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RESEARCH ARTICLE

Detection of Radiation Pollution with Depleted Uranium in some Iraqi Cattle with Cancer and their Field Soils

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Abstract

This study concerned with internal radiation pollution in cattle via testing cows' blood samples suffering from cancer tumorsfrom different Iraqi fields. The technique of Solid State Nuclear Track Detectors (SSNTDs) type CR-39 was used for the estimation Depleted Uranium (DU) concentration in blood samples. Also, the specific activity was estimated in soil samples collected from affected animals' fields by using Gamma-ray Spectrometry technique. The results showed that eyes cancer tumors were recorded more frequently and followed by skin cancers respectively. All blood samples were contaminated with DU in elevated levels. Some samples contained higher concentrations than ever recorded concentration in Iraq before. In addition, elevation in radiation specific activity was recorded in almost the soil samples. As a conclusion: contaminated soils with Depleted Uranium affected cattle grassing there via transmit this type of radiation and inducing cancers.

Introduction

Cancer is unregulated cell growth occurs when the cells turn to divide in uncontrolled manner forming a malignant tumors or neoplasm. Either in human or in animals, the causative factors (carcinogens) are the same, mainly environmental factors pointing for foods, toxic chemical pollutants, infections with certain pathogens; like viruses and fungi and radiation exposure (Veterinary Cancer Society, 2012).

Heredity is still a predisposing factor in human. While in animals the race and strain considered as predisposing factors, which is obvious due to the fact that dogs, cats and poultries are the most predisposed animals to get cancers (Snashall and Patel, 2003).

In cattle, cancers in eyes, skin, urinary bladder and gut tumors are the most incident cancer cases, while, mammary glands and nervous tissue tumors recorded as rare (Ettinger, 1993).

Cows' Immune system, like any vertebrate, is able to generate an immune response against tumors and cancerous cells when it is healthy. Cell mediated immunity CMI is the hitting arm via natural killer cells (NK) and T-cytotoxic cells (Tc) attack and kill these abnormal cells. In addition, this process is modulated by several important cytokines, mentioning IL-2 and IFN-γ (Tizard, 2009).

Humoral mediated immunity (HMI), also, defends cancers, by T-helper cells (Th) and specific Abs production which will share in ADCC and tumor elimination. But, when there is a compromising factor for the immune system, like ionizing radiation for example, it will interfere with the immune response leading of case retardation (Nagarkatti, 2007; Morrison, 2011,).

Treatment of tumors in cattle mostly starts with the surgical removal of the entire neoplasm with any associated lymph nodes if presented. Using anticancer drugs like chemotherapy depending on case severity. The small lesions or neoplasms can be removed Electrocautery (by burning) or Cryosurgery (by freezing). The veterinarian may need to remove an organ to save animal like removing the whole eye in eye cancers which is the most common type of cancer in cattle (Miller *et al.*, 1995).

The problem of cattle cancer tumors increased upon using the recombinant growth hormones, modified forage and stover and due to environmental pollution. Many scientist arranged the factors affecting incidence of cancers in cattle as breeding between strains or sire, nutrition, viruses e.g. Papiloma virus, ultraviolet solar radiation, exposure to toxic materials and ionizing radiation (Cattle Diseases Guide, 2012).

The consequences with cattle tumors for human are not restricted with economical wastage, but, furthermore to the health effects. Since some cancers resulted from viral infections e.g. Papilloma virus and ionizing radiation exposure e.g. Depleted Uranium. These causative factors can be transmitted to human via eating these affected cows' meat or use their milk and milk dairies. These factors are able to induce cancers in human in turn. The illegal slaughterhouses and butchery have role in these contaminated animals meat marketing (Cotran, 1994; Hill,2004).

Concerning Ionizing Radiation, animals exposed to radiation upon Chernobyl accident had suffered from death, tumors, abortions, still births and malformation in their next offspring e.g. eight limbs phenomenon (Milacic, 2008).

While upon NATO bombing for former Yugoslavia (Ukraine now days), the peoples were advised not to eat fish, vegetables or drink the tap water for at least six months due to rivers contamination with DU (Castronovo, 1999; Milacic ,2009).

In Japan, after the earth quake and Fukushima reactor radiation seepage, peoples resident affected places were recommended not to eat plants yield harvested from the affected fields and not to sow these soils even not to let their animals herd there too (Yamaguchi, 2011).

In Iraq, Depleted Uranium (DU) was and still an environmental pollution problem since its levels rose after both Gulf wars, and the contaminated places have not been limited or isolated to stop and avoid the spreading of this radioactive contamination (UNEP, 2007).

Depleted Uranium is an alpha particles radiation emitter; its importance came from its radioactivity and cytotoxicity. It is able to enter human and animal bodies by three means; Ingestion, Inhalation and via contact. In animals, the ingestion way is more common, it occurs by contamination of herbs and forage with dust and soil particles that contaminated with DU. Moreover its toxicity due its behavior inside living bodies as heavy metals, e.g. lead and mercury, DU acts as a source of ionizing radiation internally till excretion by urine with a half life 5 years. During DU existence internally, cells suffer from mutations and DNA breakage, when damage cannot be repaired, cells will turn to cancerous (Briner, 2010).

MATERIALS AND METHODS

Cases: This study involved (6) cows, aged over 2 years, all were Friesian females, identified with cancer tumors. Identification Authority was by Veterinary Medicine College /AL-Anbar University. Table (1), Pictures (1, 2).

Samples:

- **Blood samples:** A total of (5) ml of blood was collected by jugular vein puncture from each cow. Blood was kept in EDTA tubes in the refrigerator until used for DU estimation in blood (Roder,2001).
- **Soil Samples:** Soil was collected from each farm in clean bags and kept for DU concentration estimation.

Estimation of DU in Cattle Blood Samples:

This test was accomplished using whole blood and depending on the method of Solid State Nuclear Track Detectors (SSNTDs) type CR-39. Pershore Ltd. (UK) Polymer was used and an appropriate standard curve in order to obtain DU values in p .p.m. CR-39 detectors were etched by NaOH chemical solution with 6.25N at 60 ^{o} C for 5 hours. This detection was applied on all blood samples collected (Al-Hamadany, 2011, 2012).

Estimation of Specific Activity for Radiation Energy in Soil Samples:

The specific activity (S.A) for soil samples were estimated by using a special Gamma-ray Spectrometry system. The radioactivity results were obtained in (Bq/kg), whereas Becquerel (Bq) represents one disintegration per second, which is a radioactivity, the degree of radioactive source (Ismail, 2012; AL-Obaidi, 2006)

RESULTS

From a total of (136) cows heads; the total number of all herds heads collectively; there were (6) cases (4.4%) recorded with cancer tumors development that not resulting from an infectious carcinogenic microbe. These cases included (4) cows with eye tumors (66.7%), and (2) cows with skin warts tumors (33.3%).

Table (2) shows the concentration of DU for the six cattle blood samples. The concentrations were calculated in ppm and the normal dependent value in Blood was (0.115) ppm according to the determined limits of ICRP during 2006 (ICRP, 2006).

Soil samples showed elevated levels of radiation activity, Table (2), where the normal value for specific activity should not exceed (40 Bq/kg) (ICRP, 2006).

Table (1): Cattle Cases involved in this study and some recorded information

No.	Tumor Site	Field Location	Total No. of cattle in Farm	No. of cancer cases recorded	Management and Treatment
1	Eye	Al-Batraa/ Anbar	100	2	Opthalmoctomy and Antibiotics
2	Eye	Al-Batraa/ Anbar	100 (same herd above)	2	----------*
3	Eye	Al-Latefia/ Baghdad	10	1	----------
4	Eye	Al-Latefia/ Baghdad	4	1	----------
5	Warts in neck skin	Al-Latefia/ Baghdad	7	1	----------
6	Warts in neck skin	Al-Saqlawia/ Anbar	15	1	----------

*:Nomanagement or Treatment taken.

Table (2): Depleted Uranium obtained concentrations in cattle blood samples and Specific Activity of Radiation energy obtained for cattle fields Soil Samples.

Cow No.	Concentration of DU in cattle blood samples (ppm)	Specific Activity (Bq/kg)*
1	1.23	55.38
2	0.87	10.8
3	0.89	594.7
4	0.91	465.6
5	1.12	319.8
6	0.74	501.4

**: This activity was estimated for (^{214}Pb), which is equivalent to (^{238}U).*

Picture (1): Cow with Eye TumorPicture (2): Cow with warts in nick

DISCUSSION AND CONCLUSION

Our outcomes, concerning the predominantnoninfectious cancer type in cattle, are in consistent with (Smith,2009). These authors stated that eyes cancer tumors is the most frequent cancer type in bovines between noninfectious cancer cases, while skin cancers came as the second frequent type.

Bansiwal and his colleagues mentioned that eyes, udder and skin are most affected parts in cow body with tumors development whether resulting from a pathogenic, or other environmental factors(Bansiwal,2006)

In the study of Al-Taee, cutaneous papilloma was most common in cattle and represented (75%), while the rest were bovine skin tumors (16.7%), squamous cell carcinoma and (8.3%) amelanotic melanoma (Al-Taee, 2003).

During 2006, International Commission on Radiological Protection (ICRP) limited Uranium (U) values in living bodies with equal or below 0.115 ppm. That was after an experimental design applied on laboratory mice and clinical signs appearance, since living bodies do not need U for any biological reactions. So it is a contaminant toxic matter if it is found inside living bodies in any concentration (ICRP, 2006).

Since all of our collected cases were from fields and locations witnessed military operations in the previous wars. It is reasonably to find out that specific activity for soil samples and DU concentration in animals grazing there are elevated. TheInternational Atomic Energy Agency (IAEA) declared that environmental including soil contamination with DU is able to be transmitted to animals grazing there via ingestion type of entry, then move with their blood to skin, biotic organs and bones (International Atomic Energy Agency, 2013).

The authors Al-Rawi and hercolleagues investigated about Uranium concentrations in sheep's organs in several Iraqi governorates. They found that the most elevated value was in Karbala (3.706) ppm and the lowest one was recorded in Faluja (0.127) ppm, with a range (0.149- 1.675) ppm in animals tissue and mainly in liver. They mentioned too, that DU levels average was 1.15 ppm in the south cities in Iraq due to DU contamination there (Al-Rawi,2011).

The authors Tuhvalshin, *et al.*, searched for illness occurred in people resident near Tien-Shan, a city in Russia near Uranium Factory and the reactor, concentrations of Uranium have a range 30-100 times more than other regions in Russia. They found that these peoples were consuming lambs' meats from a herds grazing in areas near that factory. They tested these meats and they found that they were highly contaminated with U (Tuhvalshin, 2008).

The scientist Thrall stated that exposure to extensive radiation is able to cause cancers in both human and animals, and made a warning of getting radiation exposure as minimum as possible to avoid side effects of radiation exposure (Thrall, 2007). Because of DU latent period, clinical signs appearance after 1-5 years (Castronovo,1999); that lead to discovering of contaminated animals is of a high degree of importance, especially in contaminated regions and fields.

As a conclusion: contaminated soils with Depleted Uranium affected cattle grassing there via transmit this type of radiation and inducing cancers.

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