



**UNIVERSITI PUTRA MALAYSIA**

***PREVALENCE OF MASTITIS IN GOATS FROM LADANG ANGKAT  
UPM AND ITS RELATIONSHIP WITH SELECTED RISK FACTORS***

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**PREVALENCE OF MASTITIS IN GOATS FROM *LADANG ANGKAT* UPM  
AND ITS RELATIONSHIP WITH SELECTED RISK FACTORS**

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A project paper submitted to the Faculty of Veterinary Medicine, Universiti Putra  
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VETERINARY MEDICINE

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## CERTIFICATION

It is hereby certified that we have read this project paper entitled “Prevalence of Mastitis in Goats from *Ladang Angkat* UPM and Its Relationship with Selected Risk Factors”, by Wan Mohd Sukri Bin Wan Ishak and in our opinion it is satisfactory in term of scope, quality, and presentation as partial fulfilment of the requirement for the course VPD 4999 - Final Year Project.

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## DEDICATION

This thesis is dedicated to God Almighty; my father, Mohd Noor Yahya; my mother, Siti Aliah Deraman, and my sisters, Norfaizah Mohd Noor, who had accompanied me in my journey of becoming veterinarian.



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**ABSTRAK**

Abstrak daripada kertas projek yang di kemukakan kepada Fakulti Perubatan Veterinar, UPM untuk memenuhi sebahagian daripada keperluan kursus VPD 4999-  
Projek Ilmiah Tahun Akhir.

**PREVALENS MASTITIS PADA KAMBING DARI LADANG ANGKAT UPM  
DAN HUBUNGKAITNYA DENGAN FAKTOR RISIKO TERPILIH**

Oleh

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2015

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**Penyelia bersama: Professor Madya Dr. Siti Khairani binti Bejo**

Kajian ini telah dijalankan untuk menentukan prevalens mastitis klinikal dan subklinikal, patogen dalam susu, dan hubungkait faktor risiko terpilih dengan mastitis di ladang kambing, Ladang Angkat Universiti Putra Malaysia (UPM). Sebanyak 158 sampel susu dari 80 kambing dari lapan ladang telah dikumpulkan secara aseptis. Mastitis klinikal dinilai berdasarkan keabnormalan ambing susu serta susu, subklinikal mastitis telah diuji di ladang menggunakan ujian California Mastitis Test (CMT), kultur bakteria untuk kenalpasti patogen, dan kaedah resapan cakera Kirby-Bauer untuk antibiogram. Faktor risiko terpilih ladang telah dikaji menggunakan soal selidik. Prevalens keseluruhan adalah 49% (klinikal 5% dan subklinikal 44%). Daripada 70 kultur positif, *coagulase negative staphylococci* (CNS) adalah yang terbanyak, 73% (n=51), *Bacillus sp.*, 11% (n=8), *Streptococcus*

*agalactiae*, 7% (n=5), *Streptococcus viridans*, 7% (n=5), *Staphylococcus aureus*, 4% (n=3), *Staphylococcus hyicus*, 4% (n=2), *Staphylococcus intermedius*, 3% (n=2), *Enterococci*, 3% (n=2), dan *Klebsiella pneumoniae*, 3% (n=2). Patogen yang sedikit (1% setiap satu) ialah *Escherichia coli*, *Acinetobacter iwoffii*, *Achromobacter sp.*, *Streptococcus dysgalactiae*, *Proteus mirabilis* dan *Pseudomonas fluorescense*. Tiga puluh pencilan *Staphylococcus sp.* diuji untuk perintang antibiotik menunjukkan rintangan tertinggi terhadap Penisillin (37%) dan kecenderungan tertinggi kepada streptomycin (97%). Terdapat hubungkait signifikan antara mastitis dengan lesi puting dan makanan tambahan ( $p < 0.05$ ). Penternak kambing *Ladang Angkat* UPM dicadangkan supaya menjalankan kaedah mencegah dan mengawal mastitis untuk meminimakan prevalens seterusnya mengurangkan kerugian disebabkan oleh penyakit tersebut.

**Kata Kunci:** Kambing, Mastitis, Kadar Jangkitan, Bakteria, Antibiotik, Faktor risiko.

## **ABSTRACT**

An abstract of the project paper presented to the Faculty of Veterinary Medicine,  
UPM in partial requirement for the course of VPD 4999- Final Year Project.

### **PREVALENCE OF MASTITIS IN GOATS FROM *LADANG ANGKAT UPM* AND ITS RELATIONSHIP WITH SELECTED RISK FACTORS**

By

**WAN MOHD SUKRI B WAN ISHAK**

**2015**

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**Co-supervisor: Associate Professor Dr. Siti Khairani Binti Bejo**

This study was carried out to determine the prevalence of clinical and subclinical mastitis in goat farms of *Ladang Angkat UPM*, pathogens in milk, and to determine the relationship between selected risk factors and mastitis.

A total of 158 milk samples from 80 goats of eight farms were collected aseptically. Clinical mastitis was assessed based on abnormalities of the udder and milk, subclinical mastitis was tested on-site using the California Mastitis Test (CMT), bacteriological culture for identification of pathogens, and Kirby-Bauer disk diffusion method for the antibiogram. The selected farm risk factors for mastitis investigated using questionnaire. Overall

prevalence of mastitis at halves level was 49% (clinical, 5%; and subclinical, 44%). Of the 70 milk culture positive, coagulase negative staphylococci (CNS) were predominant, 73% (n=51). *Bacillus sp.*, 11% (n=8); *Streptococcus agalactiae*, 7% (n=5); *Streptococcus viridans*, 7% (n=5); *Staphylococcus aureus*, 4% (n=3); *Staphylococcus hyicus*, 4% (n=2); *Staphylococcus intermedius*, 3% (n=2); *Enterococci*, 3% (n=2); and *Klebsiella pneumoniae*, 3% (n=2). The least isolated pathogens (1% each) were *Escherichia coli*, *Acinetobacter iwoffii*, *Achromobacter sp.*, *Streptococcus dysagalactiae*, *Proteus mirabilis*, and *Pseudomonas fluorescence*. Thirty *Staphylococcus sp.* isolates tested for antibiotic resistance showed highest resistance against penicillin (37%) and highest susceptibility to streptomycin (97%). There was significant association between mastitis and teat lesions and feed supplement ( $p < 0.05$ ). It is suggested that goat farmers of *Ladang Angkat* UPM to institute preventive and control measures for mastitis to minimize prevalence thus to reduce losses due to this condition.

**Keywords:** Goat, mastitis, prevalence, bacteria, antibiotic, resistance, risk factors

## 1.0 INTRODUCTION

The goat population in Peninsular Malaysia is estimated around 400,000 in 2012 and projected to be about 420,000 in 2013 (DVS, 2014) indicating a rapid development of livestock industry in Malaysia. Approximately 8195 herds of dairy goats present in Peninsular Malaysia with more than 50% are reared in the southern state of Johor (AADGN country reports, 2013/2014).

Caprine mastitis is considered as one of the main diseases that may cause constraint to the Malaysian goat industry by affecting the milk production and health of the animals. The major income of dairy goats farming come from milk production which is sold as raw milk, pasteurized milk or even fermented products (Lietner *et al.*, 2008). The milk quality and quantity is affected when goats are infected with mastitis which may lead to an overwhelming effect on farmer's economic status. A recent study reported that milk yield and curd yield of the dairy goat can be damaged by the subclinical mastitis due to the increase in the somatic cell count (SCC) causing rejection or decreased milk quality based on the grading based on the SCC (Leitner *et al.*, 2004).

Singh *et al.* (2004) reported that the aetiologic agents for mastitis can be grouped into the environmental pathogens, contagious and normal flora of the teat. The common bacteria infecting the udder include the coagulase negative staphylococci (CNS) and *Staphylococcus aureus* (Aiello *et al.*, 2010). Bacteria can be originated from the milker's hands, towels used for udder preparation, and the pen environment that could lead to mastitis in the farm (Singh *et al.* 2004; Marogna *et al.*, 2011). Thorberg *et al.* (2006) reported that the bacterial isolates from mastitis

cases in the studied cattle are similar to the bacterial isolates from milker's hands and elbow.

Antibiotic resistance of mastitis pathogens has been reported worldwide due to the indiscriminate usage of antibiotic (Marimuthu *et al.*, 2014) Antibiotics play an important role in the treatment and control of mastitis, hence surveillance for antibiotic resistance is needed to ensure appropriate antibiotic is used for mastitis treatment, thus, minimize the risk of the development and spread of resistance in dairy goat farms.

This study was undertaken to:

1. determine the prevalence of clinical and subclinical mastitis in goat farms of *Ladang Angkat UPM*
2. determine the prevalence of the bacterial pathogen in goat milk from *Ladang Angkat UPM*
3. determine the relationship between the selected risk factors and mastitis in goat farms of *Ladang Angkat UPM*
4. determine the antimicrobial resistance pattern of the staphylococci isolates obtained from the milk culture positive in goat farms of *Ladang Angkat UPM*

The hypotheses of the study were:

1. Prevalence of caprine mastitis in *Ladang Angkat UPM* is similar with previous local studies by Benedict (2014) & Siti Zubaidah *et al.*, (2005).

2. Bacterial isolates (*Staphylococcus spp.*) from the milk culture are not sensitive against the tested antibiotics.
3. There is no association between the selected risk factors and caprine mastitis in the selected goat farms.





## REFERENCES

- Ameh, J. A., & Tari, I. S. (1999). Observations on the prevalence of caprine mastitis in relation to predisposing factors in Maiduguri. *Small Ruminant Research*. doi:10.1016/S0921-4488(99)00047-4
- Bengtsson, B., Unnerstad, H. E., Ekman, T., Artursson, K., Nilsson-Öst, M., & Waller, K. P. (2009). Antimicrobial susceptibility of udder pathogens from cases of acute clinical mastitis in dairy cows. *Veterinary Microbiology*. doi:10.1016/j.vetmic.2008.10.024
- Bergonier, D., Rupp, R., Lagriffoul, G., & Berthelot, X. (2003). Mastitis of dairy small ruminants. *Veterinary Research*, 689-716.
- Contreras, A., Sierra, D., Sánchez, A., Corrales, J. C., Marco, J. C., Paape, M. J., & Gonzalo, C. (2007). Mastitis in small ruminants. *Small Ruminant Research*. doi:10.1016/j.smallrumres.2006.09.011
- Erskine, R. J. (2014). Overview of Mastitis in Large Animals: Mastitis in Large Animals: Merck Veterinary Manual. Retrieved February 17, 2015, from [http://www.merckmanuals.com/vet/reproductive\\_system/mastitis\\_in\\_large\\_animals/overview\\_of\\_mastitis\\_in\\_large\\_animals.html](http://www.merckmanuals.com/vet/reproductive_system/mastitis_in_large_animals/overview_of_mastitis_in_large_animals.html)
- Erskine, R. J. (2014, October). Mastitis in Cattle: Mastitis in Large Animals: Merck Veterinary Manual. Retrieved February 17, 2015, from [http://www.merckmanuals.com/vet/reproductive\\_system/mastitis\\_in\\_large\\_animals/mastitis\\_in\\_cattle.html](http://www.merckmanuals.com/vet/reproductive_system/mastitis_in_large_animals/mastitis_in_cattle.html)
- Garcia, A. D. (2004). *Contagious vs. environmental mastitis*. Brookings, S.D.: SDSU, Cooperative Extension Service. Dairy science.

Gebrewahid, T. T., Abera, B. H., & Menghistu, H. T. (2011). Prevalence and etiology of subclinical mastitis in small ruminants of Tigray Regional State, North ethiopia. *Vet. World*, 2012, 5(2), 103-109. doi: 10.5455/vetworld.2012.103-109

González-Rodríguez, M. C., & Cármenes, P. (1996). Evaluation of the California mastitis test as a discriminant method to detect subclinical mastitis in ewes. *Small Ruminant Research*. doi:10.1016/0921-4488(95)00826-8

Haveri, M. (2008). Staphylococcus aureus in bovine intramammary infection: molecular, clinical and epidemiological characteristics. University of Helsinki. ISBN 978-952-10-5034-3

Jang, S. S., Biberstein, E. L., & Hirsh, D. C. (2008). *A diagnostic manual of veterinary clinical bacteriology and mycology*. University of California, Davis

Kinne, M. (2004). Mastitis, Somatic Cells and the CMT Retrieved February 17, 2015, from <http://kinne.net/cmt.htm>

Lafi, S. Q., Al-Majali, A. M., Rousan, M. D., & Alawneh, J. M. (1998). Epidemiological studies of clinical and subclinical ovine mastitis in Awassi sheep in northern Jordan. *Preventive Veterinary Medicine*. doi:10.1016/S0167-5877(97)00048-2

Lansing, E. (2011). Beta Lactam Antibiotics — Antimicrobial Resistance Learning Site For Veterinary Students. Retrieved March 4, 2015, from <http://amrls.cvm.msu.edu/pharmacology/antimicrobials/antibiotics-of-veterinary-importance/beta-lactam-antibiotics>

- Leitner, G., Chaffer, M., Silanikove, N., Shapiro, F., Merin, U., Ezra, E., & Saran, A. (2004). Changes in Milk Composition as Affected by Subclinical Mastitis in Goats. *Journal of Dairy Science*. doi:10.3168/jds.S0022-0302(04)73325-1
- Leitner, G., Silanikove, N., & Merin, U. (2008). Estimate of milk and curd yield loss of sheep and goats with intramammary infection and its relation to somatic cell count. *Small Ruminant Research*. doi:10.1016/j.smallrumres.2007.02.009
- Marimuthu, M., Firdaus, F., Mohammed, K., Sarvananthan, S., Adamu, L., Yusuf, A., & Tijjani, A. (2014). Prevalence and antimicrobial resistance assessment of subclinical mastitis in milk samples from selected dairy farms. *American Journal of Animal and Veterinary Sciences*. doi:0.3844/ajavssp.2014.65.70
- Marogna, G., Pilo, C., Vidili, A., Tola, S., Schianchi, G., & Leori, S. G. (2011). Comparison of clinical findings, microbiological results, and farming parameters in goat herds affected by recurrent infectious mastitis. *Small Ruminant Research*. doi:10.1016/j.smallrumres.2011.08.013
- Moroni, P., Pisoni, G., Ruffo, G., & Boettcher, P. J. (2005). Risk factors for intramammary infections and relationship with somatic-cell counts in Italian dairy goats. *Preventive Veterinary Medicine*. doi:10.1016/j.prevetmed.2004.10.013
- Pugh, D. G., & Baird, A. N. (2012). Disease of the mammary gland. In *Sheep and goat medicine* (2nd ed.). Maryland Heights, MO: Elsevier/Saunders.

- Singh, S., Jaisawal, S., Singh, D. D., & Singh, H. (2006). *Bovine mastitis and udder affections*. Lucknow, India: International Book Distributing Co.
- Sánchez, A., Contreras, A., & Corrales, J. C. (1999). Parity as a risk factor for caprine subclinical intramammary infection. *Small Ruminant Research*. doi:10.1016/S0921-4488(98)00148-5
- Taponen, S., & Pyörälä, S. (2009). Coagulase-negative staphylococci as cause of bovine mastitis—Not so different from *Staphylococcus aureus*? *Veterinary Microbiology*. doi:10.1016/j.vetmic.2008.09.011
- Thorberg, B., Kühn, I., Aarestrup, F. M., Brändström, B., Jonsson, P., & Danielsson-Tham, M. (2006). Pheno and genotyping of *Staphylococcus epidermidis* isolated from bovine milk and human skin. *Veterinary Microbiology*. doi:10.1016/j.vetmic.2006.01.013
- Waage, S., & Vatn, S. (2008). Individual animal risk factors for clinical mastitis in meat sheep in Norway. *Preventive Veterinary Medicine*. doi:10.1016/j.prevetmed.2008.04.002