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Chapter

Effect of Cattle-Specific Diseases on Carcass Inspection and Meat Quality

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Abstract

There are severe cattle-specific viral (foot and mouth, vesicular stomatitis, rinderpest, rift valley fever, malignant catarrhal fever, lumpy skin, rabies, bovine leukosis, bovine viral diarrhea, and bovine spongiform encephalopathy), bacterial (tuberculosis, black quarter, botulism, malignant oedema, leptospirosis, brucellosis, anthrax, hemogenic septicemia, actinomycosis, actinobacillosis, mastitis, and metritis), parasitic (lungworm, fasciolosis, cysticercosis, hydatid disease, and onchocercosis), and protozoal (trypanosomiasis, theileriosis, anaplasmosis, babesiosis, and sarcosporidiosis) diseases that affect the carcass judgment and meat quality. These diseases adversely affect cattle health, welfare, and red meat production. This chapter aims to describe the etiology, mode of transmission, ante-mortem and post-mortem findings, carcass and meat quality judgment, and differential diagnosis of these diseases.

Keywords: cattle-specific diseases, carcass judgment, meat production, meat quality

1. Introduction

Beef carcasses are commonly inspected to deliver safe and healthy meat for human consumption all over the world. An abattoir is an approved and registered place by the authorities for hygiene slaughtering, inspecting, processing, and storage of meat for human consumption [1]. It also helps to detect economic and public health important diseases [2]. The veterinarians and the meat inspectors are mainly responsible for inspecting the carcasses and the meat at the abattoir phase. The data collected from ante-mortem and post-mortem inspections at the abattoirs are useful to evaluate the disease condition and decide the fate of the carcass either approved for human consumption or should be condemned [3].

Cattle are one of the major sources of red meat all over the world including Pakistan, where the demand for animal protein is increasing with time due to the increase in population [4, 5]. There are severe cattle-specific viral, bacterial, parasitic, and protozoal diseases that are of economic and public importance [6]. Beef

production is one of the most important livelihoods of rural families, especially in developing nations and the condemnation of the carcasses or specific organs causes severe economic losses to the farmers and the livestock sector [7, 8]. Besides carcass and meat inspection, the abattoirs in the most developed nations have helped to detect and eradicate several diseases in cattle [9]. However, in developing nations like Pakistan, the abattoirs are not fully utilized, and carcasses are not properly inspected before defining their fates.

In developing nations, veterinarian and meat checkers often lack the basic guidelines to determine the fate of the carcasses whether it should be approved, conditionally approved or condemned. Therefore, this chapter aims to describe the etiology, mode of transmission, ante-mortem and post-mortem findings, carcass and meat quality judgment, and differential diagnosis of cattle-specific diseases. These guidelines will help the meat inspector to determine carcass fate and prevent the spread of public health important diseases through meat consumption.

2. Carcass and meat inspection procedures

There are two main objectives of meat inspection. Firstly, physically normal, healthy animals should be slaughtered and processed for human consumption. Secondly, the slaughtered animal should be disease free, and there should be no risk to human health. These aims could be attained by performing ante-mortem and post-mortem inspections at the abattoirs.

2.1 Ante-mortem examination

The word ante-mortem examination indicates the examination of cattle “before death”. Thus, the examination of cattle before slaughtering is termed as “anti-mortem examination”. All the animals presented for slaughtering should receive ante-mortem examination. The purposes of ante-mortem examinations are to screen cattle before slaughter, to ensure the proper rest [10, 11], to get clinical information for disease diagnosis and identifying the reportable diseases, and lastly, to identify the animals treated with antibiotics and other chemotherapeutic agents [12]. Animal should be examined from both sides in both standing and moving conditions. Ante-mortem examination should be carried out within 24 h of slaughtering and perform again if the slaughtering has been delayed over a day. Cattle showing the clinical signs should be separated from the healthy animals and treated as “suspects” and must be held for veterinary inspection and judgment. Ante-mortem examination should be performed in adequate lightening at rest and motion [13]. The general behavior along with the nutritional status, signs of disease, and abnormalities should be observed. The abnormality in behavior, posture, gait, structure, and conformation should be monitored.

2.2 Post-mortem examination

The term post-mortem means “after death”. Thus, the inspection of the animals after slaughtering is termed as “post-mortem inspection” [14]. The post-mortem examination majorly comprises head, viscera, and carcass inspection. The post-mortem inspection of the carcass should be carried out just after the dressing of the carcass to notice any abnormality or diseased condition to pass or reject the carcass for human consumption. The carcass and organs inspections should be correlated

before making the final diagnosis. The post-mortem examination is done by viewing, incising, palpating, and using olfaction techniques [15]. The lesions are classified into acute or chronic, localized or generalized and relevancy of lesions to major organs or systems. The ante-mortem and post-mortem findings should be correlated before making the final judgment.

3. Cattle-specific viral diseases

3.1 Foot and mouth disease (FMD)

Foot and mouth disease (FMD) is a highly contagious viral disease of cloven-hooved animals such as cattle [16]. FMD is caused by Aphthovirus, belonging to Picornaviridae family. There are seven serotypes of the virus, termed: A, O, C, Asia 1, and SAT (Southern African Territories) 1, 2, and 3. FMD is spread through direct or indirect contact with infected cattle, their secretions, animal products, and by-products. Ante-mortem examination shows vesicles and erotic lesions on the muzzle, mouth, feet, teats, and udder region. The cattle show high fever, dullness, reduced appetite, dropping milk production drastically, and muscle tenderness. Post-mortem examination shows a necrotic heart, usually in young cattle and the ulcerative lesion on the tongue, gums, palate, pillars of the rumen, and feet [15]. In the FMD-free countries and zones, the cattle are prohibited to enter the abattoir. If the FMD is diagnosed on post-mortem inspection, then carcass and visceral organs are condemned, and proper measures should be taken as suggested by the regulatory authorities of the country. If the FMD is present in the country, then the judgment should be done by considering the animal health status and public health concerns.

3.2 Vesicular stomatitis (VS)

Vesicular stomatitis (VS) is a viral disease that majorly affects cattle and horses. VS is a viral disease caused by New Jersey and Indiana serotypes of vesicular stomatitis virus [17]. VS is transmitted through aerosol, direct contact, fomites, and also through insects vectors [18]. Ante-mortem examination shows vesicular lesions in the mouth, teats, and around feet. The animal shows a decrease in weight, ending of lactation in lactating cattle, profuse salivation, and lips ribbing on manger edges in horses. Post-mortem examination shows lesions resembling the lesions of other mucosal diseases; however, like FMD, heart and rumen lesions do not appear in VS. The carcass displaying acute changes and the systematic lesions is condemned. If the animal is not affected by the acute stage and showing no secondary bacterial infection, the carcass is approved; however, the visceral organs are condemned.

3.3 Rinderpest (RP)

Rinderpest (RP) is an acute, viral, highly contagious disease of cattle, buffalo, and some wildlife species [19]. RP is caused by RNA virus of Paramyxoviridae family. RP is spread through air, direct contact, and fomites. Ante-mortem examination shows high fever, nasal discharge, extreme salivation, mouth erosion, decrease in appetite, depression, and bloody diarrhea. Post-mortem examination shows erotic or necrotic lesions throughout GIT and upper respiratory tract leading to the classical “zebra-striping” in the rectum. Enlarged edematous lymph nodes and necrotic foci are also

observed in the Peyer's patches. In the RP-free countries and zones, the cattle are prohibited to enter the abattoir. If the RP is diagnosed on post-mortem inspection, then carcass and visceral organs are condemned, and suitable measures should be taken as recommended by the regulatory authorities of the country. In RP, prevalent countries, if symptoms are mild, then the carcass can be conditionally approved.

3.4 Rift Valley fever (RVF)

Rift Valley fever (RVF) is a viral disease of cattle mostly seen in domesticated animals in sub-Saharan Africa. The disease is caused by the rift valley fever virus (RVFV), a member of the genus Phlebovirus. RVFV is majorly spread through biting insects and mosquitoes [20]. Humans are mostly infected through direct or indirect contact with infected organs. Ante-mortem examination in cattle shows edematous skin, discharge from the nose, weakness, diarrhea, decreased milk production, and abortion [21]. Post-mortem findings show cyanotic visible mucosa, edematous and hemorrhagic gall bladder, and spleen and peripheral lymph nodes are enlarged and edematous and may show petechiae and purple udder with invisible inflammation. The carcass of cattle affected with RVFV is condemned. The carcass of recovered animals can be conditionally approved; however, the affected visceral organs must be condemned.

3.5 Malignant catarrhal fever (MCF)

Malignant catarrhal fever (MCF) is an acute viral disease of cattle. The disease is caused by bovine herpesvirus 6 in cattle [22]. It is transmitted by close contact between cattle and wildebeest, through common water troughs. Ante-mortem examination in cattle shows high fever, lachrymation, erotic lips, tongue, gums, inappetence, and decreased milk yields. Furthermore, the cattle show photophobia linked with corneal opacity and blindness. Superficial lymph nodes might be enlarged and swollen limb joints. On post-mortem, the cattle show erosions and hemorrhages in GIT: contents may be hemorrhagic, white areas in the kidneys and enlarged lymph nodes with varying degrees in different regions of the animal [23]. Typically, "Tiger stripings" in colon region are observed. In mild disease cases, the carcasses can be conditionally approved; however, if systemic signs appear, then carcasses are condemned.

3.6 Lumpy skin disease

Lumpy skin disease is an acute viral disease of cattle. It is caused by the poxvirus. It is transmitted through blood-feeding insects, such as specific species of flies, mosquitoes, and ticks [24]. The diseased cattle show fever, nasal discharge, and hypersalivation skin eruption of different body parts. The nodular lesions are round, firm, and painful. The secondary infection can cause joint and tendon inflammation [25]. The post-mortem inspection shows ulcerative lesions of respiratory and digestive tract mucosa, edema, and nodules in the lungs. In mild disease cases, the carcasses can be conditionally approved; however, if generalized acute infection appears, then carcasses are condemned.

3.7 Rabies

Rabies is an acute lyssaviruses disease, causes encephalomyelitis. It is transmitted through infected saliva or the bite of a rabid animal [26]. It has different forms. On

ante-mortem examination, the furious form shows restlessness, aggression, paralysis, and death. Whereas, the paralytic form shows ataxia leading to paralysis of the throat and masseter muscles, hypersalivation, the inability of swallowing, and death after 48 h of laying down. On post-mortem, the cattle show inflammation of gastrointestinal mucosa. If rabies is present in the country and the animal was bitten eight days before slaughter and within 48 hours of slaughter, then the carcass can be approved after removing bitten tissues.

3.8 Bovine leukosis

Bovine leukosis in cattle is caused by the bovine leukosis virus (BLV) [27]. It is found in sporadic or enzootic forms. Between these two forms, the sporadic is observed in young, whereas the enzootic is reported in adult cattle. The infection is spread through the blood and from the dam to the calf through vertical transmission. Ante-mortem findings show weight loss, bloat, fever, tachycardia, and posterior paresis. Moreover, edema in the brisket and intermandibular region is also reported. Cutaneous nodules have also been seen in some cases. The post-mortem findings show lymph node enlargement, splenomegaly, and necrotic lesions in the heart and intestine. Furthermore, ventral edema is also reported. Carcasses are condemned for human consumption in this disease [28].

3.9 Bovine viral diarrhea (BVD)

Bovine viral diarrhea (BVD) is a cattle disease caused by the bovine viral diarrhea virus (BVDV). It is transmitted through congenital infection of the fetus [29]. This disease can lead to abortion or stillbirth. The ante-mortem findings show lethargy, fever, decreased appetite, ocular and nasal discharge, and diarrhea. On post-mortem, BVD shows erotic lesions on the nostrils, mouth, larynx, esophagus, rumen, omasum, abomasum, and caecum [30]. Cecum and colon show stripping similar to the RP. If generalized acute infection appears along with fever and emaciation, then carcasses are condemned.

3.10 Bovine spongiform encephalopathy (BSE)

Bovine spongiform encephalopathy (BSE), commonly known as “mad cow disease”, is a fatal neurologic disease of cattle [31]. BSE is caused by prions, an abnormal virus-like protein. Contaminated feed is the major reason for disease spread.

Ante-mortem examination shows behavioral changes, tremors, and abnormal ear position. Hyperesthesia, nervousness, reluctance for milking, and aggression toward other animals are also reported [32]. Post-mortem findings show microscopic lesions including degenerative lesions in the cerebral cortex, medullary region, and central gray matter of the midbrain. The carcass of cattle affected with BSE is condemned.

4. Cattle-specific bacterial diseases

4.1 Tuberculosis

Bovine tuberculosis (TB), caused by the bacterium *Mycobacterium bovis*, is an infectious disease of cattle. It can also cause disease in other mammals including

humans, goats, pigs, deer, and dogs [33]. This infection is mainly spread through inhalation or ingestion of the bacteria. Contaminated water and food are also sources of infection. The ante-mortem examination shows fluctuating fever, chronic intermittent hacking cough associated with pneumonia, weakness, difficulty in breathing, loss of appetite, and emaciation. Post-mortem findings show tuberculous granuloma in the lymph nodes of the head, lungs, intestine, and carcass. Lesions also appear in the lungs, liver, spleen, and kidney. In the country where TB has been eradicated or the eradication program is ongoing, the carcasses will be condemned. In mild cases, carcasses could be conditionally approved.

4.2 Black quarter (black leg)

The black quarter also recognized as black leg is an acute infectious disease of cattle caused by *Clostridium chauvoei* [34]. It causes inflammation of the muscles, toxemia, and high mortality. It is soil-borne infection transmitted through a wound, injection needle, or ingestion (especially when there are oral abrasions). Ante-mortem findings initially show high fever, lameness, with severe depression are classical signs of black quarter disease. Animal stops eating and ruminating. Crepitating and gaseous swelling of the affected muscles of hind quarters and shoulders leading to hot and painful swelling is very characteristic. If not treated immediately, death may occur within 12–36 h due to severe toxemia. On post-mortem, skin over the swelling appears dark with oozing dark-colored offensive-smelling fluid. Crepitating swelling when cut open shows oozing of a dark red fluid with bubbles with a rancid odor. The affected muscles on palpation appear sponge-like with the presence of gas bubbles indicating necrotizing hemorrhagic myositis (due to toxin). Usually, the spleen is enlarged and hemorrhagic. The slaughtering of affected cattle is prohibited, and if the cattle have been slaughtered, then carcass and visceral organs are condemned [15].

4.3 Botulism

Botulism is caused by the toxins produced by *Clostridium botulinum*. It causes paralysis of different muscles. Decomposed flesh and bones are the sources of infection for cattle [35]. Ante-mortem examination shows flaccid muscular paralysis, disturbed vision, difficulty in chewing and swallowing, and generalized progressive paresis. On post-mortem, foreign material in the rumen or reticulum may be found. The carcasses are condemned due to human hazards.

4.4 Malignant edema

Malignant edema is caused by *Clostridium septicum* in cattle. Infection ordinarily occurs through contamination of wounds containing devitalized tissue or soil [36]. On ante-mortem examination, the cattle show anorexia, high fever, depression, weakness, muscle tremors, and lameness. Post-mortem findings show gangrenous skin in the affected area, foul putrid odor, accumulation of sero-sanguineous fluid in body cavities, and darkening of muscles. The carcasses are condemned due to human hazards.

4.5 Leptospirosis

Leptospirosis is a bacterial disease caused by *Leptospira* genus in cattle. Leptospirosis can be transmitted directly or indirectly between animals and through

the environment, respectively [37]. The ante-mortem examination shows fever, loss of appetite, and mastitis in mild cases; however, severely affected cattle show anemia, jaundice, pneumonia, and abortion with retained placenta. Post-mortem findings show anemia, jaundice, submucosal hemorrhage, interstitial nephritis, and septicemia. In the case of acute leptospirosis, carcasses are condemned, whereas, in the case of chronic and localized conditions, carcasses can be conditionally approved [15].

4.6 Brucellosis

Brucellosis is an infectious and contagious disease of cattle that is caused by *Brucella abortus*. It is transmitted by contaminated feed, pasture, water, milk, an aborted fetus, uterine fluid, and discharges [38]. Ante-mortem examination shows stillborn or weak calves, retained placentas, and reduced milk yield. Post-mortem examination shows an edematous fetus and placenta. Carcasses of affected cattle are approved as *Brucella abortus* remains viable only for a shorter period after slaughter. However, in acute aortic form, carcasses are condemned.

4.7 Anthrax

Anthrax is a noncontagious zoonotic disease. It is caused by *Bacillus anthracis*. Anthrax is transmitted through inhalation, ingestion, and a wound in the skin [39]. Biting flies are also a source of transmission. In per acute and acute cases, no clinical signs are reported as it causes sudden death. On post-mortem examination, the cattle show dark-colored blood discharge from natural orifices, no rigor mortis development, splenomegaly, and rapid decomposition of the carcasses. Carcasses are commended and buried almost six feet below ground with a surrounding layer of lime [15].

4.8 Hemorrhagic septicemia (HS)

Hemorrhagic septicemia (HS) is a systemic disease of cattle. It is caused by specific serotypes of *Pasteurella multocida*. It is spread by the ingestion of contaminated feed-stuff. The ante-mortem examination of cattle shows high fever, salivation, difficulties in swallowing, cough, difficult breathing, and pneumonia [40]. The cattle also show edematous swelling of the throat, dewlap, and brisket region. In per acute cases, HS causes death within 8–24 h. The post-mortem findings show subcutaneous swelling and yellowish gelatinous fluid around the throat and brisket areas. Lymph nodes are enlarged hemorrhages in the organs and pneumonia [41]. If the HS is diagnosed on ante-mortem examination, then cattle are not allowed to enter or be slaughter in the abattoirs. The carcasses of HS-affected cattle are condemned.

4.9 Actinomycosis

Actinomycosis is caused by *Actinomyces bovis*. It is a chronic granulomatous disease of cattle. The causative agent is a normal inhabitant of the bovine mouth. The bacteria enter through cuts or abrasions and migrate to the bone, leading to osteomyelitis [42]. The mandible is affected more commonly than the maxilla. Ante-mortem findings show a hard, immobile, bony mass on the mandible, ulceration of cheeks and gums, and wart-like granulations outward on the head. Fever, excessive salivation, and dropping of feed from the mouth are also observed. On post-mortem examination, the

cattle show mandibular lesions (lumpy jaw). Lower part of the esophagus and anterior reticulum also show granulomatous lesions [43]. In severe cases of actinomycosis, the carcasses are condemned; however, in mild cases, carcasses are conditionally approved.

4.10 Actinobacillosis

Actinobacillosis is caused *Actinobacillus lignieresii*, a chronic disease of cattle. The causative agent is a normal inhabitant of the bovine mouth. The bacteria enter through cuts or abrasions. The ante-mortem examination shows salivation, loss of appetite, erosions in the mouth, swallowed tongue, and enlarged parotid and retropharyngeal lymph nodes. Post-mortem findings show an enlarged fibrous tongue (wooden tongue), granular lesion in the lymph nodes, and the thickening of the lower part of the esophagus and stomach wall [44]. The erosions in the mucosa of the rumen and reticulum are also reported. In severe cases of actinobacillosis, the carcasses are condemned; however, in mild cases, carcasses are conditionally approved.

4.11 Mastitis

Mastitis in cattle is caused by bacteria, fungi, and yeasts. It is spread through milk, especially through milker hands. Ante-mortem examination show variable temperature, swollen painful udder, depression, loss of appetite, and exudate from teats [45]. Post-mortem findings show pale yellow edematous udder parenchyma and enlarged supramammary, iliac, and lumbar lymph nodes. In severe cases, if mastitis is associated with systemic changes, then carcasses are condemned. In case of localized conditions, carcasses are approved for human consumption.

4.12 Metritis

Inflammation of the uterus is termed as metritis mostly originated from bacteria. It occurs majorly due to calving problems such as retention of placenta, abortion, twin births, abnormal labor, traumatic lesions of the uterus cervix, and vagina [46]. Ante-mortem examination of cattle shows high fever, retained placenta, and reddish discharge from the vulva. The post-mortem findings show an enlarged flaccid uterus, an inflamed uterus with foul-smelling exudate, and congestion in muscles. In acute disease conditions, the carcasses are condemned, whereas in case of mild infection and carcasses lacking systemic signs may be approved.

5. Cattle-specific parasitic diseases

5.1 Lungworms

Lungworms (*Dictyocaulus viviparus*) cause verminous pneumonia in cattle. The eggs are engulfed by the host while coughing [47]. On ante-mortem examination, the cattle show high temperature, nasal discharge, labored breathing, and recumbency. Post-mortem findings show hemorrhagic inflammation of the bronchi along with froth, edema in the lungs, enlarged lymph nodes, and lungworms are also present in lungs. In mild cases, carcasses are approved, while the affected lungs are condemned. In severe cases, if lungworm infestation led to pneumonia along with emaciation and anemia, the carcasses are condemned.

5.2 Fascioliasis

Fascioliasis is majorly caused by liver fluke (*Fasciola hepatica*). It is a zoonotic and public health important disease. It is spread by the ingestion of cysts by the host cattle [48]. Ante-mortem findings show emaciation, weight loss, anemia, chronic diarrhea, and swallowing in the mandibular region. Post-mortem examination shows anemic, emaciated carcasses, the presence of flukes in enlarged and thickened bile ducts, calcification of bile ducts, and blackish lymph nodes of the liver due to fluke excrement [15]. Carcasses are condemned if heavily infested along with the emaciation. If the condition is mild, then carcasses are conditionally approved.

5.3 Cysticercosis

Cysticercosis in cattle is caused by *Cysticercus bovis*. It is the cystic form of the human tapeworm *Taenia saginata*. Cattle become infested by the ingestion of ova. In human, infection occurs by eating raw or undercooked beef containing viable cisticerci [49]. Cattle may show muscle stiffness on ante-mortem examination only in heavily infested cases. Post-mortem examination shows small white lesions in the muscles and later on calcification also occurs. Carcasses and visceral organs are condemned.

5.4 Hydatid disease

Hydatid disease in cattle is caused by *Echinococcus granulosus*. This disease is also known as hydatidosis or echinococcosis. Eggs are dispersed in the environment via the feces of infected dogs [50]. Cattle become infested by the ingestion of ova. No significant ante-mortem findings are reported. On post-mortem examination, carcasses show hydatid cysts in the heart, liver, kidney, and muscle tissues including the bones. In case of edema, emaciation, and muscular involvement, carcasses are condemned. In mild cases, carcasses may be conditionally approved, however, visceral organs are condemned.

5.5 Onchocercosis

Onchocercosis in cattle is majorly caused by nematode *Onchocerca gibsoni* [51]. The midguts of the Culicoides are the common vectors. However, the other biting flies may act as the intermediate host. The larvae are developed to the infective stage in the midguts of the Culicoides. Cattle are infected through the biting flies. Ante-mortem examination show sub-cutaneous nodules in the brisket and buttock areas. On post-mortem examination, cattle show single or clusters of fibrous nodules in the brisket, buttock, and thigh region. The worms may be live, dead, or in the calcified form in nodules. The carcasses are approved by removing the affected parts.

6. Cattle-specific protozoal diseases

6.1 Trypanosomiasis

Trypanosomiasis in cattle is caused by Trypanosoma genus. It is transmitted mechanically by biting flies. Ante-mortem examination of cattle shows intermittent

fever, anemia, weakness, weight loss, enlarged lymph nodes, edema, and opacity of the cornea. Post-mortem examination shows edematous and emaciated carcasses, enlargement of the liver and spleen, and enlarged lymph nodes. The carcasses are condemned in acute cases, showing systemic involvement. In mild cases, carcasses are conditionally approved; however, affected parts and visceral organs are condemned.

6.2 Theileriosis

Theileriosis in cattle is caused by a blood-borne parasite *Theileria parva*. It is spread through ixodid ticks of the species *Rhipicephalus* [52]. Ante-mortem examination of cattle shows high temperature, difficulty in breathing, nasal discharge, and swollen lymph nodes. One-sided circling and convulsions leading to death are also reported. Post-mortem examination shows pulmonary edema, emphysema, enlarged hemorrhagic lymph nodes, enlarged liver, white spots of lymphoid aggregates in kidneys, and brownish coloration of fat. In mild cases with no systemic involvement, the carcasses and visceral organs are approved. However, in acute cases of theileriosis, showing fever and generalized lesions, the carcasses and affected organs are condemned.

6.3 Anaplasmosis

Anaplasmosis in cattle is majorly caused by a blood cell parasite *Anaplasma marginale*. It is transmitted through *Boophilus* tick. Whereas, the horsefly and mosquitoes are the mechanical transmitters. Ante-mortem examination of cattle show high fever, jaundice, anemia, and emaciation [53]. Post-mortem examination shows congested splenomegaly, watery blood with poor clotting ability, enlarged, icteric liver, deep orange in color, distended bile ducts, and yellow-colored carcasses. Confirmation can be done by detecting the parasite Giemsa stain. In case of acute infection, carcasses are condemned. In recovered and suspect cases, showing mild or inconclusive signs is conditionally approved.

6.4 Babesiosis

Babesiosis is a tick-borne disease, and in cattle, it is caused by different protozoan of genus *Babesia* [54]. Ixodidae family of ticks serve as vectors in different locations. Ante-mortem examination of cattle shows high fever and dark reddish-brown urine. Post-mortem findings show enlarged liver and spleen, edematous congested lungs, anemia, jaundice, edematous and hemorrhagic lymph nodes, and pink-colored hemorrhages in cattle brain. In acute infection, carcasses are condemned. In mild cases, carcasses are conditionally approved.

6.5 Sarcosporidiosis

Sarcosporidiosis also termed as sarcocystosis is caused by different species of *Sarcocystis* genus. Cattle become infested by ingesting contaminating feed, pasture, or water that contains *Sarcocystis* spp. cysts. Ante-mortem examination of cattle shows fever, loss of appetite, excessive salivation, anemia, and loss of hair from tip of the tail [15]. On post-mortem examinations, cysts are invisible due to their smaller size, and cysts become associated with eosinophilic myositis. Heavily infested carcasses showing macroscopic cysts are condemned. In mild infestation, unaffected parts of the carcass are approved for human consumption.

7. Conclusion

The purpose of carcass inspection is to ensure meat quality and its suitability for human consumption. Ante-mortem and post-mortem findings are helpful to diagnose any diseased condition and to give final judgment regarding meat consumption. This chapter covered cattle-specific disease and their effect on carcass judgment and meat quality. The recommendation given in this chapter regarding carcass judgment related to cattle-specific diseases will be helpful to find out the suitability of the carcass for human consumption.

Conflict of interest

The authors declare no conflict of interest.

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