Hypothesising that salts of iodine, strontium and caesium reverse ageing induced by nuclear radiation

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I, Sr and Cs salts reverse ageing induced by nuclear radiation

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Abstract: Radiation accelerates ageing, producing telomere shortening, metabolic ageing, cell apoptosis, immunological decline, mitochondrial damage, free radical damage and oxidative stress. Salts of iodine, strontium and caesium may reverse ageing induced by nuclear radiation. The American Thyroid Association (ATA) has established that potassium iodide (KI) needs to be accessible to those within 50 miles of nuclear reactors. Despite ATA recommendations, if you distribute KI at the time of explosion, it may not be effective; thus, it is a preventive measure, not a tertiary treatment. KI treatment is most successful when used prior to radioactive iodine exposure. Weekly supplementation of KI reduces hypothyroidism and thyroid nodules; strontium carbonate (SrCO₃) reduces osteopenia and inadequate bone development; and caesium chloride (CsCl) reduces brain cell apoptosis and anxiety. Low doses of radiation may result in hormesis and improved health. A radiation cleanup plan with further investigation could be implemented as a preventive measure.

Keywords: nuclear; radiation; iodine-131; strontium-90; caesium-134; caesium-137; ageing; potassium iodide; strontium carbonate; caesium chloride; hormesis.


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Bernard Loeffke, PhD, is a retired major general from the US Army who is the author of several works, including the booklet *How We Plan to Survive an Attack* and the book *From Warrior to Healer*.

1 Hypothesis

Owing to the current radioactive threat, with 433 nuclear power plants worldwide, we hypothesise following large-scale studies that a prophylactic kit be developed that will reduce the negative and damaging effects of radiation on large global populations (e.g. Fukushima, Japan). The basis for this development is the known benefits of salts of iodine, strontium, and caesium to reverse the ageing induced by nuclear radiation.

2 Introduction

Currently, there are 433 nuclear power plants around the world, with 62 being constructed. The USA ranks highest with a total of 104 plants, France holds 58 nuclear reactors, and Japan has constructed 54 reactors within its borders (European Nuclear Society, 2012). Out of the 62 new nuclear reactors being built across the world, China is responsible for the construction of 28 (Colchester, 2011). While the average age of established nuclear reactors worldwide is 27 years, federal regulations stated by the US Nuclear Regulatory Commission that set the lifespan of a nuclear reactor to 40 years are now being extended to keep these ageing power plants running, even if they do not meet the standards previously set (Donn, 2011). With Japan being the third largest producer of nuclear power in the world, the earthquake causing the meltdown of the reactor in Fukushima started a devastating chain of events that is still causing damage to both the landscape and the people of Japan today (Weissmann, 2011). An increasing number of nuclear reactors correlate to an increase in the radioactive materials present within these structures, including radioactive species iodine-131, strontium-90, and caesium-134, 137 (Cresswell, 2011).
3 Radioactive species

Radioactive species such as iodine-131, strontium-90, and caesium-134, 137 are known to cause long-term damage, accelerating ageing and the debilitating associated with ageing. Iodine-131 (half life of 8 days) is especially problematic as its primary risk from exposure is the potential occurrence of thyroid cancer later in life (American Thyroid Association, 2005). Radiation exposure from iodine-131 was prevalent after the Chernobyl accident, with over 11,000 reported thyroid cancer incidents in children (UNSCEAR, 2008). Similarly, caesium-134,137 (half life of 2 years and 27 years, respectively) also contributed to exposure rates found in those living within close proximity to Chernobyl. Evaluation of a group of inhabitants in Russia, where a high incidence of thyroid cancer was observed after the Chernobyl incident, found caesium-137 contamination to be 0.03–3.7 MBq/m² (UNSCEAR, 2008). Caesium-134,137 is also problematic because of its solubility, which creates an inability for this radioactive species to be properly contained after nuclear disasters (Sekitani et al., 2010). Strontium-90 (half life of 30 years) is another radioactive element that can be found in certain radiotherapies used to treat bone cancers. It has also been observed to have similar properties to that of calcium in bones (Parab and Sudersanan, 2010). Although exposure to these radioactive species can be detrimental to one’s health, small doses of these elements can be used prophylactically to reduce the uptake and retention in one’s body as well as excrete larger amounts of these radioactive species out of the body (Radiochemistry Society, 2003). However, it is known that radiation accelerates ageing through a number of important physiological mechanisms (Poulse et al., 2011).

4 Radiation accelerates ageing

According to Soler et al. (2009), radiation accelerates ageing, producing telomere shortening, metabolic ageing, cell apoptosis, immunological decline, mitochondrial damage, free radical damage and oxidative stress.

4.1 Metabolic ageing

According to the Mayo Clinic (2011), metabolic ageing results in metabolic syndrome, which specifically manifests as cardiovascular disease, diabetes, and high leptin levels. According to Hoel (2006), studies done on A-bomb survivors have consistently shown that among non-cancer related deaths, cardiovascular disease ranks the highest. The extreme doses of radiation received during either a terrorist related attack or error at a nuclear reactor lead to metabolic ageing.

4.2 Telomere shortening

The repeating DNA sequences at the end of our chromosomes, telomeres, are responsible for cell replication and repair. If these sequences become shortened to the point beyond repair, then cell replicating error and death can occur. The actual shortening of the telomeres due to ionising radiation has been conclusively found in mouse foetuses by Derradji et al. (2008), along with gene modulations and cytokine content changes. Short telomeres are associated with diseases such as cardiovascular disease, cancer,
degenerative disc disease, Down syndrome, muscular dystrophy, Alzheimer’s disease, osteoarthritis and rheumatoid arthritis (Cohen et al., 2007). Humans will die of simply old age once these telomeres have been shortened to a length of 5000 base pairs (Telomerase Anti-Ageing, 2010). Eisenberg (2011) inserts that telomeres, repetitive DNA sequences found at the ends of linear chromosomes, play a role in regulating cellular proliferation, and shorten with increasing age in proliferating human tissues. He suggests that the rate of age-related shortening of telomeres is highest early in life and decreases with age. Shortened telomeres are thought to limit the proliferation of cells and are associated with increased morbidity and mortality.

4.3 Cell apoptosis

Cell death, or apoptosis, has been used as a medical cure for specifically targeted cancer cells. Wang et al. (2011) found the use of strontium-89 was successful in eliminating human breast carcinoma cells. In the context of a radioactive meltdown or attack, the targeting process used by medicinal science is no longer in place, and apoptosis occurs in healthy cells as well. When low ionising radiation is induced in mammals, reactive oxygen species (ROS) are created inside the nucleus and an over production of this species leads to DNA and cell breakdown and death (Kiang et al., 2010). Oxidative stress from the production of reactive nitrogen species (RNS) occurs inside the cell as well, and once cytochrome c is released into the cytoplasm from the mitochondria, apoptosomes are formed which activate caspase variants, signalling apoptosis (Kiang et al., 2010). Portess et al. (2007) showed that in low-dose radiation, the ROS and RNS species are imperative to cell function; however, high doses equivalent to those from nuclear meltdowns or over exposure can initiate the apoptosis cycle.

4.4 Immunological decline

Immunological decline stems from the decrease in T-cells and lymphocytes, followed by an increase in infection (Yamaoka et al., 2004). The cell death occurring due to oxidative stress and mitochondrial breakdown happens in the very cells that protect our bodies from viral and bacterial infection, leaving us vulnerable to contracting disease. Moreover, Yamaoka et al. (2004) found that prior A-bomb exposure has induced long-lasting deficits in both naïve CD4 and CD8 T-cell populations along with increased proportions of these particular subsets of the memory CD8 T-cell population.

5 Disaster at Fukushima

After the events of nuclear power plant meltdowns in Japan, specifically Fukushima, multiple reports have surfaced on the radioactive after effects. The Japanese government (2011) reported to the IAEA Ministerial Conference on Nuclear Safety that on 15 March 2011, high levels of radioactive iodine-131 and caesium-134,137 were detected in topsoil and plants. Elevated values of iodine-131 and caesium-134,137 were also found in both coastal and off shore samples in the ocean soil (Japanese Government, 2011). According to World Health Organization (WHO) reports (2011), food samples “exceed the provisional regulation values for caesium (200 Bq/kg for milk and 500 Bq/kg for vegetables)”. The guidelines the Nuclear Safety Commission of Japan set for intake of
drinking water for caesium-134, 137 are 200 Bq/kg, which is higher than the values detected in the tap water near affected areas (World Health Organization, 2011).

The radiation in Japan cannot be contained, primarily due to weather conditions that are carrying radioactive materials to other villages. Strong winds are carrying plumes of radiation, as well as snow, that has carried radiation to communities as far as 17 miles from the Fukushima Daiichi nuclear complex. What is alarming is that the communities being affected are well outside the government’s evacuation zone (Hayashi, 2011).

In a series of anecdotal reports (Hayashi, 2011; Onishi and Fackler, 2011; Sato et al., 2011), many experts contend that a dose of 100 millisieverts raises cancer risk by 0.5%—no matter how long the exposure is for. The Japanese government guidelines state that residents should be evacuated once doses of radiation exceed 50 millisieverts. Radiation specialists, such as Toshio Kosako who served as an advisor to Prime Minister Naoto Kan, is worried about the risk of thyroid cancer in children. Kan believes that radiation monitoring needs to be beefed up, and even proposed that the government should consider expanding the evacuation zone to include those “outside” communities (Hayashi, 2011).

There is concern about children being exposed to radiation. About 45% of 1800 children in three Fukushima communities surveyed in late March tested positive for thyroid exposure to radiation, according to a recent announcement by the government, which added that the levels were too low to warrant further examination. Lawyer, Toshio Yanagihara, states that the authorities are withholding information to deflect attention from the nuclear accident’s health consequences, which will become clear only years later. He went on to say, “Because the effects don’t emerge immediately, they can claim later on that cigarettes or coffee caused the cancer” (Onishi and Fackler, 2011). Out of fear, the Japanese have now begun carrying around portable Geiger counters on their persons. There are also websites that now offer live streaming of Geiger counter readers in populated cities such as Tokyo. These radiation readings serve as constant reminders that exposure from radioactive species such as Iodine$^{131}$, Strontium$^{90}$, and Caesium$^{134,137}$ is real and may be harming our health.

6 American Thyroid Association recommendations

The American Thyroid Association (ATA) has made a recommendation to the US government that “potassium iodide (KI) should be part of an emergency plan that includes evacuation, sheltering, and avoiding contaminated food, milk, and water” in an event of a nuclear disaster (Kloos, 2011). The ATA also suggests that “potassium iodide should be predistributed to households within 50 miles of a plant” (Kloos, 2011). However, radiation is expected to travel further than 50 miles. Because of the possibility for further radiation exposure, KI should be dosed daily until a risk of significant exposure to radiiodine by either inhalation or ingestion no longer exists for optimal prophylaxis. The ATA’s determination to use the negative effects of both Chernobyl and Fukushima for a positive outcome for the USA is significant in the movement of public health prophylaxis and anti-ageing benefits.

In fact, Jaworska (2007) suggests that radioactive iodine isotopes may be released into air to a varying degree during accidents with nuclear reactors. Thus, Iodine tablets, taken before or shortly after such release, protect against intake of radioactive iodine isotopes, but not against other radionuclides.
Radioactive caesium, iodine, and strontium accelerate cellular dysfunction

As we discussed earlier, radiation in general accelerates ageing via a number of important well-characterised cellular disruptive mechanisms (Soler et al., 2009; Richardson, 2009; Mayo Clinic, 2011; Hoel, 2006; Derradji et al., 2008; Cohen et al., 2007; Telomerase Anti-Ageing, 2010; Eisenberg, 2011; Wang et al., 2011; Kiang et al., 2010; Portess et al., 2007; Yamaoka et al., 2004). More specifically, it was found that an oral dose of caesium of 50 mg maintains elevated blood caesium levels for 80 days (Braverman et al., 1988). Caesium is accumulated mainly in the red blood cell fraction, and exposure leads to bone marrow aplasia or myelopathy, where the marrow does not produce enough cells for the blood cells (Agency for Toxic Substances and Disease Registry, 2002). Without this continual supply of new cells, red and white blood cell levels are lowered in the body, leaving the individual open to infection and disease without a defence system. It is noteworthy that, Marie Curie, chemist at the forefront of radioactive materials, died from bone marrow anaemia due to overexposure (Nye, 2005).

Iodine isotopes, specifically 131, have been linked to the high prevalence of thyroid cancer among Chernobyl children (National Cancer Institute, 2012; Cardis et al., 2005). In the same study by Cardis et al. (2005), iodine-deficient areas around Chernobyl were found to have a risk of thyroid cancer developing three times higher than other areas (Cardis et al., 2005). Accordingly, this prior deficiency, which caused the higher prevalence of thyroid cancer, could have been avoided with prophylactic supplementation of potassium iodide in the population.

According to the Environmental Protection Agency (EPA) in the United States (2011), radioactive strontium has been labelled as a ‘bone seeker’, and can cause leukaemia, cancer of the bone, and cancer in the soft tissue surrounding the bone. The long half-life of 29 years helps strontium-90’s lethality affect, while it attacks the bone marrow and the cells within it directly, the areas in and around the bone. Stanley et al. (1987) were able to locate tumours in the bones of mice that had been exposed to high doses of strontium. Strontium can affect the bone directly due to its ability to become part of the crystalline lattice in the bone (Stanley et al., 1987), causing disruptive cellular dynamics.

8 Elements with anti-ageing benefits

8.1 Potassium iodide

Banoch et al. (2011) asserts that potassium iodide is the most important chemical needed in the body to make thyroidal hormones. As such, it is useful in protecting the thyroid gland from radioactive iodine exposure by blocking its absorption, reducing the incidence of hypothyroidism and thyroid nodules. According to the WHO (1999), the recommended dose for adults is 130 mg; whereas, children under the age of eighteen should take half the recommended dose. Neonates should receive the lowest dose of potassium iodide – only 16 mg.
8.2 Strontium carbonate

Administering stable strontium may help eliminate radioactive strontium from the body (World Health Organization, 1999). One stable form of strontium, strontium carbonate, replaces the radioactive form in bone and radioactive strontium is then excreted through the urine (United States Environmental Protection Agency, 2012).

According to a Mayo Clinic study (McCaslin and Janes, 1959), strontium tends to accumulate in the bones as found in 32 individuals with osteoporosis. Biopsy samples showed a 172% increase in the rate of bone formation after strontium therapy, with no change in bone re-absorption (McCaslin and Janes, 1959). The patients receiving strontium remarked that the pains in their bones had diminished and their ability to move around had improved. Lumbar bone mass density (BMD) increased in a dose-dependent manner, indicating that strontium imitates Forteo® in the spine.

In a randomised double-blind, placebo-controlled, trial of strontium involving 5091 postmenopausal women with osteoporosis, hip fracture was reduced by 36% and vertebral fracture was reduced by 39% (Regynster et al., 2008). Researchers conclude that strontium “offers a safe and effective means of reducing the risk of fracture associated with osteoporosis”. Other various studies have found that low doses of stable strontium is well tolerated in adults and increases bone formation, decreases bone re-absorption, is clinically effective in preventing bone loss, increases BMD, and prevents fractures. Strontium is effective in both vertebral as well as hip fractures.

Strontium in doses up to 1.7 grams per day appears to offer a safe, effective and inexpensive approach to preventing and reversing osteoporosis and may be of benefit in patients with osteoporosis, osteoarthritis, cancer with bone metastases, as well as possibly helping to prevent dental cavities (United States Environmental Protection Agency, 2012). Doses of 680 mg per day appear to be the optimum dose, although lower doses are clinically effective.

8.3 Caesium chloride

It is likely that large doses of caesium can protect against radiation toxicity by blocking sites on red blood cells, resulting in increased excretion and clearance of radioactive caesium. Caesium chloride appears to be relatively non-toxic and could be distributed with salt in the event of radioactive caesium exposure. Ingestion of caesium chloride can cut the effective half-life of radiocaesium in humans from 110 to 60–80 days, thus decreasing the chances of developing cancers. Caesium is accumulated mainly in the red blood cell fraction (Raaf et al., 2004).

Larger doses of 3–9 grams produce no observed harmful effects and maintain elevated caesium blood levels for up to a year (United States Department of Health and Human Services, 2004). This data suggests that there is a threshold of caesium in the blood; if maintained, any additional caesium exposure would be excreted. Effects of Cs-137 have the potential to be countered by liquid caesium chloride (Anspaugh, 2000). An oral dose of 50 mg maintains elevated blood caesium levels for 80 days, and further caesium exposure (e.g. radioactive caesium exposure) would be eliminated from the body rapidly (Anspaugh, 2000).

Recommended doses of caesium chloride are 250 mg to approximately 1 g. Caesium chloride could also have anti-depressive and pro-locomotor activity effects, as observed when mice received daily injections of 1.0 milliequivalents (mEq)/kg CsCl in the brain.
for 54 consecutive days (Messihha, 1978). We hypothesise that as the toxicity of caesium is minimal and its effects range from anti-depression treatments to the possibility of eliminating radiation from the body, caesium chloride should be distributed to those who have been exposed to radioactive caesium.

9 Radiation hormesis

Adaptive hormesis is an adaptive response of cells to a low dose of radiation, while a high dose causes damage or even cell death. This adaptive response described is the basis for radioactive treatments for cancer, where low doses of radiation are actually eradicating the cancer cells, rather than forming them like high doses of radiation would. We further hypothesise that by introducing the radioactive elements of potassium iodide, caesium chloride, and strontium carbonate in the proper doses, we can prepare our bodies for higher doses resulting from nuclear terror. Low doses of radiation from these elements can also help in reversing ageing and improving health. As previously described, potassium iodide, caesium chloride, and strontium carbonate can help prevent thyroid cancer, anti-depressive and anti-anxiety effects, and osteoporosis, while improving bone health. In the case of radioactive terror, a dose of 1–6 grams of caesium chloride would stay in the body, preventing any radioactive caesium entering the body from being absorbed, and allowing for the element to be immediately flushed out of the body (Memorial Sloan-Kettering Cancer Center, 2011a). 130 milligrams of potassium iodide is the accepted dose by the Centers for Disease Control (CDC) in Atlanta, Georgia (2011) for preventing thyroid damage in the event of a nuclear attack or meltdown. We therefore hypothesise that by prophylactically taking these radioactive isotopes, radioactive terror can have less of an impact than seen previously in the cases of Chernobyl and Fukushima.

10 Proposed conclusion

10.1 Hypothesising a plan for the future

Owing to the ever-increasing age of established nuclear radioactive plants globally and the potential hazards to a large population, we are hypothesising that incorporation of salts of potassium, caesium, and strontium will assist in reversing the acceleration of ageing induced by meltdown and subsequent exposure to nuclear radiation. Our plan holds specific radioactive remedies like potassium iodide, caesium chloride, and strontium carbonate. In this hypothesis, there are other potential nutrients that could be incorporated as well to offset some of the damaging effects from nuclear radiation exposure in general. These include the following:

*N-Acetyl cysteine* (NAC) plays a role in the sulphation cycle, acting as a sulphur donor in phase II detoxification and as a methyl donor in the conversion of homocysteine to methionine. Cysteine also helps synthesise glutathione, one of the body’s most important natural antioxidants and detoxifiers. Heavy metals such as lead, mercury and arsenic are detoxified and removed from the body by N-acetyl cysteine. Typical dosage recommendations are in the range of 250–1500 mg of NAC daily for the majority of therapeutic benefits (Memorial Sloan-Kettering Cancer Center, 2011b; EBSCO, 2011; Advanced Health and Life Extension, 2009).
CoQ10 is a component of the electron transport chain and participates in aerobic cellular respiration, generating energy in the form of ATP. In recent years, coenzyme Q has increasingly been assumed to exert antioxidant functions in the various biological membranes (University of Maryland Medical Center, 2011).

Lipoic acid promotes and strengthens the effects of other antioxidants (vitamins C and E). Recent studies have shown that dietary supplements containing lipoic acid can act as radioprotectors in mice exposed to whole-body gamma-radiation by reducing radiation-induced DNA damage (Ramachandran and Nair, 2011). The rest of CLEAN ME ASAP includes excrete toxins with exercise and hydration, antioxidants which help protect the body against CT radiation (Life Extension, 2011), and nutrients.

Melatonin, as summarised by Reiter et al. (2011), stops radiation from damaging the DNA material and proteins within the cell. They further suggest that due to Melatonin’s non toxic nature, it should be administered prophylactically in the case of a dirty bomb or unintentional nuclear meltdown. It is our proposal, based on the current literature and further testing of our hypothesis, that arranging an evacuation plan and supply kit may be timely and parsimonious. This kit potentially should contain the following: potassium iodide; strontium carbonate or citrate; caesium chloride; and zeolite filters, which are minerals that can be used to absorb radioactive material due to their porous nature and could eliminate caesium toxicity in the soil (Sangvanich et al., 2010).

11 Conclusion

The threat of radioactive terror is growing rapidly with nearly 500 nuclear reactors worldwide. Radioactive species iodine-131 ($t^{1/2} = 8$ days), strontium-90 ($t^{1/2} = 29.1$ years), and caesium-134,137 ($t^{1/2} = 2.1$ years; 30 years) produce long-term damage. Radiation accelerates ageing, producing telomere shortening, metabolic ageing, cell apoptosis, immunological decline, mitochondrial damage, free radical damage and oxidative stress. We hypothesise that potassium iodide, caesium chloride and strontium carbonate may have antidotal properties to radioactive iodine-131, caesium-134,137 and strontium-90. This hypothesis is based on the current literature suggesting that potassium iodide, strontium carbonate, and other potential salts such as caesium chloride and potassium/rubidium have significant anti-ageing health benefits. Based on further encouraged investigation, our proposed radiation cleanup plan could potentially be implemented as a preventive health measure, and be adjusted to serve as therapeutic treatment when radioactive terror occurs.

References


I, Sr and Cs salts reverse ageing induced by nuclear radiation


Appendix A: Radiation imitates age acceleration (Richardson, 2009)

<table>
<thead>
<tr>
<th>Effects of UV radiation</th>
<th>Ageing processes</th>
<th>Clinical manifestation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High BP and cholesterol, excess atherosclerosis</td>
<td>Metabolic ageing</td>
<td>Diabetes, cardiovascular disease, stroke, hypertension and dementia</td>
</tr>
<tr>
<td>Short telomeres increase sensitivity to radiation</td>
<td>Telomere shortening</td>
<td>Cardiovascular disease, segmental ageing in some progerias</td>
</tr>
<tr>
<td>Abnormality in neuronal migration, brain growth retardation</td>
<td>Brain damage</td>
<td>Seizures and mental retardation</td>
</tr>
<tr>
<td>Breaks in DNA, apoptosis and inflammation</td>
<td>Free-radical damage and oxidative stress</td>
<td>Cancer, cataracts, atherosclerosis and Alzheimer’s plaques</td>
</tr>
<tr>
<td>Oxidative damage to mitochondrial DNA</td>
<td>Mitochondrial damage</td>
<td>Neurodegeneration and cancer</td>
</tr>
<tr>
<td>Inhibits functions of antigen-presenting cells of immune system</td>
<td>Immunological decline</td>
<td>Viral and bacterial infections</td>
</tr>
</tbody>
</table>

Appendix B: WHO recommended dosages for radiological emergencies involving radioactive iodine (World Health Organization, 1999)

<table>
<thead>
<tr>
<th>Age</th>
<th>KI in mg per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 12 years old</td>
<td>130</td>
</tr>
<tr>
<td>3–12 years old</td>
<td>65</td>
</tr>
<tr>
<td>1–36 months old</td>
<td>32</td>
</tr>
<tr>
<td>&lt;1 month old</td>
<td>16</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Supplement</th>
<th>Potassium Iodide (KI)</th>
<th>Strontium Carbonate (SrCO₃)</th>
<th>Caesium Chloride (CsCl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended dosages</td>
<td>130 mg for &gt;12 yo</td>
<td>&gt;1.7 g for treating osteoporosis</td>
<td>3–9 g maintains blood levels for 1 year</td>
</tr>
<tr>
<td></td>
<td>65 mg for 3–12 yo</td>
<td>680 mg = optimum dose</td>
<td>50 mg maintains blood levels for 80 days</td>
</tr>
<tr>
<td></td>
<td>32 mg for 1–36 mo</td>
<td></td>
<td>250 mg to 1 g = recommended</td>
</tr>
<tr>
<td></td>
<td>16 mg for &lt;1 mo</td>
<td></td>
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</table>