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Heavy metal toxicity is a section of public health issue that is not given the attention it deserves. It can result in isolated cases and sometimes it can be an epidemic. The big problem with heavy metal toxicity is that it is very difficult to diagnose. The notorious toxic heavy metals include lead, arsenic, cadmium, mercury and cobalt. They enter the human body mainly through inhalation of their vapour or through ingestion of the compound or materials contaminated with the element. Heavy metals have subtle ways of entering the food chain and recycling itself in human body even after being excreted. This continual exposure predisposes anybody concerned to attack of cancer and other organic dysfunction. Sources and dangers of heavy metal toxicity are discussed and appropriate recommendations made. The recommendations made among other things include; avoiding the use of sewage water and industrial waste water for irrigation, close inspection and testing of imported sea foods to rule out heavy metal contamination before being sold to the public by the concerned agencies

Heavy metal toxicity has to do with the accumulation of heavy metals in the soft tissues of the body in amounts that are toxic (National Organization for Rare Disorders, (NORD), 2016). This can also be referred to as heavy metal poisoning. There has been a controversy over the correct definition of heavy metal. Some have based their definition on atomic *mass*, some others on specific gravity of greater than 4 or 5. But these did not fully address the effects of some metals on plants and animals. In order to come up with a more all-encompassing definition in recent times, heavy metal is now a general term for those metals and semi metals with potential human or environmental toxicity. According to Lentech Water Treatment and air Purification (2004) in Tanee and Albert (2013), heavy metal is defined as any metallic element that has a relatively high density and is toxic or poisonous even at low concentration.

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Heavy metal toxicity if unrecognized or not properly treated can lead to some significant level of mortality especially in third world countries where occupational safety is not taken with any amount of seriousness and also where myth, superstition, and scientific illiteracy hold sway. These heavy metals include lead (Pb), Zinc (Zn). Copper (Cu), Chromium (Cr), Iron (Fe), Mercury (Hg), Arsenic (As), Cadmium (Cd), Cobalt (Co), Manganese (Mn). The heavy metals usually known for toxicity are Pb, Hg, As, Co, and Cd. Except for Co, the other four have no known physiological benefit to human beings. Other heavy metals like Zn, Cu, Fe, Cr, Mn and Co are in one way or the other essential to body functions in trace quantities but if they accumulate in high concentration sufficient to cause toxicity, can be injurious to the body (NORO, 2016). For instance, Zn is a cofactor for some enzymatic reactions, Co is in vitamin B₁₂, Fe is in hemoglobin, Cu, Mn, Cr are trace elements important in human diet (Adal, 2016).

Heavy metal toxicity is a rare field that has just started to gain prominence in public discourse. The knowledge of heavy metal toxicity is not common in developing countries like ours. The way we handle some toxic products without recourse to safety rules shows the level of scientific illiteracy prevalent in our society. It is against this backdrop that this write-up proves relevant. Heavy metal toxicity can be prevented if one is armed with the requisite knowledge of how to avoid it. The science teacher has a great role to play in disseminating this information to the society at large.

Sources of Heavy Metal Toxicity

Heavy metal toxicity can come from different sources. That is why it can affect individuals one by one and can also affect many people at the same time. Sources of metal poisoning include;

1. Industrial source
2. Food
3. Medicaments
4. Air pollution
5. Water pollution
6. Ingestion of lead-based paints by children
7. Improperly coated food containers

Primarily, the toxic heavy metals points of entry into the human body are usually through the mouth or through the nose. Arsenic for instance can be contracted through inhalation of pesticides, fungicides, herbicides or rodenticides that contains arsenic. It can also be got through inhalation of industrial gas from arsenic production or where arsenic is used as a raw material for the production of finished products. Also ingestion of contaminated sea food, polluted water, medicine like Fowler's solution, arsenic-containing herbicides, pesticides, insecticides or fungicides and the use of some topical creams that contain arsenic used in the treatment of some skin infections are also points of entry into the body. Those particularly prone to arsenic toxicity are paint production workers, those involved in galvanizing, soldering, etching, lead plating and smelting work. Also a more general case like that of Bangladeshi citizens who are at risk of organic dysfunction and cancer from chronic arsenic poisoning from their water supply exists. (NORD, 2016). Some parts of Bangladesh have bedrock rich in arsenic. This gives deeper aquifers and crops they irrigate a high concentration of arsenic and toxicity is usually epidemic.

Lead toxicity can come from ingestion of deteriorating lead paint in older

houses by children and careless adults, accidental ingestion of gasoline especially by motor mechanics, ingestion of water contaminated by lead pipes used in urban water supply. Those likely to be more exposed to lead toxicity include welders, solders, battery plant workers and

lead paint workers. Lead toxicity is more serious in children. For instance it was reported that over 300 children died as a result of lead poisoning at Yar-Galma village of Bukkuyum Local Government Area of Zamfara State. (Atuma, 2017).

Mercury toxicity comes from the metallic mercury and its compounds especially the methyl mercury. Mercury contamination of the environment mostly comes from mining activities. Extraction of gold is normally achieved by amalgamation technique especially small gold mining activities because it is cost effective. Mercury we know forms alloys with other metals. Such alloys are called amalgams. Mercury therefore is amalgamated with gold from which gold can easily be recovered from its ores. In this recovery process the amalgam is heated to evaporate mercury leaving gold behind. This amalgamation technique releases mercury into the environment. This accounts for the second largest human-generated mercury emission in the atmosphere; the largest being coal combustion (Dozolme, 2016). Other sources of mercury contamination of the environment include volcanic activities, broken thermometer, compact fluorescent light bulbs and some other medical wastes disposed on land, chlorine-alkali industry for polyvinyl chloride (PVC) production and paper industries. Limestone used in cement production is another natural source of mercury. Mercury does not break down in the environment, but more often than not miners mix mercury with cyanide since it dissolves mercury. When they finish with gold recovery, the left over is thrown into the field where it mixes with organic molecules to form methyl mercury which is even far more toxic than the metallic mercury (Pressly, 2013). Gold miners are therefore highly prone to mercury poisoning; others are those who work in coal fired plants and in cement industry. Mercury is released into the atmosphere through coal combustion, gold mining process, incineration of some household and medical wastes, volcanic eruption and other minor ways and it is able to travel long distances in the air. This is inhaled by human beings and animals. It also gets deposited on land and on waterbodies where it lodges in the body of sea animals which are later eaten by man.

Mercury toxicity seems to have the worst record in the history of heavy metal toxicity. In what came to be known as Minamata disease, thousands of people living in Minamata bay, a fishing village in Japan died and many more disabled as a result of eating fish contaminated by methyl mercury. This came as a result of mercury wastes being discharged into the sea by an industry that produces ethanal used in making plastics. Also between 1971 and 1972 there was serious methyl mercury poisoning in Iraq as a result of people eating wheat treated with methyl mercury fungicide which was imported by the government specifically for planting. When the government discovered this they tried to recover the grains by force from the farmers and some of them out of fear dumped them by the road side, irrigation canals and in rivers which led to further contamination of birds that ate the grains and fish in the rivers. Some of the contaminated fish and birds later eaten by the people led to more casualties of the methyl mercury poisoning and about 6,500 people lost their lives with about 100,000 others going down with permanent disability. (Akubue, 2013).

Cadmium is also a notorious toxic heavy metal which is released into the environment through mining and smelting works. Cadmium is also used in the production of batteries, paint pigments and alloys. Cadmium is said to be next to lead and mercury in toxicity. Dumping of cadmium containing used batteries and paint in the environment is also a source of environmental contamination by cadmium. Rice and wheat grown in cadmium contaminated farmlands can take up cadmium which is stored in the grains. Storing acidic foods such as fruit juices in cadmium plated containers is also a source of cadmium toxicity

because cadmium plate is soluble in acids.(Akubue, 2013). Cadmium toxicity can occur as a result of inhalation of the dust or through ingestion of its salts or contaminated food materials.

Cobalt toxicity is common amongst factory workers especially those, who fabricate tungsten carbide used in industrial machinery, cutting tools, and in abrasives. Another minor source is wear and tear of metal on metal in hip prostheses.

The Cycle of Metal Toxicity

Metal toxicity goes into a cycle because of some human activities which inadvertently perpetuates the accumulation of these heavy metals in plants and animals. Primarily some people because of their occupation or environment are more exposed to these heavy metals more than others but due to certain human activities, the toxicity, circulates among the people in the society. These heavy metals are normally excreted from the human body through urine and faeces. This means that sewage is likely to be a rich source of heavy metals. When fecal materials from sewage are used to grow vegetables and fruit trees, they take up these heavy metals and store them in leaves and fruits. Even grains and cereals can absorb heavy metals from the soil and store them. Stasinou and Zabetakis (2013) confirmed that certain vegetables take up heavy metals from contaminated water used for irrigation.

In many countries sewage and waste water from industries are used for irrigation or outright fecal matter used to enrich the soil before cultivation of vegetables. This act exposes the plants to the uptake of heavy metals. Other sources of heavy metal pollution can come from exhaust fumes of vehicles that run on leaded gasoline. Research within Nigeria and outside have shown that economic/ edible plants grown close to heavily trafficked roadside contains considerable amount of heavy metals (Teju, Megersa, Chandravanshi and Zewge,2012; Tane and Albert,2013). Higher levels of lead and other heavy metals were detected in leaves and bark of tree samples in the high pollution parking lots in Ogbomoso in Nigeria (Olagire and Ayodele in Teju et al (2013). Also Rejini and Janrdhanan (1989) stated that plant leaves is the most sensitive part to be affected by air pollution as major physiological processes are concentrated in the leaf. Leafy vegetable especially near road with heavy traffic and other plants dependent on leaves for photosynthesis are Worse victims. These plants are later eaten by man thereby accumulating the heavy metals again. The plants can be eaten by animals which may in turn be later eaten by man. This keeps the vicious cycle going. Dumping of used batteries, used electronics, used solar panels and so on increase the concentration of heavy metals in the environment and more injurious if dumped in farmlands. Also phytoremediation used in cleaning the environment of toxic heavy metals most times man or animals that can be eaten by man end up eating the plants used thereby completing the circulation cycle and returning to man.

Some Common Symptoms of Metal Toxicity

Age of people and route of entry into the human body are important when considering the issue of metal toxicity. Some symptoms are the same as that observed in man from other infections. Metal toxicity is a rare disorder that needs experienced hands to diagnose. The symptoms depend on the particular metal involved.

Arsenic toxicity symptoms include; drowsiness, confusion, brain damage, oedema, transverse white lines on the fingernails (Mees' lines), hypotension and so on.

Cadmium toxicity symptoms include; nausea, abdominal cramps, breathlessness, increased salivation, yellowing of the teeth, excretion of abnormally high level of protein in urine and so on.

Cobalt toxicity symptoms include; ear ringing (tinnitus), lack of appetite, goiter, respiratory diseases, heart or kidney damage.

Lead toxicity symptoms. Lead toxicity *is* very much age dependent. For children, the symptoms include; brain damage, convulsion, seizures, mental retardation, selective deficits in language and cognitive functions. The child is also less playful, irritable and sluggish. For adults, the symptoms include; damage to reproductive organs, high blood pressure, insomnia, joint pain, hallucinations, and low levels of Fe in the red blood ceUs. Lead can pass through placental barrier and may reach unborn child reSULting in miscarriage and still births.

Mercury toxicity symptoms include; fatigue, depression, iTitability, shock and permanent damage to brain, loss of memory, lack of concentration, tremor of legs and arms. Mercury vapour inhalation may cause coughing, breathlessness, burning pain in the chest.

The Role of the Science Teacher in curbing the Menace of Heavy Metal Toxicity.

There can hardly be any meaningful development in the contemporary time that is science driven without first evolving a scientifically literate society. The science teacher holds the key to the building of a scientifically literate society. According to Okorie,(20 10) in Okorie, (2011), scientific literacy is nothing but the acquisition of the scientific knowledge, attitudes, skills and values needed to live and participate actively in our rapidly changing science-based world. The science teacher holds the key to producing informed society that can make informed decision about their health and thereby reduce the annual heavy expenditure on health related matter both by the government and the masses.

The importarice of the science teacher in this matter is clearer when we look at the yawning gap in scientific knowledge between the scientists or science practitioners and other members of the society in which they live. Most science materials, methods and processes may not be easily comprehended by the lay man on the street, but the science teacher can bring the information down to their level of understanding. To buttress this fact, Okebukola in Ekpiken and Aniefiok (2014) states that the world without teacher is a world without hope; a world without teacher is a world without progress and the world without teacher is a world that is doomed. Suffice to say that the importance of the science teacher in a matter like this cannot be over emphasized. By using the instrumentality of the classroom, the science teacher can disseminate information that can easily get to the grassroots. Social media is another contemporary platform that an average science teacher can use to feed the society with useful health information such as heavy metal toxicity. But the classroom still remains the best in inculcating longer lasting knowledge which is geared towards effecting behavioural change in the learner. Heavy metal toxicity is better prevented than for it to be treated and increased exposure to heavy metals is associated with increase in cancer cases. Medical practitioners have been lamenting increased cases of cancer in Nigeria. According to world health organization (WHO) statistics, Nigeria has the highest cancer death rate in Africa. Ten Nigerian die every hour from cancer and about 100,000 new cases are recorded annually (Obinna, 2012). Cancer come from genetic predisposition or from environmental factors of which exposure to heavy metals is one. This statistics is alarming and every avenue of preventing the scourge of cancer must be exploited.

When HIV/AIDS became a threat to human existence, it was quickly infused into the curriculum of the school systems and like wild fire, the information about it got to people of every social strata. In this same way, the science teacher should be brought in as a ready tool to fight the scourge of cancer using the classroom.

Conclusion

Metal toxicity is a silent killer and that is why the public sensitization on its killer tendencies needs to be taken seriously. Increased exposure to heavy metals is associated with increase in cancer cases. The society need to wake up to this clarion call_

and try as much as possible to break the cycle of metal toxicity which strives to perpetuate its presence in man and so expose humanity to the scourge of cancer..

Recommendations

In view of the foregoing discourse, the following recommendations are important;

- ❖ The government should completely ban the sale of leaded petrol in the country
- ❖ People should avoid dumping of used batteries and electronics in farm lands
- ❖ Farm lands should not be located near roads that have heavy traffic
- ❖ Indiscriminate use of pesticides, herbicides and fungicides should be avoided .
- ❖ Farmers should desist from use of sewage water and industrial waste water for irrigation .
- ❖ Fecal matter and urine should not be used to enrich the *soil* for planting vegetables, fruit trees, cereals and grasses used for feeding domestic animals
- ❖ Metal toxicity should be included in the curriculum of the school system so as to keep the society informed of their dangerous consequences .
- ❖ National Food and Drug Administration and Control (NAFDAC) should as a matter of urgency test all imported sea foods for the presence of heavy metal contamination before allowing the sale of such in the country .
- ❖ With the proliferation of boreholes in the country, the ministry of health should test water from such boreholes for heavy metal contamination before certifying the water fit for public consumption .
- ❖ Government should sponsor science and society hour in national media outfits to educate the masses on some important topical issues that weigh heavily on national development such as heavy metal toxicity.

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