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Review

Organic Foods and Public Health Importance: A Review

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ABSTRACT

Organic livestock farming is a useful strategy to overcome the challenges of the agricultural sector like sustainability, food security, and food safety while matching with a high status of animal welfare, care for the environment, restricted use of medical drugs, growth promoters, synthetic fertilizer and the production of healthy food products without drug residues. Furthermore, organic livestock farming could also be an interesting strategy for the eternal rural development issue and solution for the farms' decreasing profitability. The regulation of organic animal production is comprehensive and affected by different aspects such as feeding, housing, breeding, health care, and medical treatment. In contrast to conventional production systems, animals under organic livestock production are allowed a larger housing area, have obligatory straw bedding, fed organic feed, and roughage. The animal feed is a strong determinant of the fatty acid composition of the milk, egg or meat. In relation to animal health and welfare, the application of breed selection, good management, nutrition, and husbandry plays a greater role in disease prevention and good animal welfare. Now-a-days, antimicrobial resistance is a global public health issue and a threat to the modern health care system which is recognized by many international health organizations. Accordingly, over the last few years, the demand for organic products and availability in the market has been increased and made significant development in the economy. Several people have started to consider organic food instead of conventional food because it is healthier and less prone to the impact of chemical residues. Consequently, awareness creation and encouraging the importance of organic products for customers is important for the development of organic production.

Keywords

Conventional production; Organic market; Organic production; Public health.

INTRODUCTION

Organic agriculture is a farming system which had been followed by farmers from ancient times, and free from the use of synthetic fertilizers, pesticides, growth regulators and livestock feed additives. According to Food and Agriculture Organization (FAO)/World Health Organization (WHO) Codex Alimentarius Commission (CAC), it is an integrated production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity.^{1,2}

Organic farming can be distinguished from conventional agriculture by exercising particular respect for human values, the environment, nature, and animal welfare, etc. The basic principles of organic farming, as formulated by the International Federation of Organic Agriculture Movements (IFOAM) need to be incorpo-

rated. The processing of organic food aims to maintain nutritional value and limit the number and quantity of additives and processing aids in food products.^{3,5}

A risk to human health from antibiotic resistance developing in micro-organisms is one of the major public health threats that will be faced in the 21st century. In spite of these concerns, antibiotics are still used widely by non-organic livestock farmers as growth promoters or for disease suppression by routinely adding them to feed and water. The routine uses of antibiotics to curb disease outbreaks or promote growth are prohibited in organic standards. Instead, disease outbreaks are minimized by the avoidance of dense stocking levels or intensive housing and the promotion of positive animal health through good husbandry and free-range conditions. The veterinary use of antibiotics has been minimized and strictly controlled, and withdrawal periods after administration

of a veterinary drug are stricter than those recommended in order to prevent detectable residues in meat or milk.^{6,7}

Pesticide residues have been, known to exert carcinogenic, genotoxic, neuro-destructive, endocrine and allergenic effects and found usually in higher contents in conventionally produced foods. There is scientific evidence that dietary exposure of children to organophosphorus pesticides, measured on the basis of the level of pesticide metabolites in urine samples, is much lower on organic than on conventional diet.^{8,9}

Now-a-days, antimicrobial resistance (AMR) is a great concern to the world. The consequences of antimicrobial resistance include the failure to successfully treat infections, leading to increased mortality; more severe or prolonged illness; production losses; and reduced livelihoods and food security. The indirect impacts of AMR include higher costs for treatment and health care. The health consequences and economic costs of AMR are estimated at 10 million human fatalities annually and a 2 to 3.5% decrease in global gross domestic product (GDP) or United States Dollar (USD) 100 trillion, by 2050. But the true cost of AMR is hard to predict.^{10,11}

Antimicrobial use in animals for growth promotion, prophylaxis, and metaphylaxis (i.e. medicating mixed groups of healthy and infected animals in order to control outbreaks of disease) has been substantially reduced in high-income countries in recent years, however, livestock antimicrobial use will continue to increase in low- and middle-income countries (LMIC) during the next decades due to the growing demand in LMICs for animal protein that it is contributing to increasing antibiotic resistance in pathogenic bacteria.^{12,13}

There is strong evidence that poultry and livestock that consume animal feeds and pastures grown using organic methods produce meat, milk, and eggs that has modestly higher levels of protein, more of some vitamins and minerals, and elevated levels of heart-healthy n-3 fatty acids and conjugated linoleic acid (CLA).^{3,14}

ORGANIC FARMING

Organic farming and sustainable agriculture are synonymous because they both depend on the sustainability of agro-ecological systems. Sustainability can be defined as meeting the need of the present without compromising the ability of future generations.^{15,16}

Organic farming consumes less energy and at the present, when the world is focused on the energy crisis, organic agriculture achieves lower energy consumption rates because, it does not apply fertilizers and pesticides, whose production requires high energy inputs. In addition, high energy lead to large emissions of greenhouse gases and conventional farming is a very large emission source of them. Therefore, organic plant production significantly contributes to reducing greenhouse gas emissions. Furthermore, conventional agriculture leads to eutrophication and pollution of water resources by the use of pesticides.^{7,17} Body fluids i.e. urine

and blood of children on conventional diet contained six times more pesticide residues than children on an organic diet.^{18,19}

Animal Management

The standards for organic livestock farming offer a good framework for animal health and welfare management. In these fields, it is still necessary to solve certain grey areas among the organic farming objectives. Animals feed grown organically showed better for growth and reproduction than animal feed grown conventionally.^{4,20} The main advantage of organic food production is the restricted use of synthetic pesticides which leads to low residue levels in foods and thus lower pesticide exposure for consumers. It also reduces the occupational exposure of farmworkers to pesticides.^{3,21}

Feeding: Organic livestock husbandry requires that a large fraction of the feed should be locally produced. While soy, palm kernel cake, cereals, and maize silage are substantial feed fractions in many conventional livestock systems, they are less used ingredients in organic systems. On the other hand, grass-clover hay and other roughage make up a larger portion of the feed-in organic than in conventional systems. There is a well-established link between the fatty acid composition of the feed, and the fatty acid composition in the product (meat, milk, eggs). Outstandingly, soy, palm kernel cereals, and maize have a low content of omega-3 fatty acids, while grass and red clover are rich sources of omega-3 fatty acids.^{8,22}

Nutrition affects the immune status of animals and humans. Accordingly, nutrients play a great role in optimum immune response. However, deficient and excessive intakes can have negative consequences for the immune status and the susceptibility to a variety of pathogens.^{15,23,24}

Housing: The housing conditions and the access to straw bedding used in organic animal farming might lead to the conclusion that the animals would be less stressed than conventionally kept animals; therefore, stress affects the immune response of both humans and animals.²⁵⁻²⁷

Breeding: In organic livestock production, the principle for disease prevention is preferably based on the selection of the appropriate breeds or strains of animals. There are a number of breeding strategies for improved disease resistance in organic livestock production. These include (1) the recording of disease incidence in the progeny and the selection of parents that produce progeny with the lowest incidences, (2) the use of breeds possessing certain major histocompatibility-complex antigens known to be associated with resistance to certain infections, and (3) the identification of a set or combination of immune parameters crucial for resistance to infections and using parameters with high heritability in breeding programs.²⁸⁻³⁰

Health care: Organic livestock production requires producers to establish preventive health care practices. These practices include: selecting the appropriate type and species of livestock, providing adequate feed, creating an appropriate environment that minimizes

stress, disease, and parasites, administering vaccines and veterinary biologics. Besides, the animal husbandry practices should promote animal well-being in a manner that minimizes pain and stress. Producers cannot provide preventive antibiotics rather they are encouraged to treat animals with appropriate protocols, including antibiotics and other conventional medicines when needed, but these treated animals cannot be sold or labeled as organic. Producers cannot administer hormones or other drugs for growth promotion.^{29,31-33}

Quality of Organic Animal Food

Under organic farms, consumers expect quality organic products including milk, meat, eggs, leather products to come from farms. Besides, farms that are verified and meet rigorous standards have the mandate to use organic feed, prohibit the use of prophylactic antibiotics (except in medical emergencies) and give animals access to the outdoors, fresh air and sunlight. Production methods are based on criteria that meet all health regulations, work in harmony with the environment, build biological diversity and foster healthy soil and growing conditions. Animals are marketed as having been raised without the use of persistent toxic pesticides and antibiotics.^{3,29,34}

Comparison between Organic and Conventional Animal Food Products

Food products that are produced under organic farming are more nutritious and safer than conventional foods. Even though some studies indicated that organic foods have lower pesticide residues compared to conventional foods, they cannot be defined as pesticide-free.^{3,24,35}

Organic farming uses more ‘natural’ methods and differs from conventional farming in a number of ways although the difference in the actual practices of both cultivation systems can vary substantially between different countries/regions. In conventional plant production, inorganic fertilizers (NPK) are used to increase the yield, and pesticides, insecticides, herbicides, and fungicides are used for pest and weed control. Organic farming use growing intercrops or cover crops, use organic wastes and compost, crop rotation and biofertilizers to keep and build good soil structure and fertility to supply nutrients the plant.^{36,37}

Organic foods of animal origin are derived from animals fed on 100% organic food for at least 12-months. The use of antibiotics, synthetic growth promoters, genetically engineered vaccines is prohibited.^{13,38}

Currently, most research focus on compositional differences of organic and conventional animal-based foods is on the fatty acid composition, with a major interest in omega-3 fatty acids due to their importance for human health.³⁹ Some studies also address the content of minerals and vitamins in organic and conventional livestock products. The fatty acid composition of the milk, egg or meat is mainly determined by the fatty acid composition of

the feed. Roughage feeds especially grass and red clover, contain between 30% and 50% omega-3 fatty acid of total fatty acid, while the concentrate feeds such as cereals, soy, corn, and palm kernel cake have less than 10% omega-3 fatty acid of total fatty acid.^{5,40}

Milk: Milk is one of the most important nutritional sources, especially in the nutrition of children. It is reported that the composition of organic milk compared to conventional milk from high input systems can be very different, especially while comparing the antioxidant and the fatty acid profile. Organic milk has a higher content of CLA, n-3 fatty acids and a better n-6/n-3 fatty acids ratio.⁴¹ Factors for beneficial milk fatty acids composition are outdoor grazing, high biodiversity in pastures, low-levels of concentrates and no silage feeding (except red clover).^{1,42,43}

Meat: Meat (beef, pork, and lamb) from the organically raised animals are generally characterized by a lower content of total fat. At the same time, organic pork and lamb were found to present higher intramuscular fat content⁴⁴⁻⁴⁶ and it contains usually more unsaturated and less saturated fatty acids. Moreover, the n-6/n-3 fatty acid ratio in organic beef was reported to be much lower comparing to the conventional beef, higher weight of breast and thigh muscles in poultry carcasses.^{18,28}

In most cases, organic meat has also better nutritional quality than conventional meat. Organic lamb was found to present better eating quality than conventional lamb in terms of juiciness (attributed to the higher intramuscular fat content) and flavor (attributed to the higher level of linolenic acid and total n-3 fatty acids). Meat derived from organic farming perform desirable nutritional properties, such as favorable ratios of fatty acids. Since it has the lower content of saturated and monounsaturated fatty acids, higher content of polyunsaturated fatty acids and a lower ratio of n-6 fatty acids to n-3 fatty acids (Table 1).⁴⁷

Table 1. Differences between Organic and Conventionally Produced Meat Food Products, Country and Nutritional, Sensory, and Technological Aspects

Food Products	Country	Nutritional, Sensory and Technological Aspects
Pig	Korea	Organically reared pigs had higher myoglobin content compared with those for conventionally the reared pigs
Suckling lamb	United Kingdom	The appearance of the organic raw meat was more fibrous, darker, and with a lower aroma intensity than the conventional one. In grilled meat, the organic samples had less subcutaneous fat, less fibrous texture, less aroma intensity, but also less juiciness than the conventional one
Chickens	Midwest	Organically raised chickens had less yellow appearance for breast, thigh, and skin pieces when compared with conventional carcass components
Source: ⁴³		

Egg: Organic egg has higher omega-3 fatty acid content and a lower omega-6/omega-3, especially when pasture was widely available. Hens were kept indoors in a standard housing system (“control”), with access to 4 m² of pasture per hen (“organic”), in line with current requirements for organic laying hens, or with access to 10 m² of pasture.⁴⁸ Organic eggs are lighter, less pigmented, with a

lower yolk/albumen ratio but also more fragile than conventional eggs. However, the number of studies concerning eggs is limited (Table 2).^{24,38}

husbandry that producers and other stakeholders need to take into account are the origins of livestock, livestock feed, living conditions, waste management, health care, record keeping.^{3,5,33}

Table 2. Differences between Organic and Conventionally Produced Eggs Food Products Country Nutritional, Sensory and Technological Aspect

Food Products	Country	Nutritional, Sensory and Technological Aspects
Egg	Italy	Organic eggs are significantly lighter; it was found a lower yolk/albumen ratio, lower eggshell breaking strength in organic eggs than in conventional eggs. It was also observed a lower pigmentation on of organic yolk
Egg	Netherland	Lower eggshell breaking strength in organic eggs

Source: Breithaupt et al²⁶

The regulation of organic animal production is comprehensive and influences aspects of feeding, housing, demarcation, care, medical treatment, and slaughter. An European Union (EU) regulation on organic animal husbandry was released in 1999 (1804/99), different aspects of which are expected to directly affect the composition of organic animal products. This regulation provides for access to outdoor areas with a lower stocking density and restrictions on animal feeds: compulsory use of roughage feeds, ban on antibiotics, growth promoters and additive, ban on genetically modified organisms (GMOs) plus prohibit on meat and bone meal.^{21,38}

PUBLIC HEALTH IMPORTANCE OF ORGANIC FOOD PRODUCT

Most human studies reported mother-and-child have positive associations between organic vegetable and dairy consumption due to reduce risks of pre-eclampsia in mothers, hypospadias in baby boys and eczema in infants.^{18,31,49}

The human studies that have directly investigated the effects of organic food on human health have so far yielded some observations, including indications of a lower risk of childhood allergies, adult overweight/obesity and reduce Hodgkin lymphoma (but not for total cancer) in consumers of organic food.^{5,50}

Organic food consumption results in higher dietary intakes of a range of nutritionally desirable compounds such as antioxidants, certain vitamins, and omega-3 fatty acids, but lower intakes of nutritionally undesirable pesticides, cadmium, and saturated fatty acids, so organic foods are safer for human consumption (Table 3).^{7,32,51}

Access to outdoor area: Usually, zoonotic diseases can be transmitted from animals to human beings through the consumption of food, but in conventional agriculture, attempts have been made to control zoonosis through the use of hygiene barriers. Knowledge about the influence of different production systems on the occurrence and distribution of microbes in foods still very limited. However, in comparison with conventional farming practice, in outdoor organic animal production systems, the density of livestock per hectare is relatively low. This may decrease the pressure of infection and help to neutralize the risk of zoonosis.^{32,52,53}

Conventional production is typically aiming for high production levels with restricted input resources such as space, feed, etc., and these conditions may cause stress in the individual animal as it is unable to cope with the situation, e.g. in pig production. This means that higher stocking density, restricted space, and barren environment are factors increasing the risk of the development of diseases, and therefore it is more likely that animals under these conditions need antibiotic treatments.⁴³ Organic production aims for less intensive animal production, which generally means that the animals have access to a more spacious and enriched environment, access to an outdoor range and restricted group sizes, and other preconditions.^{3,25}

Table 3. Definition of Food Safety, Including Aspects of Both Product Safety and Agri-food-system Safety

Food Products	
Product Safety	Agri-food-system safety
<ul style="list-style-type: none"> • Safety, non-toxicity of the food • Safety, nutritious food • Safety of the declaration (all components of the food are shown on a declaration) • Safety of the label (the organic food is truly organic) 	<ul style="list-style-type: none"> • Safety of supply • Safety of distribution • Safety of transparency and proximity • Safety of consumer influence on food production • Safety of information on the whole food production process (e.g. by using label) • Safety, no negative impacts of production practices on humans and other living organisms, the environment, climate, etc.

Source: ^{1,18}

Compensatory use of roughage: In organic production systems, feed composition has a great role in reducing the incidence of zoonosis as compared to the conventional production system. Accordingly, in organic farms due to the higher content of grass in animal diets, a significantly higher content of conjugated linolic acid has been observed as compared to conventional milk. A higher content of conjugated linolic acid in organic milk could have positive consequences for health, because it may help to control the onset of cancer and arteriosclerosis. Feed composition can reduce the incidence of zoonosis in organic as compared to conventional production systems (Table 4), the compulsory use of roughages in organic systems reducing the occurrence of harmful intestinal bacteria.^{15,19,24}

Effect of Regulation of Animal Product

Principles of organic animal husbandry at all times require a thorough analysis of the problems and opportunities involved and existing local knowledge. Some key considerations in organic animal

Restrict the use of medicine: National Organic Standards (NOS) prohibit the use of any antibiotics in livestock production. Numerous studies have demonstrated that the benefits of organic produc-

Table 4. Effect of Regulation on Product Safety in Organic Animal Production Compared to Conventional Farming

Product Safety in Organic Products				
Compound or Organism	Potential Effects on Human Health	Driving Force State	Concentration of Compound Organism	Impact on Human Health
Conjugated linolic acid (CLA) in milk	Preventive against cancer and arteriosclerosis	More grass fodder	Higher than in conventional product	Positive
Salmonella, Campylobacter	Infections	Extended use of out-doors areas. Compulsory use of roughages	Lower/higher than in conventional product	Both positive and negative
Medicine residues	Transfer of resistance genes from animals to human pathogens	Restricted use of medicine, double retention time	Possibly lower than in conventional product	Positive

Source:⁵²

tion in protecting human health, directly reducing consumer exposure to antibiotic-resistant bacteria *via* contact and consumption of animal products. According to different investigations on retail meat products, organic chicken, turkey, pork, beef, and even eggs are much less likely to be contaminated with antibiotic-resistant bacteria than conventional meat products.^{13,31,54}

Pesticides that may contaminate feeds are potentially toxic to farm livestock, and this is even more worrying if the animal products are intended for human consumption.^{37,55} The restricted use of antibiotics could have a positive effect on health by reducing the risk for transfer of resistance genes from animals to human pathogens.⁵⁶ The growth-promoting, prophylactic and routine use of antibiotics in agriculture is of mounting concern to governments and the medical profession, and there is growing evidence that it is contributing to increasing antibiotic resistance in pathogenic bacteria. Antibiotics in animal feed are currently under review in the EU and several of those used as growth promoters are already banned.^{37,57,58}

Antimicrobial Resistance

Antimicrobial resistance is increasingly recognized by many international health organizations as a global public health issue and a threat to the modern health care system that could hamper the control of many infectious diseases and dramatically set back the modern medicine.¹² The growing worldwide phenomenon of AMR is generally associated with the “selective pressure” caused by the improper use, overuse, or misuse of antimicrobials in humans and animals. Infections by antibiotic-resistant strains are associated with a reduced quality of life, with metastatic bacterial infections, an increase in recurrence rates, chronicity, and future opportunistic infections with resistant organisms.⁵⁹

Antimicrobial resistance can lead to increased costs and the destabilization of health systems. Patients suffering from antimicrobial resistance nosocomial infections (mainly bloodstream infections) or who become sick due to the consumption of food contaminated by resistant pathogens experience longer recovery and a higher frequency of septicemic infections and mortality. In this situation, health care costs are higher, due to extended hospital stays and the use of more expensive drugs. Moreover, there are higher risks of toxicity associated with new drugs, as well as a greater frequency of adverse drug reactions (ADRs) and collateral

events.^{60,61}

Organic Food Consumers

Consumers’ perceptions of naturalness are important for the acceptance of foods and food technologies. Thus, several studies have examined the significance of naturalness among consumers. Nonetheless, the aspects that are considered essential in perceiving a food item as natural may vary across consumers and different stakeholder groups.⁶² Assessed consumer perceptions towards organic food and found that food safety, human health and environmental concern along with sensory attributes such as nutritive value, taste, freshness and appearance influence organic food consumer preferences.⁶³

Consumers’ perceptions regarding the quality of organic food consumption are influenced by different factors, such as freshness, food safety, price, environment-friendly, nutrition, and sensory attributes. Thus, food consumption patterns are ever-changing as a result of health and environmental issues.¹⁹ They prefer to buy organic food products because of their perception that organic food products are healthy and safe, nutritious and environment-friendly. Currently, organic food consumers seem to pay more attention to “hedonistic” motives for purchasing of organic food, such as health, taste and wellness, rather than to “altruistic” purchasing motives, such as environmental protection and animal welfare; this confirms the role played by sensory attributes in orienting food choices.^{7,44}

Consumers are very aware that organic food is good for health, these products are free from chemical which resulting in no side effects and do not cause harm to the consumers. The consumers living in urban areas are more aware of organic food products. Consumer believes that consumption of organic food helps to reduce stress level and maintain an energetic lifestyle. Another factor this study found that respondents are willing to pay even higher prices because it is beneficial for health.^{17,32,53}

Global Organic Market

In the last few years, the organic product production and availability in the market has been increased and made a significant development in the economy. Several people have started to consider organic food instead of conventional food because it is healthier

and less/no chemicals. This kind of purchasing behavior plays an important role in the consumer attitude and perception aspect of buying organic food products.⁵⁷ The approach for buying organic food is mainly influenced by gender, age, income, level of education and the presence of children in the household identified the main reasons for organic food consumption among consumers. The main reasons are concerns about health and nutrition, more delicious taste, care for the environment, food safety, lack of trust in conventional food, care for animal welfare, support the local economy, freshness, curiosity or because they are considered trendy.^{15,32,53}

Challenges in Organic Animal Food Production

Most serious problems are still restricting growth in organic farming. Some of these potential obstacles, especially when exporting livestock products, are as follows: small-sized land holdings, low-level of literacy, lack of information about organic production practices, high stocking density, inadequate production of feeds and fodders, high cost of certification.^{45,63} It is difficult to provide a large locomotion area, cost of production of organic meat is very high (in case of pork, 85.2% high), organic milk and meat production may further decrease the availability of milk and meat, processing or preservation of meat and meat products is difficult without use of certain chemicals like tri-sodium phosphate, sodium nitrate, etc.²⁹

CONCLUSION

Organic agriculture is one of the farming system which had been practiced by farmers from prehistoric times, and free from the use of synthetic fertilizers, pesticides, growth regulators and livestock feed additives rather used animal originated products. The application of organic farming has a great role in public health since it reduces the risk of childhood allergies, adult overweight/obesity, and the development of some cancers in consumers. In general, many people turn their face to purchase organic food products rather than conventional food because it has health important and less chemical residue. Even though organic farming has a great role in human health and biodiversity safety, but still so many constraints which obstacle its development stage like lack of awareness, inadequate production of feedstuff, lack of enough land, lack of information about its practice, high cost of production, etc. In conclusion, private and governmental organic farm owners need to be trained, encouraged and supported on how to practice and manage the organic farming system. The government and associated institutions should be creating awareness and encourage the importance of organic products for customers through scientifically explored research.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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Case Report

Caesarean Operation in Cow due to Prolonged Pregnancy

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ABSTRACT

Prolonged pregnancy is defined as a pregnancy that lasts for more than 294-days compared with term gestation which is between 260 and 293-days. This case report was prepared with the aim of describing and documenting the surgical procedures, techniques of cesarean section and its outcome on eight-years-old crossbred cow that was referred to the veterinary hospital, Mekelle University from a field; Edaga Hamus Veterinary Clinic. According to the owner's history, the cow was presented to the clinic with an extended gestational period over 345-days than anticipated according to their own record. Thus, based on the history and clinical findings, the case was diagnosed as prolonged pregnancy. After aseptic preparation of the surgical site, stabilizing the animal and locally desensitizing the incision area; a vertical skin incision with a distance of approximately (~40 cm wide) on the left flank region approximately (~10 cm) below the lumbar transverse process. After the incision of the abdominal muscles and uterus, the non-viable and abnormally oversized calf was taken out with the help of an assistant. Moreover, the uterus was filled with excess and abnormal dark brown colored blood and was properly drained, washed with sterile isotonic saline solution. The uterus was closed using a double layer of Utrecht suturing pattern whereas the peritoneum and abdominal muscles were separately closed with a continuous lockstitch pattern and simple interrupted pattern using 2-0 size sterile absorbable polyglycolic acid, respectively. After that, the skin was closed using silk 2-0 size in a horizontal interrupted mattress. Lastly, with proper antibiotic follow-up, dressing and cleaning of the surgical site, the cow was successfully recovered after two months.

Keywords

Dairy cow; Caesarean section; Prolonged pregnancy.

INTRODUCTION

In cattle, the duration of pregnancy is affected by factors like the breed of the cow and bull, calf sex, single or multiple birth, the parity of the cow, the fetal genotype and environmental factors (nutrition, ambient temperature, and the season of the year). Among these factors, the breed of cattle has the greatest impact on gestation length. As compared to the *Bos taurus* species where mean gestation length varies between 279-days in *Holstein-Friesian* to 287-days in *Charolais*, the gestation length is slightly longer in breeds of the *Bos indicus* species (*Zebu* cattle have a mean gestation length of 296-days). Within breeds, individual bulls may sire calves with longer gestation length than normal, leading to a higher incidence of dystocia.¹⁻³

Furthermore, prolonged gestation in an animal can be diagnosed due to poor record, misdiagnose of pregnancy, and miscalculation of the prospective calving date.⁴ True prolonged gesta-

tion is relatively uncommon; the common denominator is a defective hypothalamic-pituitary-adrenal axis. Suspected cases should be investigated and examined with care. Accordingly, in some cases, the dead or severely deformed fetus is often of little economic value. The life of the dam may be at risk of prolonged gestation is allowed to continue, and termination of the abnormal pregnancy is recommended.^{4,6}

Prolonged pregnancy in dairy cattle has been described previously as an unfrequented event in pregnancy. It commonly results from fetal anomalies and requires differentiation from fetal loss or fetal mummification because in both scenarios affected cattle fail to show signs of impending parturition at their due date. Mostly, the cause of prolonged gestation cases involves the abnormalities in the fetal pituitary gland and the fetal pituitary-adrenal axis.^{4,7,8}

According to different studies, the condition was report-

ed in *Holsteins* and *Brown Swiss* cattle that is thought to represent a recessive trait. During prolonged gestation, most dams appear normal without showing signs of udder edema or pelvic laxity at the predicted calving date. Gestation may be prolonged 1 to 3 months or more. Rectal palpation of the cow reveals a large fetus. Besides, errors in breeding dates or records must be ruled out before confirming the condition. Spontaneous parturition seldom occurs in true prolonged gestation unless the fetus dies in utero. If the fetus is born alive, it will be non-viable and most calves with this condition die shortly before, during, or within 48-hours of birth.^{5,9,10}

In addition, prolonged gestation in dairy cattle can occur due to fetal anomalies and should be differentially diagnosed from dead or mummified fetus since it fails to show signs of parturition at their prospected calving date. Besides adrenal abnormalities, calves produced by cloning, *in vitro* fertilization, and embryo transfer as part of the “large newborn calf” syndrome are also the cause of prolonged gestation. It also is possible that adeno-hypophyseal and pituitary abnormalities coexist or contribute to adrenal insufficiency in such fetuses.^{3,6,11}

Caesarian section, also called laparohysterotomy, means the extraction of the fetus or foeti from the mother animal, through a surgical opening in the abdominal wall and the uterus. It is commonly indicated in cases of dystocia when a calf cannot be delivered by normal parturition cascade. There are different available surgical approaches for bovine caesarean section: the standing left paralumbar celiotomy, standing right paralumbar celiotomy, recumbent left paralumbar celiotomy, recumbent right paralumbar celiotomy, recumbent ventral midline celiotomy, recumbent ventral paramedian celiotomy, and the standing left oblique celiotomy. Each has its own advantages and disadvantages. The selection of an appropriate approach depends on the type of dystocia, the health status of the cow, the environmental conditions, the availability of assistance, and the surgeon's preference. The indications for performing a caesarean section include maternal and fetal factors. Maternal indicators include immature heifers, pelvic deformities, failure of cervical dilation, uncorrectable uterine torsion, uterine tear, hydrops, a long gestation period, and prepartum paralysis.^{12,13} The current case report is prepared with the aim of describing the surgical management of caesarean section in dairy cow due to prolonged pregnancy with no sign of parturition is described.

FIELD CASE REPORT

Case History and Clinical Examination

Eight-years-old healthy *Holstein Friesian* cross-bred dairy cow with a good body condition was presented to the Edaga Hamus Veterinary Clinic before a week and the case was referred to the Veterinary Hospital, College of Veterinary Science (CVS), Mekelle University (MU), Ethiopia. In the former veterinary clinic, the cow was diagnosed for prolonged pregnancy that takes about 321-days and there was also no sign of labor and parturition. The owner also told as a proper record at the time of insemination and proposed dated of parturition was taken and recorded. Besides, the cow has a history of three parity and any abnormal as well as disease con-

dition was recorded during the gestational period. Then, the veterinarian referred the case immediately to the Veterinary Hospital, CVS, MU. A detailed clinical examination was performed by taking all the necessary parameters. Further close examination of vital organ parameters such as heart rate, respiratory rate, pulse rate, and mucous membrane was made and found within the physiological limits. In addition, upon rectal examination, most organs and structures of the fetus were palpated, but there was no response from the fetus. Accordingly, based on the history and clinical observation, the case was diagnosed as prolonged pregnancy and the team decided to be managed the case surgically by caesarean section.

Pre-operative Preparation of Surgical Site of the Cow

The cow was restrained adequately and the skin surface on the left paralumbar fossa was prepared aseptically by washing with water, soap and Salvon® (Cetrimide 3% and Chlorhexidine gluconate 0.5% solution). Then the hair was first clipped with sharp scissor and shaved with a razor blade and cleaned thoroughly with a standard solution of Salvon®. Finally, the area was scrubbed three times with tincture iodine 2% solution to decrease the microbial load in the area and left dried till readying for caesarean section.

Animal Handling and Anesthetic Protocol

The cow was properly restrained with the combination of physical and chemical methods. Upon the physical restraining technique, the cow was handled with rope-assisted by personnel and fixed at one place against a well-built wood to adequately restrain the cow in standing position (Figure 1A). In the chemical restraining technique, the cow was first sedated with Domidine® (Detomidine hydrochloride, manufactured by Dechra Veterinary Products Ltd., United Kingdom) with a dose of 20 µg/kg intravenously. In addition, regional anesthesia of the left flank area was done using two percent lidocaine (Lidocaine hydrochloride 2%, Vedco Inc. Saint Joseph Missouri, USA) to desensitize the abdominal muscle and alleviate pain during surgical procedure (Figure 1B). This was done by loading the lidocaine in a syringe with 18 gauge, 10 cm needle, 5 ml per each paravertebral space. The needle was inserted halfway between the intervertebral transverse process and the needle is slightly angled to reach and deposit the lidocaine in the sub-arachnoid space. Finally, two linear infiltrations were made in the pattern of inverted ‘T’ using local anesthetic lidocaine (60 ml) to desensitize and put in sufficient analgesia enclosing the site of incision and waited for 10-minutes (Figure 1C).

Surgical Correction and Treatment

Following proper physical and chemical restraining and aseptic preparation of the surgical site (left flank), the cow was kept on appropriate direction for the next surgical procedure. A sharp vertical skin incision with a distance of approximately (~40 cm long) was made on the left flank region approximately (~10 cm) below the lumbar transverse process (Figure 1D). After blunt dissection of the skin from the subcutaneous tissue, the incision was continued through the external and internal abdominal oblique, transverse abdominal muscle and peritoneum. Then all muscular layers to-

gether with skin were grasped with handheld retractor to get sufficient surgical field and exposure to the uterus. Upon insertion of a finger, slight adhesion of uterus with the lower abdominal wall was found and it was gently detached and the uterus was retracted from its right position to the left one.

forceps and topical infiltration of epinephrine on bleeding site depending on the site and condition.

Later, uterus was closed using a double layer of Utrecht suturing pattern with 1-0 size sterile absorbable polyglycolic acid (Shandong Sinorgmed Int'l Co., Ltd, China). The uterus and surrounding area were rinsed copiously with sterile isotonic saline solution and replaced in the abdomen to its normal position. Some fluid that leaks to the peritoneum was also sucked with sterile sponge and gauze. After proper abdominal lavage, the peritoneal incision was closed with a continuous lockstitch pattern using 2-0 size sterile absorbable polyglycolic acid (Figure 1E). Besides, all three abdominal muscular layer were separately closed with simple interrupted pattern using 2-0 size sterile absorbable polyglycolic acid. Later, the skin was closed using silk 2-0 size in a horizontal interrupted mattress. Lastly, the area was properly cleaned and dressed with a 2% tincture iodine solution and admitted home (Figure 1G).

Post-Operative Follow-Up and Result

Intermittent bleeding was noticed following skin suture but it is normal and helps to clean the wound unless continued for a long period. The dressing of the wound was done at second and third days post-operative up to 14-days until it completely healed. Besides, Ceftriaxone (Dose-500 mg/kg) Parkinson Pharma, India) was also administered Intravenously (IV) for five days post-operation at the farmers' farm. Tetracycline wound spray was also applied around the wound.

The owner was also advised to closely monitor the cow and avoid leaving the cow on the grass but advised to allow some exercise and supplied with good nutrition to facilitate wound healing. After 20-day post-operation, the wound was healed completely and after two months of follow-up, the cow was under good health status.

DISCUSSION AND CONCLUSION

Prolonged pregnancy in cattle is frequently associated with various congenital anomalies which classically include hypophyseal aplasia. Adenohypophyseal aplasia has been reported in various dairy breeds as a cause of prolonged gestation. The genetic component of the defect has been confirmed in Jersey and Guernsey breeds but not in Holstein. Definitive diagnosis of prolonged pregnancy is difficult since possible error of insemination date is almost impossible to eliminate. Pre-mature fetal death with fluid resorption by the dam is also another possible misdiagnosis. Therefore, assessment of the fetus and its annexes is valuable to determine fetal health and macroscopic anomalies.^{7,14,15} This is in agreement with the current case report regarding the assessment of the case.

Most surgeons use a standing left paramedian celiotomy to perform caesarean sections in the cow. In most cases, the left oblique approach is preferable because of less peritoneal cavity contamination and with less interference of intestinal content during the exteriorization of the uterus. Alternative approaches are



After the position and condition of the calf was determined, gently incision approximately (~40 cm) was made on the uterus. Then, the calf was taken out with the help of an assistant after proper stabilization of the uterus. However, the calf was non-viable and abnormally oversized (approximately 85 kgs) than anticipated under normal gestational conditions (Figure 1F). Additionally, the uterus was filled with excess and abnormal dark brown colored blood and was properly drained and removed together with the placenta from the uterus. Then, the uterus was washed and cleaned with sterile isotonic saline solution before suturing. In addition, bleeding during the procedure was managed by applying sterile gauze, using different straight and curved hemostatic

available that will further limit the potential for contamination. Practitioners are encouraged to consider alternative approaches for certain conditions.^{13,16} This is in agreement with the surgical approach used in this case report.

The main goals of the caesarean section are preservation of the cow and calf and the future reproductive efficiency of the cow. A number of variables may affect the successful outcome of this procedure; case selection is the most important and often overlooked variable. In addition, patient and surgeon preparation, surgical technique, calf viability at the time of surgery, and exteriorizing the uterus can affect outcomes. Moreover, a good surgical technique such as gentle tissue handling, selection of appropriate suture materials and patterns, and adequate in-folding of the uterine incision to prevent leakage, combined with antibiotics and anti-inflammatory medication when indicated, can help to minimize detrimental adhesions that may adversely affect the future reproductive efficiency of the cow.^{12,16} This agrees with the current case management in terms of surgical management.

According to different research outputs, 14.8% of cows becoming recumbent intra-operatively during caesarean section. It is believed that cows are more likely to become recumbent during attempts to exteriorize the uterus, because of the pain that arises from traction on the broad ligament during difficult uterine manipulations. Cows that remain standing during the procedure have a better chance of survival, with reports of 91-94% cow survival rate and a 95-100% calf survival rate. In the author's experience, cows that fall down intra-operatively were more likely to develop peritonitis and experienced greater post-operative mortality compared with cows that remained standing during the surgery.^{13,17,18} This report agrees with the current case report in terms of the occurrence of intra-operative recumbency and post-surgical survival rate.

Furthermore, antibiotics are indicated post-operatively when the calf is dead when there is a prolonged dystocia when there is a compromised uterus, when extensive obstetric manipulations occurred pre-operatively, and when abdominal contamination has occurred. Besides, the use, type, and frequency of antibiotics vary depending on the case. The most commonly used antibiotics are penicillin G procaine 22,000 IU/kg intramuscularly every 24-hours for 3-5 days), oxytetracycline (19.8 mg/kg intravenously, intramuscularly, every 1-3-days), ceftiofur (1 mg/kg intravenously, intramuscularly, every 12-24-hours for 3-5-days), and florfenicol (20 mg/kg intramuscularly every 48-hours or 40 mg/kg subcutaneously every 96-hours) has been used. In addition, the appropriate milk and meat withdrawals need to be followed.^{12,13} This statement agrees with the current post-operative case management.

According to different research findings, post-operative complications associated with paralumbar incisional infections are between 1.3% and 8.2% and dehiscence 3.8%. The occurrence of subcutaneous emphysema has been reported between 0% and 41%. Thus, differences in surgical site preparation, local anesthetic technique, incision length, difficulty in removing the calf through the incision, time of surgery, and the use, type, and duration of

post-operative antibiotics are among some of the common predisposing factor for post-surgical complication.^{12,19,20} This report is in contrast to this case report since there was no post-operative complication was reported.

In conclusion, the caesarean section using standing flank incisions requires little post-operative care and attention compared with other approaches especially ventral approaches. Cows with flank incisions often do not require stall rest that provides restricted activity and can be rebred using a bull without undue concern regarding abdominal wall herniation. In contrast, ventral approaches require strict stall rest for 6-weeks. Although these cows may be rebred using artificial insemination at 6 weeks, they should not be mounted by either their herd mates or the bull until 8-weeks after surgery, the time required to allow the ventral incisions to reach maximal holding strength.^{12,16} In this particular case report, the caesarean section using left flank celiotomy was performed under aseptic condition and alleviation of pain was done through paravertebral nerve block of T₁₃, L₁ and L₂ nerves and topical infiltration on the lidocaine on the incision site. Finally, after removing the calf, the incision site and the wound was regularly dressed and recovered after a few months. Accordingly, for early recovery and positive outcomes of the surgical procedure, the wound should always be managed and regularly monitored for the fast healing process.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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Original Research

Assessment of Welfare Problems on Working Donkeys in Hosaena District, Hadiya Zone, Southern Ethiopia

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ABSTRACT

Aim

The objective of this study was to assess the major welfare problems in working donkeys in Hosaena district, Hadiya Zone, Southern Ethiopia.

Methods and Materials

A total of 318 male and 76 female working donkeys were randomly selected using a cross-sectional study from November 2015 to April 2016.

Results

According to the current investigation, 70% of donkeys were used for draught and 30% were used for pack type of work. All females (100%) were used for packing purpose, whereas 86.8% of male donkeys were used for draught purpose. Overall, 41.6% of donkeys had a poor body condition in all age groups, whereas most donkeys (44.3%) under the age group less than 5-years were having poor conditions. Regarding wound on the skin, a higher proportion (82.2%) of back lesions were observed in pack donkeys whereas lip lesions were observed in 87.7% of draught donkeys. Besides, the welfare problem was observed in 28.9% of working donkeys due to overloading. A significant association ($p < 0.01$) was found between the duration of working hours of donkey and poor body condition. Out of the interviewed, the majority of animal owners (76.4%) had one donkey.

Conclusion

The assessment showed that working donkeys in the present study area were experiencing multiple welfare problems. Accordingly, awareness creation through mass education, training and extension service should be promoted in the study area in order to ensure better donkey welfare and productivity.

Keywords

Assessment; Ethiopia; Hosaena; Welfare of working donkey.

INTRODUCTION

Donkeys are an important farm animal species that descended from the African wild-ass (*Equus africanus asinus*) and early-domesticated equines that have been around as long as mankind.¹ Donkeys have been used principally as working animals for at least 5000-years. Donkeys are adapted to dry and mountainous conditions with limited access to water and poor quality sparse vegetation.^{2,3} The low cost of purchase and maintenance of donkeys, their relatively small size, ease of training and handling, highly

effective digestive system and their ability to withstand thirst has endeared them to small scale farmers and the poor living in peri-urban, remote and hostile environments with no infrastructure and road access.^{2,4-6}

The world donkey population is estimated to about 44 million; half is found in Asia, just over 25% in Africa and the rest mainly found in Latin America. Over 32% (approximately 6.21 million donkeys) of African donkeys are resident in Ethiopia and 10% of the world population, which makes Ethiopia harboring the larg-

est population of donkeys in Africa and the second largest donkey population in the world after China. In Ethiopia, the majority of donkeys are found in highland areas, even though they are widely distributed in all agro-ecological zones of the country widely distributed in the dry and mountainous areas.^{7,8}

The animal welfare is being compromised internationally due to several constraints such as poverty and lack of knowledge. Research conducted in Ethiopia demonstrated that improvements in the welfare of donkeys had significantly improved their work output which in turn improved livelihood situations of the poorest communities in the rural and peri-urban areas.⁹ The welfare of working donkeys in developing countries is therefore crucially important, not only for the health and survival of those animals, but also for the livelihoods of those people dependent on them.^{4,6,10}

The low-level of development of road transport, network and rough terrain of the country make donkeys the most valuable, appropriate and affordable pack animals under the smallholder farming system.^{11,12} In areas where draft power is a constraint for crop cultivation, a pair of well-conditioned donkeys could be used as alternative draft power sources for secondary and tertiary land preparation.⁴ Many activities that are performed by donkeys within the community are collecting firewood, transporting water, farm inputs and goods to markets and/or homes in the rural areas.¹³⁻¹⁵

Despite the fact that around the world, many working donkeys live and work in harsh conditions and can suffer from poor health and lack of productivity due to infectious diseases and poor management practices.^{16,17} Working donkeys are prone to painful, debilitating and often fatal tropical illnesses and conditions such as tetanus, parasitic infestation, and colic. In addition, these animals work under difficult environmental conditions including intense heat, difficult topography dehydration, malnutrition, lesions on different body part, and hoof problems. Animals are often engaged in work for long hours and when getting free, they are left to browse and feed on grass garbage. These have the potential to affect negatively their welfare and quality of life.^{10,18}

Donkeys are subjected to different welfare problems in rural and urban areas, even though they have a crucial role in day-to-day activity. Among the welfare issues of donkeys, overloading and inadequate access to feed or health care facilities are the most common problems.¹⁹⁻²¹ Moreover, they are exposed to long working hours with little rest, poor husbandry, lameness, poorly designed harnesses, severely tethered or hobbled, cruel training methods, lack of shade, lack of water, inhumane handling, heat stress, inhumane disposal when old or worn out.^{4,22,23}

Donkeys provide invaluable support for the livelihoods of communities. However, there is limited information regarding donkey welfare issues in and around the Hosaena area, Hadiya Zone, Southern Nation, Nationalities and Peoples Regional State. Little attention has been given to this animal and no study was conducted regarding the welfare issues of the donkey. So, the current study was performed with the objective to assess welfare issues and associated-risk factors affecting the welfare of working donkeys in

and around the Hosaena area, Hadiya Zone.

MATERIALS AND METHODS

Study Area

The study was conducted in Hosaena, capital of Hadiya zone in Southern Nations, Nationalities and People Regional State, Ethiopia. Hosaena is the administrative center of the Hadiya zone at a distance of 232 km away from Addis Ababa and 168 km away from Hawassa, the regional capital. It has a latitude and longitude of 7°33'N; 37°51'E, respectively with an elevation of 2177 meters above sea level. The mean annual temperature and rainfall are 16.9 °C and 1071 mm, respectively. The area exhibits a bimodal rainfall system (long and short rainy season). The long rainy season extends from June to September, whereas the short rainy season ranges from mid-February to the end of April.²⁴

Study Animals

The study animals were working donkeys kept by different peasant associations in and around Hosaena, Hadiya Zone, Southern Regional state. Besides, the study includes donkeys of both sex, different age group, and used for draughting and packing purposes that are common sources of transportation of goods, construction materials, farm products, and others.

Study Design and Sampling Technique

A cross-sectional study was conducted from November 2015 to April 2016 to identify the welfare problems of working donkeys in terms of body condition and wounds on the body in and around Hosaena. A total of 394 working donkeys were randomly selected from Hosaena district based on their accessibility, easy of logistic and donkeys population. Moreover, the sampling method was carried out at field level, market, homestead, grind mill houses, around water point areas and in some purposively selected peasant associations of the district.

During sample collection, various potential risk factors including sex, age, and body condition scores of the donkey were recorded. The age of the selected working donkeys was determined by the dentition pattern as described by Crane and Svendsen.²⁵ Body condition score (BCS) was estimated based on the guides by Svendsen.²⁶ The body condition scoring was performed by assessing the donkey from both sides and the hindquarter without touching the animals and scored as '0' for very thin; '1' for thin; '2' for fair; '3' for good; 4 for fat and 5 for very fat. Donkeys were also classified to age classes based on structural change and/or eruption/wear of incisors teeth in to <5-years classified as young, 5-10-years considered as an adult and >10-years were classified as old.²⁷ These age classes were based on age of first work, productive age and the life span of Ethiopian donkeys.^{11,26}

In addition, wounds on different parts of the skin were assessed based on the depth and location of the body regions. The lesions that fulfill the criteria were considered, identified and re-

corded. Thus, a lesion larger size than a 2×2 cm square or 1×4 cm rectangle or 2.3 cm diameter circle were considered as described by Dennison et al.¹⁷

Sample Size Determination

Perusal of different literatures and articles, there is no research work on the assessment of welfare problems in working donkeys in the Hosaena district. Hence, an expected prevalence of 50% was taken into consideration in order to determine the sample size of the study animals. Moreover, 95% confidence interval (CI) and 5% desired absolute precision was used to appreciate the significant difference. Thus, the Thrusfield formula was used to determine the sample size.²⁸

$$n = Z^2 \times P(1-P) / d^2$$

Where n=the required sample size, Z=Confidence level (regular value=1.96), P=expected prevalence (50%) and, d=desired absolute precision (0.05).

Accordingly, the calculated sample size was 384, which is the minimum sample size to be taken in the control area. Consequently, the sample size was determined to be 394 were sampled randomly for physical examination in the study area.

Method of Data Collection

Observational study: An observational study was made for direct welfare assessment of the donkeys and data were collected by direct physical examination. Prior to the assessment, consent was obtained from the animal's owners by presenting the aim of the study. Information regarding general conditions such as wound type, dermatological disease, musculoskeletal disease, other disease signs and behavior, age categories, body condition score, work type and condition of harnessing were properly recorded on data collection format.

The assessment carried out at field level, market and around the homestead in the day time. Based on the types of work animals were categorized as draught, pack, both draught and pack. "Draught" animals are those used for the transport of goods by carts. "Pack" animals are those used for transport of goods on their back (pack) and both for draught and pack.²⁷ The donkeys were allowed to stand for 5-10-minutes after being held by head halter and collar before assessment began, without causing major disturbance to donkey routine work.

Questionnaire survey: A questionnaire survey was also conducted simultaneously with observational study to indirectly assess the welfare status of the working donkeys by interviewing the donkey's owner. In addition, a semi-structured questionnaire was developed to collect relevant information on major welfare problems associated with working donkeys such as management practices (feeding, watering, health care, and housing practice), age, sex, duration of working hours, work type of the donkey population and number of donkey at household level. Besides, the knowledge and perceptions regarding donkey welfare issues in the area were obtained by

interviewing donkey owners/attendants.

Data Analysis

All data collected during the study period were entered into Microsoft Excel spreadsheets and analyzed using Stata version 13 statistical software. Descriptive statistics were made and the results of the analysis were presented through tables and figures and Chi-square (χ^2) was used to determine the association of the wound problem with hypothesized risk factors. Statistical significant differences were considered at a *p*-value of less than 0.05.

RESULTS

Observational Welfare Assessment Results

Management and working practices of donkey: During the study period a total of 394 donkeys, which comprised 80.7% male donkeys and 19.3% female donkeys, were thoroughly observed for body condition status and the presence of lesions on different parts of the body. According to the current observation, most donkeys (73.6%) between 5-10-years of age group were the best productive, whereas donkey above 10-years of age (8.6%) was the least productive. Regarding work type, donkeys less than 5 years of age group (68.6%) were mostly engaged in packing, whereas most donkeys in the age group 5-10-years (79.7%) were used for draughting. Furthermore, most donkey owners prefer male donkeys (86.8%) to draught and females (100.0%) to pack (Table 1).

Table 1. Description of Sex and Age Group of the Observed Working Donkeys within Work Type

Category	Frequency N (%)	Percentage within work type	
		Pack (%)	Draught (%)
Age group			
<5-years	70 (17.8)	68.6	31.4
5-10-years	290 (73.6)	20.3	79.7
>10-years	34 (8.6)	32.4	67.6
Sex			
Jack Ass	318 (80.7)	13.2	86.8
Jenny	76 (19.3)	100.0	0

Assessment of body condition score: According to the current body condition assessment, 54.1% of the donkeys were having medium a body condition and 42.1% and 3.8% of donkeys were having thin and fat body condition, respectively. Besides, donkeys less than 5-years (44.3%) were having poor body condition as compared to the age group of 5-10-years (42.1%). Consequently, most of the donkeys less than 5-years of age were managed under poor husbandry practice (Table 2).

On the basis of work type, a high proportion of pack donkeys showed a poor body condition (45.8%) as compared to draught animals (39.9%). Besides, 55.3% of female donkeys were having poor body scores than male ones (38.4%) since according to observation, most donkey owners preferred female donkeys for packing and trek long distances without providing proper access to

feed and water (Table 2).

Table 2. Age Group and Work Types Expressed as a Proportion within Body Condition of Working Donkeys

Variables	Frequency	Proportion of Body Condition Score		
		Poor	Good	Obese
Age group				
<5-years	70	44.3	47.1	8.6
5-10-years	290	42.1	54.1	3.8
>10-years	34	32.4	61.8	5.8
Work types				
Pack	118	45.8	49.2	5.0
Draught	276	39.9	55.4	4.7
Sex				
Jack Ass	318	38.4	57.5	4.1
Jenny	76	55.3	36.8	7.9

Health and welfare problems encountered in working donkeys:

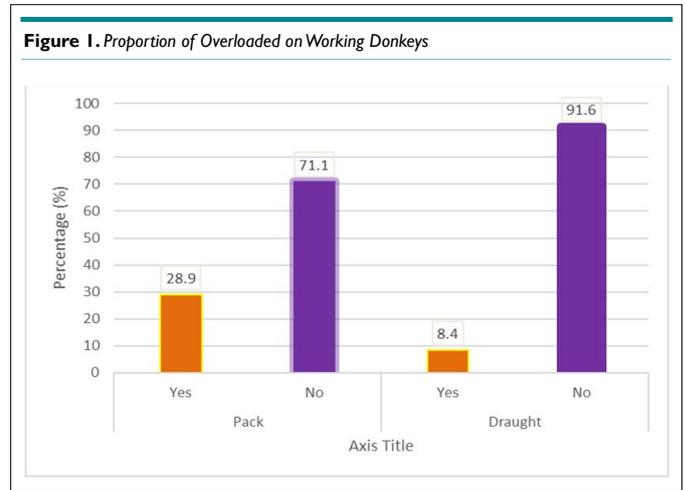
An observational welfare assessment of 394 working donkeys revealed, 48.9%, 21.1%, 13.5%, and 16.5% of the donkeys were suffering from different type of wound, dermatological problems, musculoskeletal problems, and other disease syndromes, respectively. Moreover, a higher proportion of lip (76.2%), head/neck sore (60%) and beat sore (59.3%) was observed on draught donkeys whereas a higher proportion of back (70.6%) and tail sore (55.3%) was observed on the pack donkeys (Table 3).

Table 3. The Proportion of Health Problems in Working Donkeys with their Work Type

Health Problems	Condition	Frequency	Proportion (%)		Overall (%)
			Pack	Draught	
Wound	Lip sore	21	23.8	76.2	48.9
	Head & neck sore	15	40	60	
	Back sore	38	55.3	44.7	
	Chest/Girth sore	16	43.8	56.2	
	Beat sore	27	40.7	59.3	
	Bite wound	25	52	48	
	Tail base sore	51	70.6	29.4	
Dermatological problems	Sarcoid	31	54.8	45.2	21.1
	Ectoparasite	46	45.7	54.3	
	Habronemiasis	6	66.7	33.3	
Musculoskeletal problems	Lameness	21	42.9	57.1	13.5
	Fracture	4	25	75	
	Hoof overgrowth	44	63.6	36.4	
Other disease syndromes	Metabolic disease	11	54.5	45.5	16.5
	Eye problems	26	42.3	57.7	
	Respiratory problems	12	41.7	58.3	

Assessment of workload in working donkeys: As described in the Figure 1, 114 (28.9%) of donkeys were suffered from overload-

ing. Besides, a higher 81 (29.3%) proportion of overlading was recorded on draught/cart donkeys than pack donkeys 33 (8.4%). Therefore, regardless of their work type, working donkeys were suffered from overloading in the study area.



Questionnaire Survey Results

Association of working hours and body condition: According to the current survey, there was a statistically significant association ($p < 0.01$) between the duration of working hours and body condition. The present questionnaire survey showed that 50% of the donkeys in the study area had poor body condition due to longer working hours (>8-hours). Moreover, most donkeys (54.1% and 63.4%) that were in good condition were those donkeys who spend <5 and 5-8 working hours, respectively. In addition, 43.2% of working donkeys with less than 5 working hours had an obese body condition (Table 4).

Table 4. Duration of Working Hours as Expressed as Percentages within Body Condition Score

Working Hours	Body Condition Score (%)			Chi-square (χ^2)	p-value
	Poor	Good	Obese		
<5-hours	2.7	54.1	43.2	148.26	0.00
5-8-hours	33.3	63.4	3.2		
>8-hours	50.0	50.0	0.0		

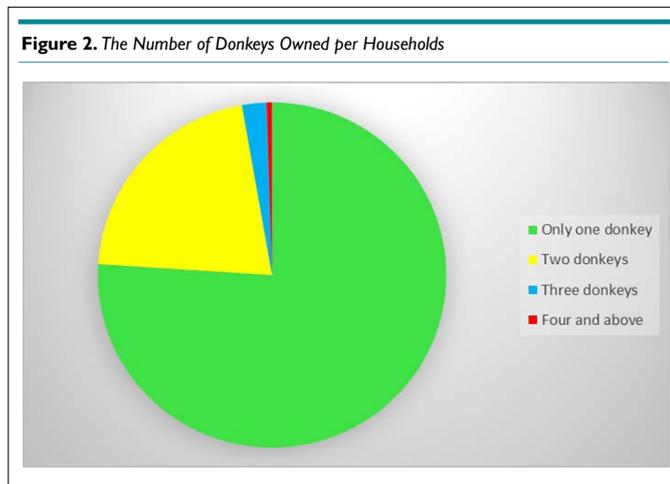
Knowledge of feeding and watering practice of working donkeys:

Out of a total of 394 respondents, the majority of the respondents in this study, provided feed (51.0%) and water (5.6%) to their donkeys. Regarding the provision of water for the working donkeys, most of the respondents give less attention and do not provide adequate water for their donkeys (Table 5).

Table 5. Proportion of Household Respondents on Management Practice of Donkeys in the Working Area

Types of Service	No. of Respondents	Respondents Said 'yes'	Proportion (%)
Feed provision	394	201	51.0
Water access		22	5.6

Proportion of working donkeys per household: Out of the total interviewed, most 301(76.4%) households had only one donkey and 84(21.3%) households had two donkeys. Only a few households were having three 7(1.8%) and four and above donkeys 2(0.5). Therefore, the majority of donkey owners rear only one donkey in the area (Figure 2).



DISCUSSION

In this study, it was observed that all donkeys were used for work, mainly for pack and draught. Similar reports were done by Herago et al⁴ and Mekuria et al¹⁰ in Wolaita Sodo and Hawassa town, respectively where all equines are mainly kept to transport people and goods in order to assure their owners' daily income. In the present study, the overall prevalence of wound in working donkeys was 48.9% which was comparable with the prevalence reported by Herago et al⁴ in Wolaita Sodo, Burn et al²⁹ in Jordan (59%) and 54% in Morocco.³⁰ However, this finding was higher than the prevalence of 40% in Central Ethiopia,³¹ 42.2% in Adet town.³² On the other hand, the current result was markedly lower than the previous report 77.5% and 79.4% by Curran et al³³ and Biffa et al¹⁹ respectively in Ethiopia.

According to the current body condition assessment, 54.1% of the donkeys were having medium body condition and 42.1% and 3.8% of donkeys were having thin and fat body condition, respectively. Besides, donkeys less than 5-years (44.3%) were having poor body condition as compared to the age group of 5-10-years (42.1%). Heavy work burden also might be the reason for a high proportion of thin and very thin animals. Moreover, poor people who cannot afford to provide supplementary feeds to their donkeys might be the reason. Observation in this study area also shows that pack donkeys were kept usually by tethering around homestead. It was also discussed by Herago et al,⁴ Mohammed¹³ and Burden²¹ that pack donkeys were kept usually by tethering around the homestead and in turn it caused discomfort and even wounds.

The present study revealed that beat sore, tail base sore, back sore and donkey bite sore were among the major type of wound identified in the area. Earlier studies have identified that as there was a probability of occurrence of all types of wounds

on the same donkey.^{4,10,29,32} These wounds are often caused by a combination of multi-factorial reasons. The difference in management and husbandry practices including environmental factors, the type of harness material used (natural or synthetic), the fit of the harness, the behavior of the owner, the frequency of work and the load were among risk factors that contribute to the onset of different type of wounds in working donkeys.^{4,31,32}

Regarding work overload, 28.9% of donkeys were suffered from overloading. Besides, a higher 29.3% proportion of overlading was recorded on draught/cart donkeys than pack donkeys 8.4%. Therefore, regardless of their work type, working donkeys were suffered from overloading since owners sometimes loaded beyond their capacity, which led to even loss of donkeys, in order to transport enough products in one journey. Concerning the duration of working hours per day, those who worked for greater than eight hours showed a high proportion of poor body condition compared to those working for less than 5-hours and 5-8-hours since overworking utilizes maintenance energy. Therefore, the association between duration of working hours and body condition was very significant (p value<0.01). This finding was in agreement with the report of Herago et al,⁴ Burden²¹ and Getnet et al¹² that work overload and duration have an impact on body condition and health of working donkey.

The prevalence of dermatological diseases such as sarcoid, habronemiasis, and ectoparasites were common among working donkeys of the study area. This might be associated with the owner's poor knowledge of health care, feeding and irregular or no medication for parasites.^{4,34} The present overall finding of dermatological disease was 21.1%, which is comparable with the findings of Kumar et al³⁵ in Mekelle city (23.7%) and Sameeh et al³⁶ in Jordan (22.7%) but, higher than the finding of Herago et al⁴ in Wolaita Sodo (12.6%), Ahmed et al³⁷ in Pakistan (11%) and Yilma et al²³ in Debre Zeit (16%). Mekuria et al⁵ made a similar observation, where higher prevalence of ectoparasites were found in donkeys than horses and suggested that donkeys were the most neglected animals in Ethiopia, receiving less attention by owners and kept under poor management conditions. Whay et al³⁸ also reported that skin lesions as one of the major prevalent and severe welfare issues in working donkeys.

Most donkey cases that were observed in this survey mainly related to the musculoskeletal system including lameness, fracture, hoof overgrowth and abnormal gait. Overall problem of 13.5% which is close to Kumar et al³⁵ finding in Mekelle city (18.2%) but lower than Herago et al⁴ in Wolaita Sodo (21.8%), Sameeh et al³⁶ findings in Jordan (32.2%). This is likely due to many reasons such as overloading, lack of hoof care and continuous movement in various landscapes and on rough roads were the main reasons for the occurrences of musculoskeletal problems. This implies that any type of interaction between limb abnormalities in these animals may have serious welfare and health problems.^{39,40}

In the present study, it was observed that among other disease problems the most frequently encountered in the study areas were metabolic disease, [54.5% (pack) and 45.5% (draft)],

respiratory problem [43.3% (pack) and 57.7% (draft)] and from eye problems [41.7% (pack) and 50.3% (draft)]. This finding was much higher than the report by Herago et al⁴ that was digestive or metabolic problems (3.9%), respiratory problems (13.1%) and eye problems (20.9%) and Sameeh et al³⁶ who found 21%, 7% and 4% for digestive system, respiratory and eye problem, respectively in Jordan. These differences might arise due to difference in topographical nature and misuse; low-level of donkey health care, keeping characteristics of the donkey, digestive problem may also be related to high parasite burdens and impaction. The behavioral part of the welfare assessment aims gives some insight into the animals' emotional state.

The majority of the respondents in this study had only one donkey and do not provide enough feed and water to their donkeys. This finding disagrees with the report of Herago et al⁴ in Wolaita Sodo, Dinka et al⁴¹ in southern Ethiopia (98.6%) who reported that the majority of the respondents provided feed and water separately at different frequencies in a day. The type and amount of feed fed requirement varies according to the workload of the donkey.⁴² Anderson et al¹⁶ suggested that animals which are being used year-round for transport, need more feeds than animals that are only worked for short periods seasonally.

CONCLUSION AND RECOMMENDATIONS

In conclusion, many of the working donkeys in the study area were faced with multiple welfare problems. Beat sore, tail base sore, back sore and donkey bite sore were among the major type of wound identified in working donkeys in the study area. Furthermore, poor husbandry, underfed and overloading are also prominent problems, that predisposed the animal for poor body condition and skin lesions that was directly associated with work type. In light of the current finding, it is recommended that comprehensive awareness creation on donkey welfare issues should be promoted through training, extension service by the government. Besides, the owners should be taught about improving management and harnessing in order to reduce the incidence of back sore and tail lesions on working donkeys.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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Short Communication

Recurrent Prepartum Cervico-Vaginal Prolapse in a Crossbred Holstein Friesian Dairy Cow

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ABSTRACT

A Holstein Friesian (HF) crossbred dairy cow of 5-years-old and 38.5-weeks pregnant was presented to the Veterinary Hospital of College of Veterinary Science, Mekelle University with a history of repeated prolapse since last 10-days. Upon clinical examination, the case was confirmed as prepartum cervico-vaginal prolapse due to excess labor and straining to deliver the fetus. After caesarean section, the cow was restrained on sternal recumbency and the prolapsed mass was made aseptic by washing with a 2% potassium permanganate solution and was repositioned into the pelvic cavity. The cow was kept on fluid therapy (stat), anti-inflammatory and antibiotic for three successive days. A modified Buhner's technique, using infusion set tube as suture was to keep the prolapsed tissue in position to prevent the recurrence and the cow had an uneventful recovery. A successful management of recurrent prepartum cervico-vaginal prolapse using modified Buhner's suture after caesarean section in a crossbred Holstein Friesian dairy cow is discussed.

Keywords

Modified Buhner's suture; Cervico-vaginal prolapse; Crossbred Holstein Friesian cow; Recurrence.

INTRODUCTION

Reproductive disorders negatively affect their productive and reproductive performances in dairy cows. The cervico-vaginal prolapse is an emergency reproductive condition in dairy cows that commonly occur in pluriparous cattle with recurrence in subsequent gestations. In cervico-vaginal prolapse, there is eversion of vagina and cervix over caudal attachment, then from the vulvar commissure protrude outside and finally, the inside layer remains out.¹ Besides, rectovaginal prolapse in the cow and recto-cervico-vaginal prolapse in buffalo were also reported by some researchers.²

Cervico-vaginal prolapse in the cow typically occurs for the first time in the last trimester of gestation, but may occasionally occur during the postpartum period. During last trimester of pregnancy, higher circulating estrogen predispose to cervico-vaginal prolapse since it enhances relaxin hormone production that induces relaxation of the pelvic ligaments and perineum and the increasing size of the gravid uterus predispose the vagina to pro-

lapse.^{3,4} Hereditary factor in some breeds of cattle, intra-abdominal fat accumulation, large and multiple fetuses, previous trauma to the perineal region, rumen distension also contribute to the problem. Dietary factors such as hypocalcemia, food containing estrogenic substance (clover, soybean meals) are also associated with genital prolapse.⁵

Vaginal prolapse has been classified based on the severity and duration of the condition. First-degree vaginal prolapse involves only the vaginal floor and occurs only when the cow is recumbent. With second-degree prolapse, the vagina and often the bladder continuously protrude through the vulva. Third-degree prolapse involves the prolapse of the cervix as well as the vagina and bladder, and straining becomes constant. In fourth-degree prolapse, there is extensive tissue necrosis caused by chronic exposure of the vaginal and cervical mucosa. As the prolapse becomes more severe or chronic, the likelihood of systemic problems such as peritonitis and adhesions increases, and the survival of the fetus is endangered.^{5,6}

The diagnosis of cervico-vaginal prolapse is obvious; however, a rectal examination should be performed to determine fetal viability and location of the urinary bladder. Ultrasonography can be used as an adjunct to palpation if the diagnosis of fetal viability or the bladder location is uncertain. The case should be treated as soon as possible; otherwise, the prognosis will be grave.^{5,7} This short communication highlights the approach and successful management of pre-partum labor induced cervico-vaginal prolapse in a crossbred Holstein-Friesian dairy cow.

CASE PRESENTATION, HISTORY AND CLINICAL OBSERVATIONS

A 5-years-old multiparous Holstein Friesian (HF) crossbred dairy cow and 38.5-weeks pregnant with a history of repeated Cervico-vaginal prolapse since the last 10-days was presented to Veterinary Hospital, College of Veterinary Science, Mekelle University, Ethiopia. The first case was diagnosed as a first-degree vaginal prolapse that involves only the vaginal floor and managed properly without any complication. However, after 10-days, the owner reported the recurrence of the same case. The owner also communicates to us the date was the expected date for parturition.

Upon arrival and physical examination, the cow was found on sternal recumbency with slight depression due to long straining and confirmed prepartum cervico-vaginal prolapse. On recurrence, vaginal tissue broke through the sutures tearing (local synthetic thread) the vulvar lips and was hanging outside the vulva. Vulvar lips tearing, vaginitis and contamination of prolapse mass were observed (Figure 1A). Besides, the prolapse was of third-degree that involves prolapse of the cervix, the vagina and bladder with constant straining (Figure 1B). Upon rectal examination, the fetus was alive with the head on the pelvic cavity. The physiological parameters (rectal temperature, respiration rate and heart rate) were slightly elevated. Moreover, the prolapsed mass was found swollen, edematous with mild laceration in the exposed part. The cow could not pass urine due to prepartum prolapse and at frequent intervals exhibited intermittent straining.

SURGICAL MANAGEMENT, POST-OPERATIVE FOLLOW-UP AND RESULT

The previous case was managed properly after proper restraining on sternal recumbency and administering caudal epidural anesthesia (2% lidocaine hydrochloride). The vaginal tissue made aseptic by washing with a 2% potassium permanganate solution and was repositioned inside the pelvic cavity. After repositioning, a Buhner's technique, using sterile cotton thread as a suture material, was applied parallel to vulva apart from the vagina beneath the skin to keep it in position. The cow was kept on fluid therapy (5% Dextrose solution, 1000 ml stat, I.V.), antibiotic (Ceftriaxone, 5 gm/kg, I.V.), and Meloxicam (0.5 mg/kg, IM) for 3 successive days. During the follow-up of the cow, no complications on the vulvar area was noticed.

On recurrence, a similar approach pre- and post-operative technique was followed to manage the case. However, it was

unsuccessful due to some complications listed below. Thus, the repositioning of the prolapsed mass was found difficult and unsafe and the caesarean section was performed to minimize the risk and to increase prognosis. After caesarean operation, the cervico-vaginal prolapse was successfully repositioned into the pelvic cavity in a similar manner with the first case. However, this time a modified Buhner's technique using an infusion set tube was used as suture to retain the prolapsed mass (Figure 1C). After 15-day post-operation, the wound was healed completely and after three months of follow-up, the cow was under good health status. The owner was advised to cull the cow.

Figure 1. (A) Cervico-vaginal Prolapse on Recurrence in Crossbred HF Cow (B) Post-Cleaning View of Prolapsed Mass (C) Modified Buhner's Technique Using Infusion Set Tube as Suture in a Crossbred HF Cow



COMPLICATIONS

Some of the complications that occur during the procedure were first, there was the excessive enlargement of the prolapsed mass due to the time lapse between eversion and its reporting. Secondly, increased size and weight of the prolapsed tissue and vaginal tear due to the involvement of cervix, vagina and fully distended urinary bladder with some fetal fluids. Thirdly, there was excess labor and straining to deliver the fetus since the cow in normal parturition cascade.

DISCUSSION AND CONCLUSION

Cervico-vaginal prolapse is a major reproductive disorder and an emergency condition in cattle that should be managed earlier excessive edema, mucosal trauma, contamination, tear and fatal hemorrhage.^{5,8} In this report, cervico-vaginal prolapse has resulted from the excess labor force and straining of the cow for extraction of the fetus and the case was managed as early as possible. Forced extraction of the calf and dystocia have been implicated as causes of prolapse in dairy and beef cattle by Hopper⁹ and Kumar.¹⁰ In the present report, the cervico-vaginal prolapse was observed during the last trimester of pregnancy. This finding is in accordance with an earlier report where the maximum number of such cases was noticed in the last 2-months of gestation.⁷ Besides, prepartum cervicovaginal prolapse was frequently observed. This finding is in accordance with earlier reports of different authors that states vaginal prolapse occurred most frequently a few hours following parturition.^{5,7}

In this study, the prolapse was progress from first-degree vaginal prolapse turned to third-degree. According to an earlier

study, first-degree vaginal prolapse is likely to progress to second/third-degree, without temporary retaining sutures or a permanent fixation technique.¹⁰ This was in contrast with the report of Bhattacharyya et al⁷ where no temporary suture was applied. In the present study, the modified Buhner's technique, using infusion set tube as suture material, was found to be very satisfactory in preventing recurrence of the prolapse particularly in developing countries where farmers cannot afford repeated costly treatment of their livestock. This finding is in agreement with the finding of Bhattacharyya et al⁷ and disagrees with the previous reports of Akhil et al,² Pravesh et al,³ Kumar,¹⁰ that used other suture material Vetafil, Umbilical tape, Finlayson thread, nylon.

Modified technique has some advantages over the standard Buhner's technique including a) sufficient space on ventral vulvar commissure that ease urination, ii) less traumatic since it doesn't need suture above and below the vulva, iii) when required, the suture can be loosened and reapplied by the owner himself, iv) quick application with no additional instruments requirement and v) no scar formation in the vulvar area. This was in agreement with Bhattacharyya et al.⁷

Accordingly, recurrent prepartum cervico-vaginal prolapse due to parturition could be managed by a combination of caesarean section to deliver the fetus and modified Buhner's using infusion set tube as suture material and recommended as an alternative technique. This surgical protocol may be used as a preliminary strategy for managing third-degree vaginal prolapse under field conditions.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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Case Illustration

Successful Therapeutic Management of Ivermectin Toxicity in American Pitbull Terrier

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A BRIEF HISTORY

A 2-year-old American Pitbull Terrier bitch weighing 25 kg was presented to Teaching Veterinary Clinical complex at College of Veterinary and Animal Science, Udgir District, Latur, Maharashtra, India on 24/02/2020 with a history of convulsions, restlessness, severe howling, muscle tremors along with inappetence for 1-day and muscle weakness. On obtaining the history from owner it was found out that the owner had accidentally fed the bitch Hitex (Ivermectin) bolus of 80 mg.

CASE DISCUSSION

The case had been presented with the information that the animal was accidentally fed Ivermectin bolus of 80 mg, and subsequently which led to the clinical manifestations. The recommended dosage of Ivermectin for dogs is 0.2 mg/kg of body weight. Thus the required dosage in this case was 5 mg, but the animal was given 80 mg, thus 75 mg was overdosed to the animal. Also the clinical signs like congested palpebral mucous membrane, dry mouth, convulsions along with supporting haemogram indicated that the bitch had developed toxemia due to Ivermectin overdosage. Thus

the bitch was treated on lines of Ivermectin toxicity which is as discussed below and resulted in the uneventful recovery of the bitch with disappearance of clinical manifestations and normalization of the physiological parameters along with normal appetite and activeness in behaviour.¹

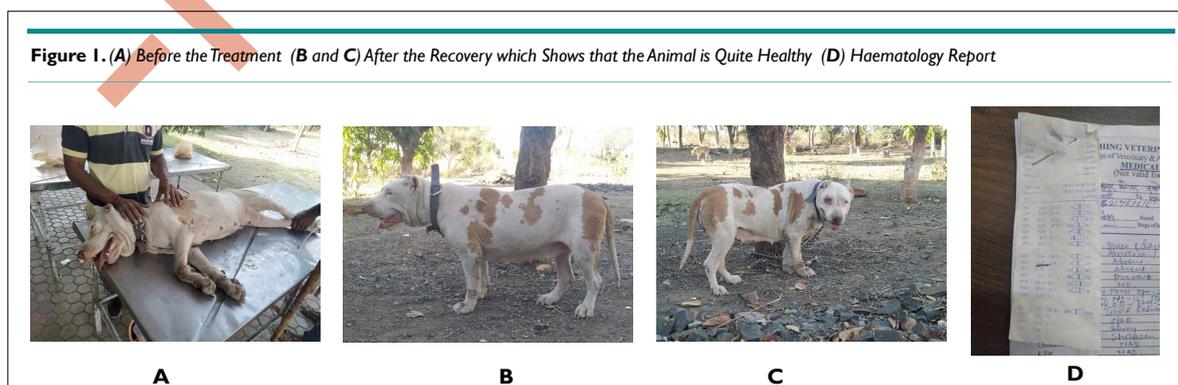
Clinical Examination

The clinical examination revealed congested mucous membranes, heart rate (86 pm), respiration rate 44/minute and rectal temperature of 103 °F along with panting. The complete blood cell count examination revealed mild leukocytosis (Granulocytosis), along with haemo-concentration and mild dehydration indicative of toxemia.

Diagnosis

Based on the history obtained from the owner and on the basis of complete blood count (CBC) examination, it was diagnosed that the bitch was suffering from Ivermectin toxicity which led to the above mentioned clinical manifestations.

Figure 1. (A) Before the Treatment (B and C) After the Recovery which Shows that the Animal is Quite Healthy (D) Haematology Report



Treatment

Therefore the bitch was treated on the basis of above mentioned diagnosis with Neostigmine 1 ml administered subcutaneously which was repeated at an interval of 4 hrs. Also supportive therapy comprising of Isofluid acetate (2 ml) -M, DNS 500 ml slow IV(BID), RL 500 ml slow IV (BID), calcium sandoz 10 ml IV slow and vitamin-B complex 2 ml IM was administered for three-days.

CONCLUSION

Treatment with Antidote of Ivermectin along with supportive therapy resulted in the uneventful recovery of the bitch with reso-

lution of signs of convulsions, howling, and muscle tremors along with normalization of urination, defecation and normal food and water intake. Thus a bitch suffering from Ivermectin toxicity was successfully treated with Neostigmine.

DECLARATION

The approval of ethical committee was taken for conducting this study and followed all the animal ethics and welfare guidelines.

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Retracted