Abattoir-Based Survey and Histopathological Findings of Lumpy Skin Disease in Cattle at Ismailia Abattoir

Ali Meawad Ahmed and Amina A. Dessouki

***Abstract*—A cross-sectional study on Lumpy Skin Disease (LSD) was conducted at Ismailia Abattoir, Egypt for determining the prevalence of LSD in cattle. The results showed that summer represented the highest season for slaughtering of the cattle (5468 animal) followed by autumn (4367) then spring (3421), and winter (2988). Out of 10055 slaughtered cattle, 101 male (1.0%) and 14 female (0.1%) that presented lesions diagnosed as specific LSD lesions. There was statistically difference (P>0.05) in prevalence of LSD in cattle between seasons. LSD could not be reported in buffaloes or calves. The highest prevalence of LSD in male cattle was observed in autumn 53 (2.01%) followed by winter 30 (1.7%), summer 18 (0.5%). Similarly, the highest prevalence of LSD in female cattle was observed in autumn 7 (0.3%) followed by winter 5 (0.2%), summer 2 (0.1%). Histopathological examination of the suspected samples revealed presence of ballooning degeneration and intracytoplasmic inclusion bodies characteristic of LSD. The estimated annual loss from condemn carcasses was 13770 Egyptian Pound. In conclusion, abattoir records showed a wide spectrum data concerning LSD occurring in traditional livestock herds. In order to overcome the economic loss, it should be development of effective vaccines derived from the original.**

***Index Terms*—Lumpy skin disease, Egypt, cattle, histopathological, economic impact.**

I. Introduction

Lumpy skin disease (LSD) is an economically devastating emerging viral disease of cattle that currently endemic in most African countries and has recently spread out of Africa into the Middle East region [1]. LSD is caused by the pox virus of the genus Capripoxvirus which causes acute, subacute or inapparent disease in cattle. The disease was first described in Northern Rhodesia (currently Zambia) in 1929 and then a rapid spread was observed in cattle over most of the African continent [2].

Lumpy skin disease has a worldwide distribution but the disease is very common in Africa reaching a level of 30-36% in Kenya, 20% in Guinea, 18% in Sierra [3]. A recent cross-sectional study across different agro-ecological zones and Oromia region in Ethiopia showed an overall observed LSD animal-level prevalence of 8.1% and 33.93% respectively, a mortality of 2.12% and 7.43% respectively [4, 5]. LSD is endemic in Egypt (Ismailia) since 1988 [6] with a marked increase in the prevalence of clinical disease reach level of 25.47% in 2008 [7]. Recent study by [8] was conducted on 500 cattle of different breed in Giza governorate, Egypt, revealed that the mortality and case fatality rates of LSD among examined Egyptian cattle were, 1.8%, and 1.8% respectively.

Histopathology can be an important tool to exclude viral, bacterial or fungal causes of nodular development in clinical cases and characteristic cytopathic effects (necrosed epidermis, ballooning degeneration of squamous epithelial cells and eosinophilic intracytoplasmic inclusion bodies) in cases of lumpy skin disease are well documented [9]. Histopathology of skin lesions provides a method to recognize the intracytoplasmic inclusion bodies of LSD virus-infected cells by using haematoxylin and eosin staining [10], [11].

The clinical effect of lumpy skin diseases on infected animals is economically important. It causes considerable economic losses due to emaciation, infertility in males and females, mastitis, loss of milk production and mortality of up to 40%, although mortality rarely exceeds 3% [12]. Economic losses may be high due to the condemnation of carcass arising from fever as well as the cost of inspecting meat. Moreover, severe and permanent damage can occur to hides, decreasing their commercial value [5].

Abattoir-based studies may be considered to be the most sensitive approach for the evaluation of animal health and economic impact of any infection diseases. However, lumpy skin disease and the associated financial loss in cattle at Ismailia Abattoir (Egypt) were not yet assessed. Therefore, the objectives of this work were to determining the prevalence of lumpy skin disease at main traditional abattoir of Ismailia city, Egypt. Laboratory confirmation for the obtained data using histopatholgical examination of infected samples. The economic impact for the disease was also calculated.

II. Materials and Methods

A. Study Area

The study was done at main traditional abattoir of Ismailia city that present in Abo-Atoa district. This abattoir considered one of the largest and oldest province abattoirs in Egypt which built in 1956. Ismailia is a city in northeast Egypt, on the west bank of the Suez Canal, and is the capital of the Ismailia Governorate. It has a population (including surrounding rural areas) of approximately 750,000. It is located approximately half way between Port-Said to the north and Suez to the south. The Canal widens at that point to

Manuscript received January 9, 2013; revised March 22, 2013.

Ali Meawad Ahmed is with the Faculty of Veterinary Medicine, Suez Canal University, Egypt (e-mail: ameawad@yahoo.com).

Amina A. Dessouki is with the Dept. of Food Hygiene and Dept. of Pathology.

include Lake Timsah, one of the Bitter Lakes linked by the Canal. It is located 140 km near the east of Cairo along the Suez Canal. Ismailia geographical coordinates are 30-35° North, 32 16° East.

B. Study Population

The study animals comprised male cattle presented for slaughter from different localities in the Ismailia Abattoir. A total of 16244 cattle were slaughtered over one year and examined following ante-mortem and post-mortem inspection procedure. The prevalence of the gross lesions was collected on a monthly basis started from March 2010 to February 2011. It was not possible to get the exact records on breed, gender, weight and age for each slaughtered animals during the study period due to poor recording systems at the Ismailia abattoir.

C. Pre and Post Slaughter Inspection

Meat inspection was carried out at the Ismailia abattoir by trained veterinarians under close supervision of local authority. Each slaughtered animal is individually inspected by veterinarians in the course of their routine duties. All animals presented for slaughter were physically observed before or shortly prior to slaughter. Inspection of the animals was made while at rest or in motion for any obvious sign of disease. Post-slaughter examination involved visual examination of carcasses and organs with keen attention being directed to livers, lungs, hearts, gastrointestinal tract and skin. Through palpation and incision of suspected organs.

D. Macroscopic LSD Lesions

The records of the skin and organ lesion(s) that observed and condemned were noted by meat inspector based on Egyptian Guidelines for Inspection of Cattle [13]. Gross lesions on skin, tongue, lips, dental pad, lung, liver, spleen, kidney, feet and udder, teats were recorded and imaged by digital camera.

E. Laboratory Investigations

Representative pieces of skin nodules from all clinical cases were collected in sterilized containers. Samples were then fixed in 10% buffered formalin and transported to pathology section of VRC. The tissues were processed to obtain 4-5μ thick paraffin embedded sections and were stained with heamatoxylin and eosin [14].

F. Statistical Analysis

Data obtained from antemortem and postmortem examination, and laboratory findings were entered into Ms Excel and analyzed using SPSS version 12. The data showed in table by frequency and percentages (%). The figures of LSD lesion showed in colored imaged.

III. Results and Discussion

A. Cattle Slaughter and Economic Impact

The study was a retrospective abattoir survey, undertaken for a period of one full year from March 2010 to February 2011. During this period a total of 16244 bovine species were slaughtered and inspected (Table I). A total of 642 female buffaloes, 175 female cattle, 3169 male buffaloes, 9880 male cattle and 2378 calve were slaughtered and their records formed a source of data for the current study. The frequency and percentages of female buffaloes, female cattle, male buffaloes, male cattle and calve slaughtered in autumn were 141 (21.9%), 37 (21.1%), 894 (28.3%), 2502 (25.3%) and 793 (33.3%) animals, respectively. For winter the same number were 85 (13.3%), 25 (14.3%), 647 (20.4%), 1737 (17.6%) and 494 (20.8%) animals respectively. For spring, the slaughtered animals were 218 (33.9%), 75 (42.9%), 654 (20.6%), 1950 (19.7%) and 524 (22.1%), respectively. Finally for summer, the number of slaughtered animals were 198 (30.9%), 38 (21.7 %), 974 (30.7%), 3691 (37.5%) and 567 (23.8%), respectively.

TABLE I: Cattle Population by Sex and Age Groups in the Study Districts

Slaughter Animal											
Animal	Female				Male				Calves		Total
	Buffaloes		Cattle		Buffaloes		Cattle				
Season	No.	~F	No.	F	No.	F	No.	F	No.	F	No. (F)
Autumn	141	21.9	37	21.1	894	28.3	2502	25.3	793	33.3	4367 (26.8)
Winter	85	13.3	25	14.3	647	20.4	1737	17.5	494	20.8	2988 (18.4)
Spring	218	33.9	75	42.9	654	20.6	1950	19.7	524	22.1	3421 (21.1)
Summer	198	30.9	38	21.7	974	30.7	3691	37.5	567	23.8	5468 (33.7)
Total	642	100	175	100	3169	100	9880	100	2378	100	16244 (100)

~F means Frequency

Male cattle represented the most bovine species slaughtered in Ismailia abattoir followed by male buffaloes, then calves. Summer season represented the highest season for slaughtering of the cattle (5468 animal) followed by autumn (4367) then spring (3421), and winter (2988). This may due to the location of Ismailia as tourist city that attract many people during summer season, subsequently increased in their population and meat demand.

Based on the obtained data and the population number of Ismailia (average 750000), each person gain average 3.3 kg of meat per year. FAO (2001) recorded that at least 25 kg of meat per year is necessary for each person. In the current study, the low meat production from Ismailia abattoir may be interpreted as the economic status of Ismailia population and the possibility too much of the meat consumed is coming from the informal or illegal slaughter of the animals. In addition to, some of imported meat was marketed in Ismailia city.

Out of 10055 slaughtered cattle, 101 male (1.0%) and 14 female (0.1%) that presented lesions diagnosed as “specific” LSD lesions (Table II). There was statistically significant difference (P>0.05) in prevalence of LSD between seasons. The highest prevalence of LSD in male cattle was observed in

autumn 53 (2.01%) followed by winter 30 (1.7%), summer 18 (0.5%). Similarly, the highest prevalence of LSD in female cattle was observed in autumn 7 (0.3%) followed by winter 5 (0.2%), summer 2 (0.1%). LSD could not be reported in buffaloes nor calve at the current study. Higher results was reported by [7], who recorded that LSD observed in all seasons: autumn, winter, spring and summer by 25.60%, 36.70%, 21.43% and 14.58%, respectively. The prevalence of LSD in this study was slightly in agreement with the findings of [8].

TABLE II: PREVALENCE AND ECONOMIC IMPACT OF LUMPY SKIN DISEASE ON THE ISMAILIA ABATTOIR

	Number Slaughtered		Diseased cattle				Condemned Carcasses				Economic Losses
			Male		Female		Number		Weight (Kg)		
Season	No.	~F	No.	%	No.	%	No.	%	No.	F	**E. P.
Autumn	a2539	25.3	53	2.01	7	0.3	16	0.6	*2720	59.3	81600
Winter	b1762	17.5	30	1.7	5	0.2	7	0.4	1190	25.9	35700
Spring	c2025	20.1	0	0	0	0	0	0	0	0	0
Summer	d3729	37.1	18	0.5	2	0.1	4	0.1	680	14.8	20400
Total	10055	100	101	1.0	14	0.1	27	0.3	4590	100	137700

*Average weight of cattle carcass was 170Kg. **Average market price for beef was 30 E.P. LSD did not detect in both of buffaloes nor calves. ~F means Frequency Means with the same litter in the same column were not different ($P > 0.05$).

The Directorate of Veterinary Medicine in Ismailia has immunization program against the LSD for all herds of cattle, however there is the emergence of many cases that difficult to interpret because no published data are available that deal with failure of beef cattle to develop immune resistance following LDSV vaccination. Beef cattle vaccination presents many technical and management difficulties, and the questions arise of whether these difficulties are responsible for the high proportion of beef cows with lesions and whether this high proportion is caused by vaccination or immunization failure [15].

The economic impact of LSD results from carcasses condemnation as the result of secondary infection and fever. The average price of un-deboned beef in Ismailia city was 30 Egyptian Pound. The estimated annual loss from carcasses condemnation was 13770 Egyptian Pound. Autumn and winter season represent the higher economic loss in compared with other season. LSD constitutes a serious and major problem for breeders than for veterinarians, because of the major economic losses they cause, and the expenses of the care and control programm.

Gross Lesions and Histopathological Finding

Nodules are present which involve all layers of the skin, the subcutaneous tissue and sometimes the adjacent musculature. There were disseminated cutaneous papules with necrotic centers (Fig. 1 and Fig. 2). Same grossly lumpy skin lesions reported by [8] as nodules 1 to 7 cm in diameter and occurred anywhere on the animal body. The hair stands erected over early skin lesions. The nodules involved the epidermis, dermis, and subcutaneous tissue and may even spread to the musculature.

Fig. 1. Progression of lumpy skin disease: note the necrotic nodules.

The histopathological examination was aimed to exclude bacterial or fungal involvement in the formation of the characteristic nodules of LSD. The H & E stained section from different parts of the skin lesion showed hyperplasia of spinous cell layer (acanthosis), degeneration (Fig. 3). Lesion of Lumpy Skin diseases showed presence of eosinophilic intracytoplasmic inclusions bodies was easily recorded due to lumpy skin disease virus (Fig. 4). The study of [9] describe the Histopathological skin lesion of LSD on cattle as the epidermis was extensively necrotic, while in the intact areas, some ballooning degeneration of squamous epithelial cells with occasional intra-cytoplasmic inclusions were seen. Some lesions can be seen in the squamous epithelial cells of some of the hair follicles. Prominent lesions of vasculitic necrosis with cell debris and severe diffuse infiltration with inflammatory cells mainly neutrophlis, were seen in the superficial and deep dermis. In some areas they also involved the muscular layers.

Fig. 2. Skin nodules have congestion, hemorrhage, edema, and vasculitis with consequent necrosis and involve all layers of the epidermis, dermis, subcutaneous tissue, and often adjacent musculature.

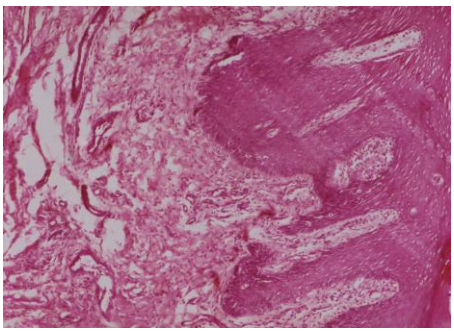

Fig. 3. Cattle skin showed hyperplasia of spinous cell layer (acanthosis), degeneration, H & E. X 200.

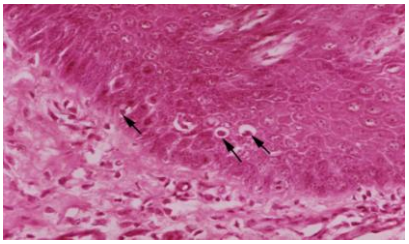

Fig. 4. Photomicrograph of skin presence of Intracytoplasmic eosinophilic inclusions due to lumpy skin disease virus, H & E X 400.

In conclusion, this data should be considered to the concerned authority in their endeavors to control the lumpy skin disease. Histopathological examination is useful method for a rapid confirmation for the diagnosis of LSD. Egyptian buffaloes are more resistance to LSD than cattle. In order to overcome the economic loss and the continuous appearance of new cases of the LSD, it should be development of effective vaccines derived from the original.

ACKNOWLEDGEMENTS

The authors would like to thank Dr. Ahmed Al-Garhy, Vice Director of Ismailia city abattoir, Egypt for co-operation, his technical assistance during samples and data collection.

REFERENCES

[1] E. S. Tuppurainen and C. A. Oura, "Review: lumpy skin disease: an emerging threat to Europe, the Middle East and Asia," *Transbound Emerg Dis.*, vol. 59, no. 1, pp. 40-48, 2012.

[2] F. G. Davis, "Lumpy skin disease, an African capripox virus disease of cattle," *Br. Vet. J.*, vol. 147, pp. 489-502, 1991.

[3] P. Hunter and D. Wallace, "Lumpy skin disease in southern Africa: a review of the disease and aspects of control," *J. S. Afr. Vet. Assoc*, vol. 72, no. 68–71, 2001.

[4] G. Gari, A. Waret-Szkuta, V. Grosbois, P. Jacquiet, and F. Roger, "Risk factors associated to observed clinical lumpy skin disease in Ethiopia," *Epidemiol. Infect*, vol. 138, pp. 1657–1666, 2010.

[5] G. Garia, G. Bonnetc, F. Rogerb, and A. Waret-Szkutab, "Epidemiological aspects and financial impact of lumpy skin disease in Ethiopia," *Preventive Veterinary Medicine*, vol. 102, pp. 274– 283, W. M. Ahmed and K. S. Kawther S. Zaher, "2008 Observations on lumpy skin disease in local Egyptian cows with emphasis on its impact on ovarian function," *African Journal of Microbiology Research*, vol. 2, pp. 252-257, 2011.

[6] A. A. Ali, E. H. Attia, A. Selim, and Y. M. Abdul-Hamid, "Clinical and pathological studies on lumpy skin disease in Egypt," *Vet Rec*, vol. 127, pp. 549-550, 1990.

[7] W. M. Ahmed, S. Kawther, and K. S. Zaher, "Observations on lumpy skin disease in local Egyptian cows with emphasis on its impact on ovarian function," *African Journal of Microbiology Research*, vol. 2, pp. 252-257, 2008.

[8] F. A. Salib and A. H. Osman, "Incidence of lumpy skin disease among Egyptian cattle in Giza Governorate, Egypt," *Vet. World*, vol. 4, no. 4, pp. 162-167, 2011.

[9] J. Brenner *et al.*, "Lumpy skin disease (LSD) in a large dairy herd in Israel," *Isr. J. Vet. Med.*, vol. 61, pp. 73-77, 2006.

[10] D. H. Haines and B. J. Chelack, "Technical considerations for developing enzyme immunohistochemical staining procedures on formalin-fixed paraffin-embedded tissues for diagnostic pathology," *Ournal of veterinary Diagnostic Investigation*, vol. 3, pp. 101-112, 1991.

[11] E. S. M. Tuppurainen, W. H. Stoltz, M. Troskie, D. B. Wallace, C. A. L. Oura, P. S. Mellor, J. A. W. Coetzer, and E. H. Venter, "A potential role for Ixodid (hard) tick vectors in the transmission of lumpy skin disease virus in cattle," *Transbound Emerg Dis*, vol. 58, pp. 93-104, 2011.

[12] B. J. H. Barnard, E. Munz, K. Dumbell, and L. Prozesky, "Lumpy skin disease," in J. A. W. Coetzer, G. R. Thomson, R. C. Tustin, N. P. J. Kriek, editors, *Infectious diseases of livestock with special reference to Southern Africa*, Cape Town: Oxford University Press, pp. 604–12, 1994.

[13] Law 517, "Slaughter animals and meat trade. Ministry of Agriculture," *Egyptian Gazette*, no. 257, 1986.

[14] L. G. Luna, *Manual of histological staining methods of the Armed Forces Institute of Pathology*, 3rd ed., New York: McGraw-Hill, 1968.

[15] J. Brennera *et al.*, "Appearance of skin lesions in cattle populations vaccinated against lumpy skin disease: Statutory challenge," *Vaccine*, vol. 27, pp. 1500–1503, 2009.

Dr. Ali Meawad Ahmed has completed his Ph.D at the age of 29 years from Suez Canal University with cooperation of Virginia Polytechnic and State University, USA (Egyptian Mission). He is a professor of Food Hygiene. He was a chief of Food Hygiene department and now he is a Vice Dean of Faculty of Veterinary Medicine, Suez Canal University. He follows the scientific school that fervors food safety, meat hygiene, meat technology, meat microbiology, fish hygiene, and poultry hygiene. He has published more than 48 scientific papers in local and international journals.