyroid gland.

Hormone: A chemical substance that is produced by an endocrine gland and released into the bloodstream to have its effect on other parts of the body; also known as a 'chemical messenger.' For example, thyroid hormone, released by the thyroid gland speeds up or stimulates certain bodily functions.

Hyperthyroidism: Condition, in which too much thyroid hormone is circulating throughout the body, causing excessive stimulation of metabolic activity in body cells; same condition as thyrotoxicosis.

Hypothyroidism: Condition in which too little thyroid hormone is circulating throughout the body, causing inadequate stimulation of metabolic activity in body cells.

Immune system: The body system (consisting primarily of white blood cells) that enables the body to fight infection or reject organs from another individual.

Iodine: A chemical element found naturally in seawater and in many foods that is needed to produce thyroid hormone. Iodized table salt has had iodine added to it.

Lymphoma: Any one of several cancers (including Hodgkin's disease) that originates in lymph nodes.

Metabolism: The chemical and physical processes in the body that create the substances and generate the energy needed for cells to function, grow normally, and divide. Metabolism is also known as metabolic activity.

Nucleus: The part of the cell that contains genes, the biological form of information that is inherited from one generation to the next and that controls cell activity.

Pituitary gland: A relatively small endocrine gland about the size of a pea. This gland is located underneath the brain and releases a number of essential hormones, including thyroid stimulating hormone (TSH).

Placenta: The structure within the pregnant uterus that is the interface between the maternal and fetal bloodstreams. Oxygen, food substances, and other materials pass from the mother's bloodstream to the fetus's bloodstream through the placenta.

Puberty: The last growth phase of childhood, puberty is the period during which a child's body becomes sexually mature and develops into adult form.

Radioactive iodine: A radioactive form of iodine, which means it, emits intense energy due to chemical reactions in the atomic nucleus. It is often used in the treatment of hyperthyroidism in adults and less commonly used in young children.

Synthetic thyroid hormone: Thyroid hormone (T4) that is artificially manufactured but is structurally identical to that naturally produced in the body.

Thyroid gland: Small, butterfly-shaped organ, located in the neck below and in front of the Adam's apple, which produces thyroid hormone.

Thyroid hormone: Chemical substance produced by the thyroid gland and released into the bloodstream. It interacts with almost all body cells, causing them to increase their metabolic activity. Two forms of thyroid hormone, abbreviated as T3 and T4, are found in blood.

Thyroid-stimulating hormone (TSH): Hormone produced by the pituitary gland that interacts with thyroid cells causing them to produce and release more thyroid hormone into the blood.