# Epsom Salt Baths

Information compiled by Mary Wetherby, with editing and research information provided courtesy of Susan Owens. This information may be shared with families and professionals, but please do not use it in a part of a larger document/paper without obtaining written permission.

**What are Epsom Salts?**

Epsom Salts are the same thing as Magnesium Sulfate, which is a salt made of only magnesium and sulphate (and maybe a little bit of water). Magnesium is a positively charged ion, and it binds to sulfate, which is a negatively charged ion. Sulfate is a sulphur atom surrounded by four oxygen atoms.

**What is the anticipated effect from an Epsom Salt bath?**

Epsom Salts have long been used to stimulate detoxification, reduce inflammation to sore muscles, promote healthy circulation, and help with relaxation and normalizing sleep patterns.

Most children respond to an ES bath by appearing happier, more relaxed. Some parents report that their children are more responsive, more "with it".



Some parents who give the bath in the evenings report that their children are able to get to sleep easier, and have a more normal sleep pattern.

Given over time, the ES baths may help reduce sensory integration symptoms. Some of this effect may occur due to benefits of detoxification, but it is much more likely to come from direct effects on the nervous system.

**Why do they work? And Why is sulfation important?**

One benefit of the ES baths is linked to an enzyme system known as phenolsulfotransferase or PST. Dr. Rosemary Waring researched this and found that in 92% of the autistic children tested, PST was functioning at below optimal levels.

This enzyme, like all other sulfotransferases, has to use a modified form of sulfate: not the form it takes in the bathtub. This change occurs inside your cells by adding the molecules adenosine and phosphate to sulfate before any sulfotransferase enzyme can use it. The molecular additions are said to turn sulfate into its "activated form".

If you think about it, none of this can be happening in the bathtub: it is happening in your body after sulfate is absorbed through the skin and after a complicated interplay of enzymes.

It is not going to happen spontaneously, no matter how much sulfate you have around.

When PST has enough activated sulfate to use, it will then attach the sulfate part of that molecule to molecules called phenols. In most cases, adding sulfate sets up those molecules for excretion in the urine, but it can actually activate other molecules.

When there is a deficiency of sulfate inside your cells, phenols may build up. In the brain and nervous system this may interfere with neurotransmitter function since many neurotransmitters are phenolic, too. For instance, there is actually a form of PST called catecholamine sulfotransferase or M-PST which acts on neurotransmitters.

Other sulfotransferases act on hormones and proteins and carbohydrates of certain sorts.

Again, epsom salts are believed to help PST by providing the much-needed sulfate to the child's body, by being absorbed transdermally (through the skin) during the bath.

The body is full of other sulfotransferases that need sulfate to be much more concentrated than what PST likes. These other sulfotransferases, among other jobs, help form the extracellular nets around certain neurons, and regulate things like axon guidance and neurons sending out processes to make connections.

The gastrointestinal system especially needs a lot of sulfate. A different sulfotransferase enzyme called TPST uses sulfate to activate two major gut enzymes. In animal studies the GI system takes as much sulfate out of the blood as the liver puts into the blood, so epsom salts are likely to mostly nourish the gut and spare the liver the job of making sulfate from scratch from the amino acid cysteine.



**But how does this produce neurological improvements?**

Detoxification is only a little part of sulfate's job. Most of the body's sulfate is used to form huge molecules that govern chemical traffic at the cell surface. Many of these sulfated molecules find their more enduring home in the area immediately around the cell called the extracellular matrix. [Extracellular = outside the cell] These sulfated molecules function in all cell types. However, in the brain, this type of molecule has a very special role, providing modulation, or something like a volume control. It does this by forming a geometric net outside particular types of neurons.

The sulfate in these molecules is no longer in an ionic form, like you see in epsom salts in the bathtub, but is part of highly organized structures that will attract, bind and regulate many of the ions that are involved in cell signalling before those ions even get to the surface of neurons or to ion channels. You haven't heard about this from your neurologist because research on the function of this type of molecule has been done mainly in the last decade, and in the last year or two, especially. Even so, there are pictures of these
nets around neurons that were drawn by scientists more than a hundred years ago before they knew what they were made of. Nobody thought they did anything!

What seems particularly relevant is that the nets are abundant and function in the auditory system, the somatosensory system, the vestibular system, the cerebellum, and in almost half of the cranial nerves. They even seem important for developing trunk strength.

You may recognize these systems as the parts of the nervous system that are targeted by sensory integration therapy. Interestingly, the nets won't form properly in the brain without two things happening at the same time: adequate biochemical resources, and continued rapid firing of the relevant nerves.

This argues favourably for coupling biochemical therapies that support this chemistry with the physical and educational approaches that are also known to offer benefits to these systems.

If you want to know more about the biochemical side of this, you can read a paper written by Susan Owens who has studied the sulfated molecules (called GAGs) for seven years. Her paper reviewing this area is part of a book that is sold by the Autism Research Unit in Sunderland: The Proceedings of the 2001 conference in Durham, England. See http://osiris.sunderland.ac.uk/autism/

**What are the potential long-term benefits of continued use?**

After using Epsom salts on a regular basis, children may have improvements with language, behaviour, mood, and physical skills.

**What if my child gets agitated?**



Very few children may seem more agitated after the initial bath, or several baths later. It is not known why this happens, but it is easy to deal with. Just cut back on the baths for a few days and then begin again, but with a much smaller amount of ES—perhaps a teaspoon, and work up the amount very slowly. Also, you may see if the child reacts to magnesium by trying it in a different form orally.

Kirkman Laboratories "Guide To Intestinal Health" booklet discusses how impaired sulfation process can lead to a decreased production of peptides, and bile acids, which are important to digestive function, and lead to problems with maldigestion and malabsorption. Sulfation is also important to the intestinal lining. Over time, decreased sulfation can allow small portions of the gut wall to be exposed, creating the "Leaky Gut" which is suspect in allergies, asthma, and other neurobehavioral disorders. Sulfate's relative absence from the esophagus may be what makes reflux hurt so much.

**Okay, I think we'll try the baths--what do I need and how much Epsom Salt, and for how long?**

The amount and frequency can vary from child to child. Some parents prefer to use as much as 2 cups of ES in a bathtub of water, allowing the child to be in the tub for around 20 minutes, on a daily basis.

Some parents prefer to do the baths every few days, some prefer every week. As mentioned before, if your child is one of the rare few who seem to get agitated by the bath, then simply cut back on the amount of salt used (my son was one of these kids and we dropped back to a teaspoon and worked up gradually to about ¼ to ½ a cup).

**What are other ways to employ Epsom Salts for sulfation benefits?**

Some parents prefer to mix the ES with water and keep it in a spray bottle and spray their kids during the day. As it dries, it leaves a white residue that you can leave on for more of a timed-released effect if it is tolerated. Others have found ways to make ES oil or lotion. There are recipes on how to make your own creams/lotions here:

http://www.enzymestuff.com/epsomsalts.htm

Instead of a bath, some parents give their child a foot soak while they are eating or doing something else. Kirkman Laboratories sells a ready made cream which you can buy in the UK from: www.nutricentre.com.

If you order on line you get £5 off for every £25 you spend. Read about it at the US site which has lots of info:
http://www.kirkmanlabs.com/.

The cream can be applied 1 to 3 times a day. It does not leave a residue.

**Frequently asked question – info from Susan Owens**

Q: I gave my child an Epsom salt bath, and s/he seemed more hyper and/or emotional afterwards. Is this related to the bath? Why would my child react this way instead of having the "expected" results?



A: I think the trick here, which is important to know about, is that you need to start slowly when introducing a supplement of something for which you have been deficient a long time, and then slowly work up to more. This is because, unlike drugs, where the quantity of a dose is set by the doctor trying to obtain a blood level of something FOREIGN to the body, introducing a supplement of something the body uses every day works in a whole different way, and this can be generalized to lots of things. I'll explain why.

Most chemical reactions happen inside cells after substances have crossed over the cell's outer membrane. For things cells use everyday, they have specific transporters and receptors that are expressed on the cell surface in the quantity that is appropriate to assure an appropriate supply to that cell type. Not all cells like the same quantity. When everything works right, the inside of the cell gets the appropriate quantity of what it needs of that substance. The cell wants not too much and not too little and it knows how to
adjust the availability of that substance to the inside of the cell when the supply outside the cell changes.

If the supply of something the body uses up every day has been low for a while, the cell will up-regulate the transporter or receptor that is specific for that substance. Up-regulation means it will put more of these working molecules on the cell surface in order to increase the odds that the substance will find its receptor or transporter.

When the supply has been high for a long time, the cell will also cut back the quantity of the receptor or transporter on the cell surface. Cells are very fluid like that: changing and adjusting constantly: not like a machine at all! Your car doesn't increase the gas caps when its fuel supply is low, but it doesn't

have to get its gas from the passing parade by chance and kinetics….

So, if you have been deficient in sulfate for a long time, your cells would have up-regulated the transporters to make much of little. All over the body, receptors that need sulfated ligands might have been up-regulated as well, trying to increase their signal or supply.

If you suddenly increase the quantity of sulfate that approaches the cell by several fold, you can get too intense a signal, and that can be overwhelming. That is why you should start slowly. This gives your body's cells a chance to readjust to the new level they will be seeing. We're not trying to overdo that level, but just to return it to something normal.

Remember that cells are accustomed to biological rhythms that change the quantities of nutrients that cells see. This includes feeding schedules and sleep. Cells don't make these adjustments on whim or very quickly, for they know there will be long periods of time when the supply gets lower just because it has been a long time since you ate something. I would guess, for that reason, that cells tend to adjust to conditions that may continue for at least
a day or two.

The way this biology works gives me the suspicion that the children who get the most hyper after their first Epsom salts bath or baths may be the children who have been the most deficient of this substance, and have receptors and transporters dialled WAY up.



If you are deficient in supply, even when you have receptors or transporters expressed at extremely high quantity, you still might be low in quantity for the function you need. The increase of receptors or transporters will help, but it isn't much of a solution long term.

If you get exposed to something that requires a lot of sulfate for your body to detoxify (like phenols in fumes or foods or drugs), the level of sulfate available for NORMAL functions will be hurting temporarily as your body tries to recover from this demand. The loss of the function of other molecules that use sulfate for normal function is likely what is producing symptoms: not your body feeling toxic as if it had just been "burned" by the substance your body was trying to detoxify. That sort of injury might take longer and it would probably be more subtle, anyway. If you are having neurological
reactions, you are probably seeing an adjustment in the neurological chemistry, which is feeling shorted and may be overwhelmed with sudden change.

Of course, you really need an appropriate supply of sulfate, but the story of HOW the supply got low in the first place can be very different from child to child, and involve organs like the kidneys, the liver and the GI tract and systems like the immune system.

Anyway, as an example of this sort of mechanism with an entirely different substance, I'll tell you a little about the Secretin story. This sort of receptor-quantity issue was suspected to be happening in the children with autism who were given IV Secretin. In response to the same dose that had a predictable response in normal people, those with autism instead put out huge quantities of pancreatic fluid. Their response was intense on the very same dose that other patients were getting without experiencing this over-exuberant
response.

Why? The sudden increase in secretin was more of a surprise for the bodies of autistic children than it was for the other children with GI problems being tested. The pancreas was OVER responsive to secretin probably because this was the first good supply of secretin that it had gotten in a long time. Scientists suspected that the amount of secretin these children had been producing on their own had been low for a long time. I hope all this makes sense.

Your body makes secretin, but it also makes sulfate from the amino acids cysteine and methionine. There may be a reason this isn't happening appropriately.

I've heard of parents starting with as little as a teaspoon in the bathwater and working up. You can also apply the solution topically, and can control the quantity by how much surface of the skin you cover. The half-life of sulfate in the blood is 4-9 hours.

At any rate, please do not interpret this [emotional/hyper reaction] to mean the epsom salts were the wrong thing...it may mean exactly the opposite!  Normal people do not have any response to epsom salts baths except maybe to feel relaxed later! They don't get hyper or emotional ☺

If you have already tried reducing the quantity of Epsom salts drastically and slowly increasing the quantity, and it doesn't work to reduce this hyper or emotional response, I'd be glad to talk to you off list about what else it might mean.

Anyway, I hope this helps. You've just got to think like a cell thinks!