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Review Article

The Slaughter House and the Re-emerging Foodborne Illness with Special Reference to Bovine Tuberculosis

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Abstract

The Slaughter house is the place in which the animals are slaughtered for human consumption. The Slaughter house plays important role in prevention of zoonotic diseases between animals and humans like Mycobacterium tuberculosis as reemerging foodborne illness and also prevent infectious diseases between animals. Bovine Mycobacterium tuberculosis is caused by a species of pathogenic Gram positive, acid fast stain bacteria in the Mycobacteriaceae family. the causative agent bacteria of Bovine tuberculosis as reemerging foodborne illness tuberculosis bacteria has an waxy cover on its surface primarily due to the presence of acid called mycolic which refers the cells impervious to Gram staining, and as a result, the causative agent bacteria of Bovine tuberculosis as reemerging foodborne illness may appear weakly Gram-positive. Acid-fast bacilli by using certain stains called Ziehl Nielsen, or through using stain called fluorescent such as aura mine are used to identify the cause of Bovine tuberculosis as reemerging foodborne illness with a microscope. The Bacteria cause Bovine tuberculosis as a reemerging foodborne illness is aerobic bacteria and needs high concentrations of oxygen. Mainly this bacteria is pathogenic to human and mammal's respiratory system, it infects the lungs. The most diagnostic means for Bovine tuberculosis as a reemerging foodborne illness are the tuberculin skin examination, stain of acid-fast, laboratory culture, and through using polymerase chain reaction method.

Keywords

The Slaughter House, Cattle, Mycobacterium Tuberculosis, Reemerging, Foodborne Illness

1. Introduction

Bovine tuberculosis as a reemerging foodborne illness is one of the ignored foodborne illness in the developing countries in the world [1-4]. The Bovine tuberculosis as a reemerging foodborne illness occurrence and transmission would be still used in many places in the world Bovine Tuberculosis as a reemerging foodborne illness needs further studies, efforts and works to detect the infected cases of Bovine Tuberculosis as a reemerging foodborne illness in cattle, role of the Slaughter houses as well in humans. The advanced methods of interaction between researchers including medical and veterinary disciplines, would generate accurate results [5-8]. Even more, as human tuberculosis due to Bovine tuberculosis as reemerging foodborne illness is still a public health importance in different countries in the world, in developing countries in the world where detection is mostly not depend upon molecular and accurate diagnostic examinations, in addition to microscopy investigation for Bovine Tuberculosis as a reemerging foodborne illness bacteria in samples

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from the body as well as culture in the laboratory, the Bovine tuberculosis bacteria would be causing many of M. tuberculosis attributed human Tuberculosis, especially in the case of outside lung forms of Tuberculosis, even more in rural areas where both Tuberculosis diseases may overlap and where human–cattle contact as ingestion of unpasteurized milk and contaminated dairy products with Bovine tuberculosis bacteria may be of importance [9-11]. Control methods and human tuberculosis control methods, especially in those areas in the world, should consider the importance of Bovine tuberculosis and begin to introduce applicable research into their activities as recording of the illness to control and eradicate Tuberculosis from this bacteria in the world [12-15].

Methods of identification and Diagnosis of Bovine Tuberculosis as a reemerging foodborne illness [16-21].

Bovine Tuberculosis symptoms are not accurate distinctive, so do not enable veterinarians in the field to perform accurate diagnosis depend upon symptoms and appearance without other aids.

Test called tuberculin skin examination is standard mean for Tuberculosis diagnosis in live cattle. The living animal is injected with bovine tuberculin through intra-dermal way of injection and then measuring thickness of the skin at the site of injection three days later to detect any subsequent thickening in the skin at the place of the injection.

Blood based in vitro examinations method, this methods could detect M. bovis bacteria, detect antibodies, or detect cell-mediated immunity are suitable, or under development to give accurate results. The most common used methods of examination of blood is a gamma interferon release assay.

Accurate diagnostic means may be confirmed in the laboratory by the aid of culturing of bacteria and other identification methods, a process that may take several weeks. The used examinations including all procedures for the manufacturing and the administering of bovine tuberculin.

Nature of Bovine tuberculosis as a reemerging foodborne illness. Bovine tuberculosis as reemerging foodborne illness is a chronic disease affects cattle caused by members of the Mycobacterium tuberculosis complex comes mainly by Bovine tuberculosis, but also may be caused by M. caprae and to a lesser extent may be caused by M. tuberculosis [22-26]. Bovine tuberculosis as reemerging foodborne illness is a mostly infectious Tuberculosis among cattle, and wild animals, Bovine tuberculosis as reemerging foodborne disease causes symptoms of a general condition of illness, pneumonia in the lung, loss in the weight, and death in the last stage of the disease [27-31]. The name Bovine tuberculosis as a reemerging foodborne illness is derived from the nodules word, called ‘tubercles’ word, present in the lymph nodes of cattle and other infected organs [32-35].

Herds of cattle are the main reservoir of Bovine tuberculosis as a reemerging foodborne illness and are the common source of human infection. In addition, the Tuberculosis is reported in other domesticated and wild animals in the world [36-39].

Geographical distribution of Bovine tuberculosis as a reemerging foodborne illness. Bovine tuberculosis as reemerging foodborne illness is found throughout the world [40-43], but in some countries in the world have never detected tuberculosis, and many developed countries in the world have reduced the incidence of the illness or eliminated bovine tuberculosis from their cattle population and kept the Tuberculosis limited to certain areas [44-48]. Significant areas of infection are remained in wildlife. The highest incidence of bovine tuberculosis is in African countries, parts of Asian countries and Tuberculosis is still affects countries in Europe area & the America area [49-56].

The most prominent clinical pictures of Bovine tuberculosis as a reemerging foodborne illness in cattle, Bovine tuberculosis as a reemerging foodborne illness may be sub-acute or chronic, with a variable rate of progression [57-62]. Few numbers of cattle can become severely infected within a few months of infection, while other cattle may take several years to appear clinical pictures. Bovine tuberculosis bacteria may also lie dormant in the host without showing clinical pictures for a long times [63-68]. Common clinical pictures of Bovine tuberculosis as a reemerging foodborne illness in man include Weakness, loss of appetite and weight loss, fluctuating fever, dyspnea and cough, clinical pictures of low-grade pneumonia, diarrhea, enlargement of lymph nodes [69-72].

2. Discussion

Mycobacterium bovis has been isolated from cattle, other domestic and wild animals as cattle, buffalo, sheep, goats, equines, camels, deer, antelopes, dogs, cats, and animals [73-76].

Bovine tuberculosis as a reemerging foodborne illness is an infectious illness [77-84].

Bovine tuberculosis as a reemerging foodborne illness causes tuberculosis in human. Bovine tuberculosis as a reemerging foodborne illness *is a form of* tuberculosis *in human commonly caused by related types*, Bovine tuberculosis, *which related to the* Mycobacterium tuberculosis *complex* [85-89].’

Transmission and spread of Bovine tuberculosis as a reemerging foodborne illness. The Tuberculosis is infectious and may be transported directly through direct contact with the infected cattle, or indirectly through oral route of infection [90-94].

The common route of infection in cattle herds occur through the way of inhalation of infected air aerosols produced from the infected lungs of infected animals. Young calves may be infected through ingestion of contaminated colostrum or milk from cows infected with bovine tuberculosis [95-101].

The man may acquire the infection through ingestion of raw unpasteurized milk or milk products from an infected cow, or through contact with infected tissues at the Slaughter house

inspection or butcheries shops [102, 103]. The incubation period of Tuberculosis is slow and takes months or several years to reach the hopeless case. The infected animal may shed the bacteria within the animal herd before the clinical pictures of the symptoms appear. Movement of subclinical infected cattle is a main route of spreading the Tuberculosis infection [104-106].

Detection of Bovine tuberculosis as a reemerging foodborne illness, Bovine tuberculosis as a reemerging foodborne illness symptoms are inaccurate and, therefore, do not enable inspectors to make a definitive Detection based on symptoms alone [107, 108].

The tuberculin test depend up on skin examination is the standard method for tuberculosis Detection in the live cattle [109-112].

The recommended Blood based in vitro examinations that detection of causative bacteria, detection of antibodies, or detection of cell-mediated immunity are also available, or under development to give accurate results [113-118]. The most widely recommended blood-based examination is a gamma interferon release assay which detects a cell-mediated immune response to infection with Bovine tuberculosis [1, 118]. This examination is based on the principle that bovine blood cells that have previously been exposed to Bovine tuberculosis illness through an infection are known to produce elevated levels of gamma interferon following in vitro incubation time with Bovine tuberculosis antigens [2, 3].

The definitive Detection is confirmed through bacterial culture and identification in the laboratory [77, 78].

The used detection methods of Bovine tuberculosis as a reemerging foodborne illness, showing all the efforts of processing and the administering of the bovine tuberculin requirements [84, 85].

Public health risk of Bovine tuberculosis as a reemerging foodborne illness. The most common form of tuberculosis in *man* is caused by M. tuberculosis bacteria [89, 90]. It is impossible to clinical pictures differentiation to infection by M. tuberculosis bacteria from those caused by Bovine tuberculosis, able to account for up to ten percentages of human tuberculosis cases in some countries in the world [77-93]. Bovine tuberculosis as a reemerging foodborne illness detection may be further complicated through the tendency of Bovine tuberculosis infections to affect tissues other than the lungs and Bovine tuberculosis bacteria is resistant to one of the antimicrobials used in the treatment of tuberculosis infection in human [23, 24].

The applicable methods and decisions that are used to control the human and animal health hazards due to the infection of cattle with Mycobacterium tuberculosis complex, including Bovine tuberculosis [29, 30].

Role of the Slaughter house in eradication of Bovine tuberculosis as a reemerging foodborne illness. The Tuberculosis in human is the most common cause of illness and mortality in the world [117-118]. Caused mainly by Bovine tuberculosis as a reemerging foodborne illness and is transmitted by the respiratory route through direct close contact and inspiration aerosols of persons infected with tuberculosis [35, 36]. The Bovine tuberculosis as a reemerging foodborne illness is a less incidence form of human tuberculosis due to related member of the Mycobacterium tuberculosis complex (Bovine tuberculosis) [41, 42]. The Bovine tuberculosis as a reemerging foodborne illness is mainly indirectly transmitted by the ingestion of contaminated unpasteurized milk, dairy products, or meat that containing infected materials from infected animals [114-116]. In the world the regions where food inspection is still applied, the hazard to the public health has been minimized [111-113]; however Bovine tuberculosis as a reemerging foodborne illness infection remains an occupational hazard to food of animal origin eaters workers, the Slaughter house workers, and butchers [43-48]. Bovine tuberculosis as a reemerging foodborne illness is depend up on a One Health of human and animals recognizing the interdependence of human and animal health sectors for showing the main health, environmental and economic impacts of this disease [107-110, 49-54]. Effective action from all sectors and different methods as political, financial and investigation methods [56-60]. Defining the priorities for control Bovine tuberculosis as a reemerging foodborne illness in *man* and bovine tuberculosis in cattle [66-68]. Through Improving the scientific evidence base, Reduce transmission between cattle and humans, Supporting the cooperation between sectors, Preventive and control measures of Bovine tuberculosis as a reemerging foodborne illness [100-103]. The control and eradication measures Nationally depend up on examination, slaughtering healthy and infected cattle at the Slaughter house under the hygienic precautions, each in separate place is successfully used to control and eradicate Bovine tuberculosis as a reemerging foodborne illness [74, 75]. The meat quality is a complex concept involving a whole range of factors which for the consumer include safety, nutritional quality, availability, convenience and integrity, freshness, eating quality and the obvious physical attributes of the species, size and product type. Information about handling, processing and storage techniques, including time / temperature histories, that may affect the freshness and quality of the products is used for the partners in the chain The measures still inapplicable in some heavily infected countries in the world because it could necessitate slaughtering large numbers of cattle, and this may not be suitable, due to human resources are limited [16-18]. Besides contamination in meat processing facilities, contamination at the consumer and restaurant levels has gained increasing attention. Cross-contamination is the major concerns. Hands and utensils, as well as other food contact surfaces in kitchens, have repeatedly been reported as contamination sources So, most of countries in the world apply varying types of examination and segregation in early state, and then switch to examine &slaughter methods in the final stage [78-80]. The Bovine tuberculosis as a reemerging foodborne illness is the most serious cause of losses in meat, so many Tuberculosis eradication tools are successful used to eradicate the Bovine

tuberculosis as a reemerging foodborne illness in animals, through applying a strict hygienic post mortem meat inspection at the Slaughter house, for detection of infected cattle and herds for Bovine tuberculosis as a reemerging foodborne illness, intensive surveillance on-farm visits, systematic individual examination of cattle, removal of infected and in-contact cattle, adequate local legislation, effective animal transportation control, diseased cattle identification, and effective Bovine tuberculosis as a reemerging foodborne illness traceability [16-19]. The raw meat may harbor a large number of foodborne bacteria, resulting in the substandard quality and the public health hazards, and so detection of Bovine tuberculosis of the diseased cattle in the Slaughter houses to protect the food chain and allows Veterinary Services to know the herd origin of the infected animal, then examine and eliminate the source of the Bovine tuberculosis [5-9].

The pasteurization or heat treatment tool of cow's milk to certain temperature able to kill the Bovine tuberculosis bacteria is efficient tool for minimizing Bovine tuberculosis in humans [24-27].

The antimicrobial treatment of the infected cattle is rarely attempted because of the doses and the duration of the treatment that would be required, the high cost of the medications, and the interference with the primary goal of eliminating the Bovine tuberculosis, and the potential hazards of the developing Bovine tuberculosis resistance to the drugs [28-34].

3. Conclusion

The Vaccination tool in human is applied, but in cattle it is not used as a preventive method due to the lack of suitable safe and effective method of vaccination, and may be possibility of interaction with bovine tuberculosis surveillance and examinations, due to false results due to the reactions in vaccinated cattle. Studies are actively examine potential new or improved bovine tuberculosis vaccines and alternate methods of vaccine delivery for application in cattle and new examinations methods to reliably differentiate vaccinated cattle from infected one.

Conflicts of Interest

The author declares no conflicts of interest.

References

[1] Abdel-Moein K. A., Hamed O., Fouad H. Molecular detection of Mycobacterium tuberculosis in cattle and buffaloes: A cause for public health concern. Trop. Anim. Health Prod. 2016; 48: 1541–1545.

[2] Shaltout, F. A., Riad,. M., and AbouElhassan, Asmaa, A (2017): prevalence Of Mycobacterium Tuberculosis In Imported cattle Offals And Its lymph Nodes. Veterinary Medical Journal -Giza (VMJG), 63(2): 115–122.

[3] Manual of Diagnostic Tests and Vaccines for Terrestrial Animals, twelfth edition 2023.

[4] Shaltout, F. A., Riad, E. M., and Asmaa Abou-Elhassan (2017): Prevalence Of Mycobacterium Spp. In Cattle Meat And Offal's Slaughtered In And Out Abattoir. Egyptian Veterinary medical Association, 77(2): 407–420.

[5] Roadmap for zoonotic tuberculosis © World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO) and World Organisation for Animal Health (OIE), 2017.

[6] Abd Elaziz, O., Fatin S. Hassanin, Fahim A. Shaltout and Othman A. Mohamed (2021): Prevalence of Some Foodborne Parasitic Affection in Slaughtered Animals in Loacal Egyptian Abottoir. Journal of Nutrition Food Science and Technology 2(3): 1-5.

[7] Smith T. A comparative study of bovine tubercle bacilli and of human bacilli from sputum. *J. Exp. Med.* 1898; 3: 451–511.

[8] Abd Elaziz, O., Fatin, S Hassanin, Fahim, A Shaltout, Othman, A Mohamed (2021): Prevalence of some zoonotic parasitic affections in sheep carcasses in a local abattoir in Cairo, Egypt. Advances in Nutrition & Food Science 6(2): 25-31.

[9] Borham M., Oreiby A., El-Gedawy A., Hegazy Y., Al-Gaabary M. Tuberculin test errors and its effect on detection of bovine tuberculosis. J. Hell. Vet. Med. 2021; 72: 3263–3270.

[10] Al Shorman, A. A. M.; Shaltout,. A. and hilat, (1999): Detection of certain hormone residues in meat marketed in Jordan. Jordan University of Science and Technology, 1st International Conference on Sheep and goat Diseases and Productivity, 23-25 October, 1999.

[11] Alvarez A. H., Estrada-Ch ávez C., Flores-Valdez M. A. Molecular findings and approaches spotlighting Mycobacterium bovis persistence in cattle. Vet. Res. 2009; 40: 22.

[12] Edris, A. M.; Shaltout, F. A.; Salem, G. H. and El-Toukhy,. I. (2011): Plasmid profile analysis of Salmonellae isolated from some meat products. Benha University, aculty of Veterinary Medicine, Fourth Scientific Conference 25-27th May 2011 Veterinary Medicine and Food Safety: 194-201 benha, Egypt.

[13] Krajewska-Wędzina M., Didkowska A., Sridhara A. A., Elahi R., Johnathan-Lee A., Radulski Ł., Lipiec M., Anusz K., Lyashchenko K. P., Miller M. A., et al. Transboundary tuberculosis: Importation of alpacas infected with Mycobacterium bovis from the United Kingdom to Poland and potential for serodiagnostic assays in detecting tuberculin skin test false-negative animals. Transbound. Emerg. Dis. 2020; 67: 1306–1314.

[14] Hassanien, F. S.; Shaltout, F. A.; Fahmey, M. Z. and Elsukkary, H. F. (2020): Bacteriological quality guides in local and imported beef and their relation to public health. Benha Veterinary Medical Journal 39: 125-129.

[15] Egbe N. F., Muwonge A., Ndip L., Kelly R. F., Sander M., Tanya V., Ngwa V. N., Handel I. G., Novak A., Ngandalo R., et al. Molecular epidemiology of Mycobacterium bovis in Cameroon. Sci. Rep. 2017; 7: 4652.

[16] Hassanin, F. S; Shaltout, F. A., Lamada, H. M., Abd Allah, E. M. (2011): THE EFFECT OF PRESERVATIVE (NISIN) ON THE SURVIVAL OF LISTERIA MONOCYTOGENES. BENHA VETERINARY MEDICAL JOURNAL (2011)-SPECIAL ISSUE [I]: 141-145.

[17] Ameni G., Tadesse K., Hailu E., Deresse Y., Medhin G., Aseffa A., Hewinson G., Vordermeier M., Berg S. Transmission of Mycobacterium tuberculosis between farmers and cattle in central Ethiopia. PLoS ONE. 2014; 8: e76891.

[18] Khattab, E., ahim Shaltout and Islam Sabik (2021): Hepatitis A virus related to foods. BENHA VETERINARY MEDICAL JOURNAL 40(1): 174-179.

[19] Abdellrazeq G. S., Elnaggar M. M., Osman H. S., Davis W. C., Singh M. Prevalence of Bovine Tuberculosis in Egyptian Cattle and the Standardization of the Interferon-gamma Assay as an Ancillary Test. *Transbound. Emerg. Dis.* 2016; 63: 497–507.

[20] Saif., Saad S. M., Hassanin, F. S; Shaltout FA, Marionette Zaghloul (2019): Molecular detection of enterotoxigenic Staphylococcus aureus in ready-to-eat beef products. Benha Veterinary Medical Journal 37 (2019) 7-11.

[21] Charles O. T., James H. S., Michael J. G. Book. Mycobacterium bovis Infection in Animals and Humans. 2nd ed. Blackwell Publishing; Hoboken, NJ, USA: 2006.

[22] Shaltout, F. A., Mona N. Hussein, Nada Kh. Elsayed (2023): Histological Detection of Unauthorized Herbal and Animal Contents in Some Meat Products. Journal of Advanced Veterinary Research 13(2): 157-160.

[23] Klepp L. I., Eirin M. E., Garbaccio S., Soria M., Bigi F., Blanco F. C. Identification of bovine tuberculosis biomarkers to detect tuberculin skin test and IFNγ release assay false negative cattle. Res. Vet. Sci. 2019; 122: 7–14.

[24] Shaltout, F. A., Abdelazez Ahmed Helmy Barr and Mohamed Elsayed Abdelaziz (2022): Pathogenic Microorganisms in Meat Products. Biomedical Journal of Scientific & Technical Research 41(4): 32836-32843.

[25] Helmy N. M., Abdel-Moghney A. R. F., Atia M. A. Evaluation of Different PCR-Based Techniques in Diagnosis of Bovine Tuberculosis in Infected Cattle Lymph Nodes. Am. J. Microbiol. Biotechnol. 2015; 2: 75–81.

[26] Shaltout, F. A., E. M. El-diasty and M. A. Asmaa- Hassan (2020): HYGIENIC QUALITY OF READY TO EAT COOKED MEAT IN RESTAURANTS AT Cairo. Journal of Global Biosciences 8(12): 6627-6641.

[27] Domingo M., Vidal E., Marco A. Pathology of bovine tuberculosis. Res. Vet. Sci. 2014; 97: S20–S29.

[28] Shaltout, F. A. (2019): Food Hygiene and Control. Food Science and Nutrition Technology 4(5): 1-2.

[29] Orłowska B., Krajewska-Wędzina M., Augustynowicz-Kopeć E., Kozińska M., Brzezińska S., Zabost A., Didkowska A., Welz M., Kaczor S., Żmuda P., et al. Epidemiological characterization of Mycobacterium caprae strains isolated from wildlife in the Bieszczady Mountains, on the border of Southeast Poland. BMC Vet. Res. 2020; 16: 362.

[30] Gaafar, Hassanin, F. S; Shaltout, F. A., Marionette Zaghloul (2019): Hygienic profile of some ready to eat meat product sandwiches sold in Benha city, Qalubiya Governorate, Egypt. Benha Veterinary Medical Journal 37 (2) 16-21.

[31] Radostits O. M., Gay C. C., Blood D. C., Hinchliff K. W. Veterinary Medicine. A Textbook of the Diseases of Cattle, Sheep, Goats and Horses. 8th ed. Ballier Tindals; London, UK: 2007. pp. 830–838.

[32] Osman M. M., Shanahan J. K., Chu F., Takaki K. K., Pinckert M. L., Pagán A. J., Brosch R., Conrad W. H., Ramakrishnan L. The C terminus of the mycobacterium ESX-1 secretion system substrate ESAT-6 is required for phagosomal membrane damage and virulence. Proc. Natl. Acad. Sci. USA. 2022; 119: e2122161119.

[33] Saad S. M., Shaltout, F. A., Nahla A Abou Elroos2 and Saber B El-nahas (2019): Incidence of Staphylococci and E. coli in Meat and Some Meat Products. EC Nutrition 14.6 (2019).

[34] Miller M. A., Kerr T. J., de Waal C. R., Goosen W. J., Streicher E. M., Hausler G., Rossouw L., Manamela T., van Schalkwyk L., Kleynhans L., et al. Mycobacterium bovis Infection in Free-Ranging African Elephants. Emerg. Infect. Dis. 2021; 27: 990.

[35] Saad S. M., Hassanin, F. S.; Shaltout, F. A., Marionette Z Nassif, Marwa Z Seif. (2019: Prevalence of Methicillin-Resistant Staphylococcus Aureus in Some Ready-to-Eat Meat Products. American Journal of Biomedical Science & Research 4(6): 460-464.

[36] Fielding H. R., McKinley T. J., Delahay R. J., Silk M. J., McDonald R. A. Characterization of potential superspreader farms for bovine tuberculosis: A review. Vet. Med. Sci. 2021; 7: 310–321.

[37] Shaltout, F. A.; E. M EL-diasty; M. S. M Mohamed (2018): Effects of chitosan on quality attributes fresh meat slices stored at 4 C. BENHA VETERINARY MEDICAL JOURNAL, 35(2): 157-168.

[38] Byrne A. W., Graham J., Brown C., Donaghy A., Guelbenzu-Gonzalo M., McNair J., McDowell S. W. Modelling the variation in skin-test tuberculin reactions, post-mortem lesion counts and case pathology in tuberculosis-exposed cattle: Effects of animal characteristics, histories and co-infection. Transbound. Emerg. Dis. 2018; 65: 844–858.

[39] Shaltout, F. A., Mohamed, A. H. El-Shater., Wafaa Mohamed Abd El-Aziz (2015): Bacteriological assessment of Street Vended Meat Products sandwiches in kalyobia Governorate. BENHA VETERINARY MEDICAL JOURNAL, 28(2) 58-66.

[40] Elsayed M. S. A. E., Amer A. The rapid detection and differentiation of Mycobacterium tuberculosis complex members from cattle and water buffaloes in the delta area of Egypt, using a combination of real-time and conventional PCR. Mol. Biol. Rep. 2019; 46: 3909–3919.

[41] Shaltout, F. A., Mohamed A El shatter and Heba M Fahim (2019): Studies on Antibiotic Residues in Beef and Effect of Cooking and Freezing on Antibiotic Residues Beef Samples. Scholarly Journal of Food and Nutritionm 2(1) 1-4.

[42] Dejene S. W., Heitkönig I. M., Prins H. H., Lemma F. A., Mekonnen D. A., Alemu Z. E., Kelkay T. Z., de Boer W. F. Risk factors for bovine tuberculosis (bTB) in cattle in Ethiopia. PLoS ONE. 2016; 11: e0159083.

[43] Shaltout FA, Ahmed A A Maarouf and Mahmoud ES Elkhouly. (2017): Bacteriological Evaluation of Frozen Sausage. Nutrition and Food Toxicology 1.5; 174-185.

[44] Belinda S. T., Erin L. G. Rebhun's Diseases of Dairy Cattle. 3rd ed. Elsevier; Amsterdam, The Netherlands: 2018. Miscellaneous Infectious Diseases; pp. 745–746.

[45] Shaltout, F. A., A. M. Ali and S. M. Rashad (2016): Bacterial Contamination of Fast Foods. Benha Journal of Applied Sciences (BJAS) 1 (2) 45-51.

[46] Bezos J., Casal C., Romero B., Schroeder B., Hardegger R., Raeber A. J., Dom ńguez L. Current ante-mortem techniques for diagnosis of bovine tuberculosis. *Res. Vet. Sci.* 2014; 97: S44–S52.

[47] *Shaltout, F. A.,* Zakaria. I. M., Jehan Eltanani1, Asmaa. Elmelegy (2015): Microbiological status of meat and chicken received to University student hostel. BENHA VETERINARY MEDICAL JOURNAL, VOL. 29, NO. 2: 187-192, DECEMBER, 2015.

[48] Abbate J. M., Arfuso F., Iaria C., Arestia G., Lanteri G. Prevalence of bovine tuberculosis in slaughtered cattle in Sicily, Southern Italy. *Animals.* 2020; 10: 1473.

[49] Saad, S. M. and Shaltout, F. A. (1998): Mycological Evaluation of camel carcasses at Kalyobia Abattoirs. Vet. Med. J. Giza, 46(3): 223-229.

[50] Krajewska M., Załuski M., Zabost A., Orłowska B., Augustynowicz-Kopeć E., Anusz K., Lipiec M., Weiner M., Szulowski K. Tuberculosis in antelopes in a zoo in Poland–Problem of Public Health. Pol. J. Microbiol. 2015; 4: 405–407.

[51] Constable P. D., Hinchcliff K. W., Done S. H., Gr ünberg W. *Veterinary Medicine-e-Book: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats.* Elsevier; Amsterdam, The Netherlands: 2016.

[52] Shaltout FA, Riad EM, ES Ahmed and AbouElhassan A. (2017): Studying the Effect of Gamma Irradiation on Bovine Offal's Infected with *Mycobacterium tuberculosis* Bovine Type. Journal of Food Biotechnology Research 1 (6): 1-5.

[53] Romha G., Gebru G., Asefa A., Mamo G. Epidemiology of Mycobacterium bovis and Mycobacterium tuberculosis in animals: Transmission dynamics and control challenges of zoonotic tuberculosis in Ethiopia. *Prev. Vet. Med.* 2018; 158: 1–17.

[54] Howell A. K., McCann C. M., Wickstead F., Williams D. J. Co-infection of cattle with Fasciola hepatica or F. gigantica and Mycobacterium bovis: A systematic review. *PLoS ONE.* 2019; 14: e0226300.

[55] Shaltout FA, Mohamed, A. Hassan and Hassanin, F. S (2004): THERMAL INACTIVATION OF ENTERO-HAEMORRHAGIC ESCHERICHIA COLI O157: H7 AND ITS SENSTIVITY TO NISIN AND LACTIC ACID CULTURES. *1rst Ann. Confr., FVM., Moshtohor, Sept, 2004.*

[56] Shaltout FA, Mohammed Farouk; Hosam A. A. Ibrahim and Mostafa E. M. Afifi4. 2017: Incidence of Coliform and Staphylococcus aureus in ready to eat fast foods. BENHA VETERINARY MEDICAL JOURNAL, 32(1): 13-17, MARCH, 2017.

[57] Le Roex N., Koets A. P., Van Helden P. D., Hoal E. G. Gene polymorphisms in African buffalo associated with susceptibility to bovine tuberculosis infection. *PLoS ONE.* 2013; 8: e64494.

[58] Shaltout, F. A. (1992): Studies on Mycotoxins in Meat and Meat by Products. M. V. Sc Thesis Faculty of Veterinary Medicine, oshtohor, agazig University Benha branch.

[59] Vordermeier H. M., Jones G. J., Buddle B. M., Hewinson R. G., Villarreal-Ramos B. Bovine tuberculosis in cattle: Vaccines, DIVA tests, and host biomarker discovery. *Annu. Rev. Anim. Biosci.* 2016; 4: 87–109. https://doi.org/10.1146/annurev-animal-021815-111311

[60] Shaltout, F. A. (1996(: Mycological And Mycotoxicological profile Of Some Meat products. Ph. D. Thesis, Faculty of Veterinary Medicine, Moshtohor, Zagazig University Benha branch.

[61] Shaltout, F. A. (1998): Proteolytic Psychrotrophes in Some Meat products. Alex. Vet. Med. J. 14 (2): 97-107.

[62] Shaltout, F. A. (1999): Anaerobic Bacteria in Vacuum Packed Meat Products. Benha Vet. Med. J. 10 (1): 1-10.

[63] Hlokwe T. M., Said H., Gcebe N. Mycobacterium tuberculosis infection in cattle from the Eastern Cape Province of South Africa. BMC Vet. Res. 2017; 13: 299.

[64] Shaltout,. A. (2000): Protozoal Foodborne Pathogens in some Meat Products. Assiut Vet. Med. J. 42 (84): 54-59.

[65] Didkowska A., Orłowska B., Krajewska-Wędzina M., Krzysiak M., Bruczyńska M., Wiśniewski J., Anusz K. Intra-palpebral tuberculin skin test and interferon gamma release assay in diagnosing tuberculosis due to Mycobacterium caprae in European Bison (Bison bonasus) Pathogens. 2022; 11: 260.

[66] Shaltout,. A. (2001): Quality evaluation of sheep carcasses slaughtered at Kalyobia abattoirs. Assiut Veterinary Medical Journal, 46(91): 150-159.

[67] Jaouad B. Ph. D. Thesis. Iowa State University; Ames, IA, USA: 1993. Mycobacterium bovis Infection in Cattle in Morocco: Preparation and Evaluation of Chemical Extracts for Use in Detection of Immune Responses.

[68] Shaltout, F. A. (2003): *Yersinia Enterocolitica* in some meat products and fish marketed at Benha city. The Third international conference Mansoura 29-30 April.

[69] Kuria J. K. *Bacterial Cattle Diseases.* IntechOpen; London, UK: 2019. Diseases Caused by Bacteria in Cattle: Tuberculosis.

[70] Shaltout,. A. and Abdel Aziz,. M. (2004): ESCHERICHIA COLI STRAINS IN SLAUGHTERED ANIMALS AND THEIR PUBLIC HEALTH IMPORTENCE .J. Egypt. Vet. Med. Association 64(2): 7-21.

[71] Mittal M., Chakravarti S., Sharma V., Sanjeeth B. S., Churamani C. P., Kanwar N. S. Evidence of presence of Mycobacterium tuberculosis in bovine tissue samples by multiplex PCR: Possible relevance to reverse zoonosis. Transbound. Emerg. Dis. 2014; 61: 97–104.

[72] Shaltout,. A., Amin, R., Marionet, Z., Nassif and Shimaa, Abdel-wahab (2014): Detection of aflatoxins in some meat products. Benha veterinary medical journal, 27(2): 368-374.

[73] Pollock J. M., Neill S. D. Mycobacterium bovis infection and tuberculosis in cattle. Vet. J. 2002; 163: 115–127.

[74] Shaltout, A. and Afify, Jehan Riad, M and Abo Elhasan, Asmaa, A. (2012): Improvement of microbiological status of oriental sausage. Journal of Egyptian Veterinary Medical Association 72(2): 157-167.

[75] Kassa G. M., Abebe F., Worku Y., Legesse M., Medhin G., Bjune G., Ameni G. Tuberculosis in goats and sheep in Afar Pastoral Region of Ethiopia and isolation of Mycobacterium tuberculosis from goat. Vet. Med. Int. 2012; 2012: 869146.

[76] Shaltout, F. A. and Edris, A. M. (1999): Contamination of shawerma with pathogenic yeasts. Assiut Veterinary Medical Journal, 40(64): 34-39.

[77] Pascual-Linaza A. V., Gordon A. W., Stringer L. A., Menzies F. D. Efficiency of slaughterhouse surveillance for the detection of bovine tuberculosis in cattle in Northern Ireland. Epidemiol. Infect. 2017; 145: 995–1005.

[78] Shaltout, F. A.; Salem, R. Eldiasty, E.; and Diab, Fatema. (2016): Mycological evaluation of some ready to eat meat products with special reference to molecular chacterization. Veterinary Medical Journal -Giza 62(3) 9-14.

[79] Broughan J. M., Judge J., Ely E., Delahay R. J., Wilson G., Clifton-Hadley R. S., Goodchild A. V., Bishop H., Parry J. E., Downs S. H. A review of risk factors for bovine tuberculosis infection in cattle in the UK and Ireland. Epidemiol. Infect. 2016; 144: 2899–2926.

[80] Shaltout, F. A.; Elshater, M. and Wafaa, Abdelaziz (2015): Bacteriological assessment of street vended meat products sandwiches in Kalyobia Governorate. Benha Vet. Med. J. 28 (2): 58-66.

[81] Cvetkovikj I., Mrenoshki S., Krstevski K., Djadjovski I., Angjelovski B., Popova Z., Janevski A., Dodovski A., Cvetkovikj A. Bovine tuberculosis in the Republic of Macedonia: Postmortem, microbiological and molecular study in slaughtered reactor cattle. Maced. Vet. Rev. 2017; 40: 43–52.

[82] Shaltout,. A. and Ibrahim, H. M. (1997): Quality evaluation of luncheon and Alexandrian sausage. Benha Vet. Med. J. 10(1): 1-10.

[83] Ameni G., Vordermeier M., Firdessa R., Aseffa A., Hewinson G., Gordon S. V., Berg S. Mycobacterium tuberculosis infection in grazing cattle in central Ethiopia. Vet. J. 2011; 188: 359–361.

[84] Shaltout,. A., Amani M. Salem, A. H. Mahmoud, K. A (2013): Bacterial aspect of cooked meat and offal at street vendors level. Benha veterinary medical journal, 24(1): 320-328.

[85] Oreiby A. F., Hegazy Y. M., Al-Gaabary M. H., Osman S. A., Marzok M. A., Abushhiwaa M. Studies on clinical identification, elisa, bacteriological isolation, PCR and x-ray radiography for diagnosis of ovine caseous lymphadenitis. J. Anim. Vet. Adv. 2015; 14: 250–253.

[86] Shaltout,. A. and Salem, R. M. (2000): Moulds, aflatoxin B1 and Ochratoxin A in Frozen Livers and meat products. Vet. Med. J. Giza 48(3): 341-346.

[87] Murai K., Tizzani P., Awada L., Mur L., Mapitse N. J., Caceres P. Panorama 2019-1: Bovine tuberculosis: Global distribution and implementation status of prevention and control measures according to WAHIS data. OIE Bull. 2019; 1: 3.

[88] Shaltout, F. A.; Salem, R. M; El-diasty, Eman and Fatema, A. H. Diab. (2016): Mycological evaluation of some ready to eat meat products with special reference to molecular characterization. Veterinary Medical Journal – Giza, 62(3): 9-14.

[89] Brahma D., Narang D., Chandra M., Filia G., Singh A., Singh S. T. Diagnosis of Bovine Tuberculosis by Comparative Intradermal Tuberculin Test, Interferon Gamma Assay and esxB (CFP-10) PCR in Blood and Lymph Node Aspirates. Open J. Vet. Med. 2019; 9: 55–65.

[90] Shaltout FA, Reham A. Amin, Marionette Z. Nassif2, Shimaa A. Abd-Elwahab (2014): Detection of aflatoxins in some meat products. BENHA VETERINARY MEDICAL JOURNAL, VOL. 27, NO. 2: 368-374, DECEMBER 2014.

[91] Didkowska A., Orłowska B., Krajewska-Wędzina M., Augustynowicz-Kopeć E., Brzezińska S., Żygowska M., Wiśniewski J., Kaczor S., Welz M., Olech W., et al. Microbiological and molecular monitoring for bovine tuberculosis in the Polish population of European bison (Bison bonasus) Ann. Agric. Environ. Med. 2021; 28: 575–578.

[92] Shaltout,. A.; Hanan M. Lamada, Ehsan A. M. Edris. (2020): Bacteriological examination of some ready to eat meat and chicken meals. Biomed J Sci & Tech Res., 27(1): 20461-20465.

[93] Koch R. Die aetiologie der tuberkulose. Berl. Klin. Wochenschr. 1882; 19: 221–230.

[94] Edris,. M., Hassan,. A., Shaltout,. A. and Elhosseiny, S (2012): Detection of E. coli and Salmonella organisms in cattle and camel meat. BENHA VETERINARY MEDICAL JOURNAL, 24(2): 198-204.

[95] Ibrahim S., Danbirni S., Abubakar U. B., Usman A., Saidu A. S., Abdulkadir A. Estimates of Mycobacterial Infections Based on Abattoir Surveillance in Two North-Eastern States of Nigeria. Acta Sci. Microbiol. 2018; 1: 60–65.

[96] Hassanin, F. S; Shaltout,. A. and, Mostafa E. M (2013): Parasitic affections in edible offal. Benha Vet. Med. J. 25(2): 34-39.

[97] Markey B., Leonard F., Archambault M., Cullinane A., Maguire D. Clinical Veterinary Microbiology e-Book. 2nd ed. Elsevier; Amsterdam, The Netherlands: 2013.

[98] Ebeed Saleh, Fahim Shaltout, Essam Abd Elaal (2021); Effect of some organic acids on microbial quality of dressed cattle carcasses in Damietta abattoirs, Egypt. Damanhour Journal of Veterinary Sciences 5(2): 17-20.

[99] McCallan L., McNair J., Skuce R., Branch B. A Review of the Potential Role of Cattle Slurry in the Spread of Bovine Tuberculosis. Agri-food and Biosciences Institute; Belfast, UK: 2014.

[100] Hassanin, F. S; Hassan, M. A; Shaltout F. A.. and Elrais-Amina, M (2014): CLOSTRIDIUM PERFRINGENS IN VACUUM PACKAGED MEAT PRODUCTS. BENHA VETERINARY MEDICAL JOURNAL, 26(1): 49-53.

[101] Taylor S. J., Ahonen L. J., de Leij F. A., Dale J. W. Infection of Acanthamoeba castellanii with Mycobacterium bovis and M. bovis BCG and survival of M. bovis within the amoebae. Appl. Environ. Microbiol. 2003; 69: 4316–4319.

[102] Hassan, M. A and Shaltout, F. A. (2004): Comparative Study on Storage Stability of Beef, Chicken meat, and Fish at Chilling Temperature. Alex. J. Vet. Science, 20(21): 21-30.

[103] Mukundan H., Chambers M., Waters R., Larsen M. H., editors. Tuberculosis, Leprosy and Mycobacterial Diseases of Man and Animals: The Many Hosts of Mycobacteria. CABI; Oxfordshire, UK: 2015. Immunopathogenesis of Mycobacterium bovis Infection of Cattle; p. 136.

[104] Edris, A. M.; Shaltout, F. A. and Abd Allah, A. M. (2005): Incidence of Bacillus cereus in some meat products and the effect of cooking on its survival. Zag. Vet. J. 33(2): 118-124.

[105] Liebana E., Johnson L., Gough J., Durr P., Jahans K., Clifton-Hadley R., Downs S. H. Pathology of naturally occurring bovine tuberculosis in England and Wales. Vet. J. 2008; 176: 354–360.

[106] Waters W. R. Large Animal Internal Medicine-e-Book. Elsevier; Amsterdam, The Netherlands: 2015. Bovine Tuberculosis; pp. 633–636. Chapter 31.

[107] Hazaa, Shaltout, F. A., Mohamed El-Shater (2019): Identification of Some Biological Hazards in Some Meat Products. Benha Veterinary Medical Journal 37(2) 27-31.

[108] Stear M. OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals (Mammals, Birds and Bees) 5th Edn. Volumes 1 and 2. World Organization for Animal Health 2004. ISBN 92 9044 622 6.€ 140. Parasitology. 2005; 130: 727.

[109] Elnaggar M. M., Abdellrazeq G. S., Elsisy A., Mahmoud A. H., Shyboub A., Sester M., Davis W. C. Evaluation of antigen specific interleukin-1β as a biomarker to detect cattle infected with Mycobacterium bovis. Tuberculosis. 2017; 105: 53–59.

[110] De la Rua-Domenech R., Goodchild A. T., Vordermeier H. M., Hewinson R. G., Christiansen K. H., Clifton-Hadley R. S. Ante mortem diagnosis of tuberculosis in cattle: A review of the tuberculin tests, γ-interferon assay and other ancillary diagnostic techniques. Res. Vet. Sci. 2006; 81: 190–210.

[111] Picasso-Risso C., Grau A., Bakker D., Nacar J., M ńguez O., Perez A., Alvarez J. Association between results of diagnostic tests for bovine tuberculosis and Johne's disease in cattle. Vet. Rec. 2019; 185: 693.

[112] Saif,., Saad S. M., Hassanin, F. S; Shaltout, F. A., Marionette Zaghlou (2019); Prevalence of methicillin-resistant Staphylococcus aureus in some ready-to-eat meat products. Benha Veterinary Medical Journal 37(2019) 12-15.

[113] Parlane N. A., Chen S., Jones G. J., Vordermeier H. M., Wedlock D. N., Rehm B. H., Buddle B. M. Display of antigens on polyester inclusions lowers the antigen concentration required for a bovine tuberculosis skin test. Clin. Vaccine Immunol. 2016; 23: 19–26.

[114] Gaafar, Hassanin, F. S; Shaltout, F. A., Marionette Zaghloul (2019): Molecular detection of enterotoxigenic Staphylococcus aureus in some ready to eat meat-based sandwiches. Benha Veterinary Medical Journal 37(2) 22-26.

[115] Picasso-Risso C., Alvarez J., VanderWaal K., Kinsley A., Gil A., Wells S. J., Perez A. Modelling the effect of test-and-slaughter strategies to control bovine tuberculosis in endemic high prevalence herds. Transbound. Emerg. Dis. 2021; 68: 1205–1215.

[116] Shaltout FA, El-Toukhy EI and Abd El-Hai MM. (2019): Molecular Diagnosis of Salmonellae in Frozen Meat and Some Meat Products. Nutrition and Food Technology Open Acces (1): 1-6.

[117] El-Sawalhy A. Veterinary Infectious Diseases in Domestic Animals. 3rd ed. Vetbook; Cairo, Egypt: 2012. pp. 305–308.

[118] Edris, A. M.; Shaltout, F. A.; Salem, G. H. and El-Toukhy,. I. (2011): Incidence and isolation of Salmonellae from some meat products. Benha University, aculty of Veterinary Medicine, Fourth Scientific Conference 25-27th May 2011Veterinary Medicine and Food Safety) 172-179 benha, Egypt.