Assessment of Plant and Chemical Poisoning In Livestock in Central Ethiopia

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Abstract

The survey was conducted with the objective of assessing potentially poisonous plants and chemicals in and around Adama town, Central Ethiopia. Three types of structured questionnaires were developed and 118 individuals (93 livestock owners, 11 animal health practitioners and 14 factories managers) were interviewed on voluntary basis. The result of this assessment indicated that 71(76.3%) of livestock owners and 10(90.9%) of animal health practitioner complained presence of plant poisoning on livestock in the study area. Similarly 31 plants were identified as having poisoning effect on livestock among which Rhizophoraceae, Sorghum bicolar, Parthenium hysterophorus, and Medicago polymorpha had the highest botanical frequency. On the other hand, 22(23.7%) livestock owners and 1(9.1%) animal health practitioners observed chemical toxicosis, respectively. About two individuals of (14.2%) interviewed factories managers received complaints of chemical toxicosis of livestock due to inappropriate disposal of their wastes. Food shortage 48%, nutritional deficiency 10.4% and due to excess consumption 8.1% were identified as major risk factors which predispose livestock in and around Adama town to poisonous plants and toxic chemicals. Therefore, further study on complained poisonous plants and toxic chemicals in the study area, and institution of pertaining control and prevention method is strongly recommended.

Keywords: Livestock owners; Animal health practitioners; Poisonous plant; Toxic chemical; Toxicosis.

Introduction

Livestock are facing various life threatening hazards notably infectious (parasitic, bacterial, viral, protozoal, fungal) and non-infectious like metabolic diseases, poisoning and other miscellaneous origin. Ethiopian people especially farmers and traditional animal healers have been using traditional methods to treat both human and their livestock diseases for generations. Traditional medicine is still widely practiced in areas where modern health care services are limited [1]. Traditional animal healers can use plant parts like seeds to treat cattle with abdominal distension, leaves for different treatment of diseases and other parts of the plants [1,2]. Though Ethiopia is rich in its flora of about many species of vascular plants, only few of the families of flowering plants are clemency used are known to have medicinal properties. Ethiopia also possesses three traditionally recognized agro climatic zones. These are Kola (a hot zone of 500-1500 m above sea level), Weina Dega (intermediate Zone of 1500 m and 2500 m), and Dega (a cold zone usually cited as being 250 m above sea level). These ecological zones have favorable to various species of plants and animals. Apart from the globally listed ones, therefore, some factors are inherent in Ethiopia to contribute to phytotoxicity [3].

A variety of poisonous plants have caused extensive losses to the livestock industry in many parts of the world mainly east Africa including Ethiopia since the days of early settlement. They are still significant problems in numerous areas. Poisonous plants produce their toxic effects after being ingested and/or absorbed by animals [4] which include physical upset, loss of productivity and death. Therefore, even though plants have vital nutritious and providing the normal atmospheric oxygen, it will cause life threatening if it is toxic. In addition to this, some chemicals which are in natural environment i.e. soil, water or industrial origin also may be toxic to livestock. But there are also some chemicals, macro and micro minerals, which living things cannot survive without them; in other side their absence causes abnormality of one or total body structure or disturbance in health situation of an individual [5]. Ingestion or contact with some industrial products or by-products disposed on grazing area cause physical upset or death of an individual [6].

Plant poisoning is due to either accidental ingestion of material eaten along with grass or willful consumption of poisonous plants when pasture is dry while most poisonous plants remain green all the year round. It is also more likely to occur in animals which have been moved from one part of the country to another. New importations are unfamiliar with the strange ingestion of their fresh surrounding. Acclimatization in herbivores animals induces a sense of discrimination between edible and non-edible parts [7].

The current practices of using pesticides and herbicides in agriculture resulted in world-wide increase in food production and provision of abundant food for human [8]. However, a number of persistent problem concerning the safety of pesticides remain with us and new problems arises from time to time. Because of these problems, and increasing tendency to use pesticides as additives in the protection of cereals in storage from infesting insects, a regulatory body is essential. Thus, it requires a subsequent storage and treatment step which also includes appropriate measures for minimization of contamination and losses [9].

Numerous factors influence the action of poisonous substances which include: route of absorption; the dose, the physical and chemical nature of the poison; whether exposure to poison is single or repeated;

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Received January 29, 2014; Accepted March 06, 2014; Published March 10, 2014

Citation: Abera D, Jibat T, Sori T, Feyisa A, Beyene T (2014) Assessment of Plant and Chemical Poisoning In Livestock in Central Ethiopia. J Environ Anal Toxicol 4: 215. doi: 10.4172/2161-0525.1000215

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the species, body size, sex, and general health state of animal; and chemical factors such as particle size, solubility, toxicity, absorption and excretion rate, affinity for body tissues or fluids, interaction with other drugs, and lacking development of metabolic pathway. Liver or kidney insufficiency may enhance toxicity due to poor metabolism or slow excretion of toxicants. Alteration in gastrointestinal PH can change the ionization of drug or chemicals and influence their absorption; presence or absence of food in the stomach affects the toxicity of certain compounds [10]. Overgrazing of pastures and ranges probably the greatest factor in causing losses from poisonous plants. The danger of overgrazing is always greatly increased in periods of moisture deficiencies that reduce forage production [4]. However, plant poisoning essentially is a local problem occurring in areas where poisonous plants may form a large proportion of the herbage species available to grazing animals. Poisonous plants are often naturally refused by animals (may have repulsive smell or contain highly irritant juices) and are eaten only when other herbage pastures is scarce [11].

Generally, the materials causing intoxication in animals also may be classified as naturally-occurring or man-made. The former includes mycotoxins, poisonous plants, snake venom, insects, minerals and these often become hazardous only when human intervention allows animals to access to them whereas the second (i.e. man- made toxic agents) includes industrial products, like insecticides, herbicides and others. As there is no syndrome due to poisonous substance that cannot also be produced by some other causative agent, the diagnosis of poisoning is not an easy task and cannot be based on any single observation. The chemical characteristic of plants constituent is of at most importance. Moreover, laboratory analysis of part of plant or detection of toxic substances in the animal’s tissue leads to diagnosis of doubtful cases. In general, in Ethiopia a number of plant species are found in which some have medicinal value without having toxic effect on animal [12] and some have very toxic even at small dose. Besides, there are also chemicals which result in loss of production and even death on animals grazing in the field which are very toxic to animal [13]. Hence, the loss incurred by phytotoxicity and chemical toxicosis is likely to be significant. Therefore, it is imperative to bring to the attention of all professionals the effects of poisonous plants on animal health and productivity [14]. Therefore, the present study is designed to assess potentially poisonous plants and toxic chemicals to livestock in and around Adama town.

Materials and Methods

Study area

The study was conducted from November 2008 to May 2009 in and around Adama town, East Showa Zone of Oromia regional state, central Ethiopia. Adama is located at 95 km south east of Addis Ababa at 39.1°N and 8.31°E at elevation of 1770 meter above sea level and receives an annual rainfall ranging from 400mm to 800 mm; the temperature range is 13.9 °C to 27 °C [15]. The peri-urban area of the city is featured by mixed livestock-crop production where livestock is likely to be significant. Therefore, it is imperative to bring to the attention of all professionals the effects of poisonous plants on animal health and productivity [14]. Therefore, the present study is designed to assess potentially poisonous plants and toxic chemicals to livestock in and around Adama town.

Study population

The target study population was voluntary animal owners, animal health practitioners and factories Managers. A total of 118 individuals were interviewed in which convenience method was employed.

Study design

Questionnaire survey was carried out by interviewing voluntary animal owners, animal health practitioners and factories’ managers. For this study, structured questionnaire was designed to collect information related to plant and chemical poisoning in livestock in the study area.

Data storage and statistical analysis

The information that was gathered through questionnaire survey of suspected toxic plants and chemicals was entered to Microsoft Excel program. To identify the scientific names of the complained poisonous plants the National Herbarium of Biology Department of Science Faculty, Addis Ababa University was consulted. The data was analyzed by descriptive statistics using SPSS version 20.

Results

A total of 118 individuals were interviewed (93 livestock owners, 11 animal health practitioners and 14 factories’ managers) using structured questionnaires. This assessment revealed that 76.3% of livestock owners and 90.9% of animal health practitioners observed plant poisoning in livestock. However, only 23.7% of livestock owners and 9.1% of animal health practitioners complained presence of chemical poisoning in livestock in the area (Table 1).

A total of 31 plants were complained having poisonous effect on livestock by livestock owners and animal health practitioners (Table 2). Among these plants Rhizophoraceae, Medicago polymorpha, Sarghum bicolar, Parthenium hysterophorus and Trifolium burchellianum were the most frequently complained toxic plants (Table 3). This study also showed that gastrointestinal upsets: salivation, bloating, inappetance and weakness are among the frequently manifested signs by poisoned livestock. Bovine species is the most frequently poisoned livestock followed by ovine and caprine whereas horse and camel were the least (Table 2).

This survey also revealed that the toxic parts of 58%, 19.4%, 16.1% and 6.5% of suspected poisonous plants are leaf, whole part, flower and seed and fruit, respectively (Table 4). There were no plants with stem or root toxic. This study indicated that food shortage is the primary predisposing factor followed by nutritional deficiency and excessive consumption (Table 5). The current study also indicated the presence of toxic chemicals which threaten the health of livestock in and around Adama town (Table 6).

Out of 93 interviewed livestock owners, 42.81% indicated that toxic chemicals were acquired from contaminated water and 57.1% acquired from contaminated pasture by chemicals sprayed on crops and wastes of factories. 0.1% of chemical poisoning was acquired from unknown sources. The result from the interviewed factories’ managers revealed that their means of waste disposal for more than 80 % of tanneries were in their own disposal sites, whereas, 20% of them release wastes in to water bodies in the vicinity. Fifty percent of flora cultures dispose flower propagation to their own restricted place where livestock have no access to it and 25% of them dispose in to pits prepared for this

| Group of interviewed | Number interviewed | No. of respondent observed |
|----------------------|--------------------|---------------------------|
|                      | Plant poisoning (%)| Chemical poisoning (%)     |
| Livestock owners     | 93                 | 71 (76.3%)                | 22 (23.7%)                |
| Animal Health practitioners | 11     | 10 (90.9%)                | 1 (9.1%)                  |
| Factors’ managers   | 14                 | 0                         | 2 (14.2%)                 |
| Total               | 118                | 81 (68.6%)                | 25 (21.2%)                |

Table 1: A summary of plant and chemical poisoning.
## Table 2: Summary of complained poisonous plants with their local and scientific names, manifested signs and affected species.

| Name of the plant | Botanical | Frequency | Veterinary Frequency | Exposure |
|-------------------|-----------|-----------|----------------------|----------|
| Rhizophoraceae    |           | 11        | Bloating (7)         | Single   |
| Sorghum bicolor   |           | 9         | Colic (3), Salivation(2), Bloating (5) | Single |
| Parthenium hysterophorus |       | 8         | Salivation(4), Sour milk (4) | Repeated |
| Medicago polymorpha |         | 8         | Bloating(5), Colic (3) | Single |
| Trifolium burchellianum | 6     | Depression (2), Erection of hair(4), Bloating (4) | Single |
| Bracken fern      |           | 5         | Bloody urine (5)     | Repeated |
| Ricinus communis  |           | 5         | Bloating (4) , Salivation (5) | Single/ Repeated |
| Amaranthus spp    |           | 3         | Bloating (2), Anorexia (1) | Single |
| Helinus mystacinus|           | 3         | Bloating and colic   | Single |
| Lantana camara    |           | 3         | Photosensitization   | Repeated |
| Birra (kesso)     |           | 3         | Bloody Urine         | Single |
| Hypantheriaria and other species | | 3 | Submandibular swelling, weight loss | Repeated |
| Acacia            |           | 2         | Bloating (2)         | Single |
| Poaceae spp       |           | 2         | Bloating and colic   | Single |
| Snowdina polystarch |         | 2         | Bloating             | Single |
| Banda             |           | 2         | Loss of body condition (2) | Single |
| Shoke             |           | 2         | Diarrhea             | Repeated |
| Medicago burweed  |           | 1         | Bloating and colic   | Single |
| Menkera           |           | 1         | Crying loudly (1)    | Repeated |
| Philosophy (Eng)  |           | 1         | Weakness (1)         | Repeated |
| Bala gebis        |           | 1         | Bloating, anuria (1) | Single |
| Kecho             |           | 1         | Excessive nasal discharge & diarrhoea (1) | Single |
| Bala dimakankore  |           | 1         | Bloating (1)         | Single |
| Kebu (Red leaf with thorn) | | 1 | Bloody urine | Single |
| Terminalia browni |           | 1         | Progressive weight loss (1) | Single |
different edaphic and climatic factors. These factors also contribute to the occurrence of plant poisoning and various chemical toxicosis, which pose health problems in livestock in the study area. Similarly, 90.9% and 9.1% of animal health practitioners in the area revealed that toxic plants and chemical toxicosis are among causes of ill health in livestock.

### Discussion

The results of the present study showed that both phytopoisoning and chemical toxicosis are among causes of ill health in livestock. Out of 93 interviewed individuals 76.3% and 23.6% of livestock owners responded that poisonous plants and chemicals, respectively, pose health problems in their livestock in the study area. Similarly, 90.9% and 9.1% of animal health practitioners in the area revealed the occurrence of plant poisoning and various chemical toxicosis, respectively. The results in general have shown that toxic plants and chemicals are causing significant animal health problems in and around Adama town. The chemical toxicants can also pose serious human health complication if they accumulate in the edible organs of the animals. The situation was aggravated by prevailing feed shortage, clean drinking water and inappropriate chemical waste disposal from factories. Feed shortage can force animals to browse perennial shrubs and bushes while most of these perennial plants have been known to contain toxic secondary metabolites [16,17]. Shortage of water made the animals to drink river water contaminated with chemical waste effluent from various factories in the area.

In this study 31 plants having toxic effect to livestock were identified. Rhizophoraceae, Medicago polymorpha, Sarghnum hysterothorus and Trifolium burchellianum were the most frequently complained plants. Various plants grow in different areas that have different edaphic and climatic factors. These factors also contribute to the chemical compositions of plants which account for existence of different toxic plants in different geographical areas. However, some of the plants recorded in this study were reported to have similar effect on the plants recorded in this study were reported to have similar effect on different toxic plants in different geographical areas. However, some of the plants recorded in this study were reported to have similar effect on livestock elsewhere. For instance Amaranthus retroflexus (Red root) has been known to cause poisoning of cattle in Iran [18]. Medicago sativa was also reported to have caused poisoning of livestock in many countries. These plants have already been confirmed to contain nitrate in their tissues [19,20]. Similarly, the importance of Trifolium spp., Accacia and Sorghum species as causes of livestock poisoning have been published [19]. Bracken fern is also widely distributed in many parts of the world. In Ethiopia, its existence and importance as a cause of enzootic hematuria has been previously shown in different regions [17,19] and it has also been reported elsewhere [4,19].

### Summary of predisposing factors to poisoning plants in the study area.

| Predisposing factors | Total number interviewed | Number of respondent who identified major risk factors which predispose livestock to poisoning plants (%) |
|----------------------|--------------------------|---------------------------------------------------------------------------------------------------|
| Food shortage        | 104                      | 48%                                                                                               |
| Nutritional deficiency| 104                      | 10.4%                                                                                             |
| Excess consumption   | 104                      | 8.1%                                                                                              |
| Unknown reasons      | 104                      | 28.3%                                                                                             |

### Toxic chemicals Being complained, species affected and the frequency of each observed.

| Toxic chemicals            | Poisoned species | Frequency |
|----------------------------|------------------|-----------|
| Burned oil, Naphthalene    | All species      | 1         |
| Sulfuric acid              | Bovine, Caprine  | 2         |
| Limestone                  | All species      | 3         |
| Soda ash                   | All species      | 3         |
| Fluoride                   | Bovine           | 3         |
| Herbicides                 | Bovine           | 3         |
| Tannery wastes             | Bovine, most but all species | 5 |

### Summary of predisposing factors to poisoning plants (%)

| Frequency | Number of respondent who identified major risk factors which predispose livestock to poisoning plants (%) |
|-----------|---------------------------------------------------------------------------------------------------|
| Food shortage | 104 | 48%                                                                                               |
| Nutritional deficiency | 104 | 10.4%                                                                                             |
| Excess consumption | 104 | 8.1%                                                                                              |
| Unknown reasons      | 104 | 28.3%                                                                                             |

### Summary of questionnaire survey on toxic chemicals being complained, species affected and the frequency of each observed.

| Seed and Fruit | Leaves | Whole part |
|----------------|--------|------------|
| Amaranthus spp | Terminalia browni | Medicago brueweed [Eng] |
| Xanthium spinosum | Ricinus communis | Parthenium hysterophorus |
|                 | Lantana camara | Bracken fern |
|                 | Acacia | Poaceae spp |
|                 | Hypanthianuifa and other spp | Banda |
|                 | Sorghum biclor | Rhizophoraceae |
|                 | Medicago polymorpha with other spp | |
|                 | Spino pods | |
|                 | Philosophy | |
|                 | Birra | |
|                 | Bala gebisa | |
|                 | Kecho | |
|                 | Baladimakan | |
|                 | Kara kabu | |
|                 | Kumutu | |
|                 | Menkera | |
|                 | Osyridocarpus | |
|                 | Medicago sativa | |
|                 | Tribulusterestris | |
|                 | Helinus mystacinas | |

### Table 3: Summary of complained poisonous plants with their botanical and veterinary frequency and frequency of exposure.

| Seed and Fruit | Leaves | Whole part |
|----------------|--------|------------|
| Xanthium spinosum | Osyrido carpus | |
| Parthenium hysterophorus | | |
| Tribulus Terestris | | |
| Bloating and diarrhea | | |
| Oxyridocarpus | | |
| Tribullusterestris | | |
| Helinus mystacinus | | |

### Table 4: Toxic parts of suspected poisonous plants.

| Seed and Fruit | Leaves | Whole part |
|----------------|--------|------------|
| Xanthium spinosum | Oxyridocarpus | |
| Tribulus Terestris | | |
| Helinus mystacinus | | |

### Table 5: Summary of questioned survey on toxic chemicals being complained, species affected and the frequency of each observed.

| Seed and Fruit | Leaves | Whole part |
|----------------|--------|------------|
| Xanthium spinosum | Oxyridocarpus | |
| Tribulus Terestris | | |
| Helinus mystacinus | | |

### Table 6: Summary of complained, species affected and the frequency of each observed.

| Seed and Fruit | Leaves | Whole part |
|----------------|--------|------------|
| Xanthium spinosum | Oxyridocarpus | |
| Tribulus Terestris | | |
| Helinus mystacinus | | |

### Table 7: Summary of predisposing factors to poisoning plants (%)

| Predisposing factors | Total number interviewed | Number of respondent who identified major risk factors which predispose livestock to poisoning plants (%) |
|----------------------|--------------------------|---------------------------------------------------------------------------------------------------|
| Food shortage        | 104                      | 48%                                                                                               |
| Nutritional deficiency| 104                      | 10.4%                                                                                             |
| Excess consumption   | 104                      | 8.1%                                                                                              |
| Unknown reasons      | 104                      | 28.3%                                                                                             |
Generally, as many literatures state as well as information obtained from this study, toxic plants may grow together with forage plants and are therefore readily accessible to grazing animals. Under normal conditions only a few toxic plants can be considered sufficiently palatable. But during shortage of pasture and forage they may be forced to browse these toxic plants.

The present study has also shown that toxic chemicals especially those of waste disposal from various factories and herbicides are causing problems in animals. The livestock owners’, animal health practitioners and factory managers all are aware of the toxic effect of chemicals on livestock health. The study showed that animals get chemical toxicants either from grazing pasture or from water. For instance, the use of weed-killers and pesticides has enormously increased at present. These chemicals have been known to cause serious health problems in livestock [21].

In conclusion, the results of the present study show that herbal poisoning and chemical toxicities are among important causes of health problems in and around Adama. Rhizopheraeeae, Medicago polymorpha, Sorghum bicolar, Parthenium hysterophorus and Trifolium burchellianum were the most commonly incriminated toxic plants. Similarly, various chemicals mainly herbicides and pesticides, and factory effluents were shown to cause ill health in livestock. Shortage of pasture and drinking water, and mismanagement of the chemicals are among the predisposing factors to toxicosis in the area. Therefore, it is recommended that detailed investigation should be performed to know the epidemiology of the poisonings caused by plants and chemicals; livestock owners should be advised to remove the toxic plants from the pasture land; experimental studies should be carried out to substantiate the empirical knowledge of plant poisonings; animal health practitioners and factory managers should take necessary measures to reduce the chances of poisonings; and government and non-governmental organizations should focus on pasture and water development to minimize risk of poisonings.

Acknowledgment

The authors would like to thank farmers, traditional animal healers, animal health practitioners and industrial managers found in and around Adama town for their attractive and volunteer response to the questionnaire. All other individuals, who directly or indirectly, took part in the preparation of this manuscript, deserve appreciation.

Author contributions

Contributed to designing the methodology: Dereje A, Tariku J, Teshale S and Ashena F. Contributed to collecting materials: Dereje A. Contributed to correcting the methodology and checking up for collected materials: Dereje A, Tariku J, Teshale S, Ashena F and Takele B. Writing the first draft of the manuscript: Dereje A. Contributed to writing the manuscript: Dereje A, Tariku J, Teshale S, Ashena F and Takele B. Reviewing the manuscript to be ready for publication: Takele B. Agree with the manuscript results and conclusions: Dereje A, Tariku J, Teshale S, Ashena F and Takele B.

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