UNIVERSITI PUTRA MALAYSIA

PREVALENCE AND RISK FACTORS OF LAMENESS IN SHEEP IN SELECTED FARMS IN SELANGOR

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FPV 2023 33

PREVALENCE AND RISK FACTORS OF LAMENESS IN SHEEP IN SELECTED FARMS IN SELANGOR

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A project paper submitted to the
Faculty of Veterinary Medicine, Universiti Putra Malaysia
In partial fulfilment of the requirement for the
DEGREE OF DOCTOR OF VETERINARY MEDICINE
Universiti Putra Malaysia
Serdang, Selangor Darul Ehsan.

October 2023

CERTIFICATION

It is hereby certified that we have read this project paper entitled "Prevalence and Risk Factors of Lameness in Sheep in Selected Farms in Selangor", by Fatini Dayana Binti Rashid and in our opinion it is satisfactory in terms of scope, quality and presentation as partial fulfilment of the requirement for the course VPD 4999- Project.

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ACKNOWLEDGEMENTS

All praises to Allah S.W.T. for his blessings showered upon me, giving me strength and perseverance along the journey of completing this final year project. This thesis would not have been possible without the guidance and help of several individuals who extended their valuable assistance throughout this project.

I would like to express my deepest gratitude and appreciation to Dr Siti Zubaidah Binti Ramanoon, my dear supervisor and Dr Mohammed Babatunde Sadiq, my co-supervisor for supervising me dearly and giving me their full dedication, patience, knowledge, expertise and insightful suggestions and opinions in assisting me during the period of conducting and finishing this project. Their vast wisdom and wealth of experience have inspired me to not give up and strive to do better for this project.

Special thanks to my mother, Nor Hanifah Binti Omar and my siblings, Farah Aiman, Najid Rasydan, Najat Razan and Hannah Widad for their continuous love and encouragements in all my pursuits in following my dreams. In remembrance of my late father, Rashid Bin Jarmin, who I know would be the proudest knowing that I chose to be in veterinary medicine. I would not remiss in not mentioning my cat, Lulu for being my emotional support throughout this journey.

Last but not least, I am extremely grateful to my FYP partner and my friends who help me restraining the animals in the farms, and everyone who may have contributed directly and indirectly in completing this project.

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999- Projek.

PREVALENS DAN FAKTOR RISIKO KETEMPANGAN PADA BIRI-BIRI DI LADANG TERPILIH DI SELANGOR

Oleh

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Ketempangan ialah masalah yang biasa dilihat pada haiwan ladang dimana keadaan ini menyebabkan haiwan berada dalam kesakitan dan kesusahan. Ketempangan telah menjadi cabaran kepada penternak kerana ia memberi kesan negatif terhadap produktiviti haiwan. Di Malaysia, kajian mengenai ketempangan pada biri-biri adalah terhad. Oleh itu, kajian ini dijalankan dengan objektif untuk menentukan prevalens ketempangan dan faktor risikonya terhadap biri-biri di ladang terpilih di Selangor. Seratus dua puluh enam ekor biri-biri telah disampel dari empat ladang terpilih di bawah program ladang angkat Hospital Veterinar Universiti (UVH). Sistem pemarkahan pergerakan 4 mata digunakan untuk menilai ketempangan dan data individu setiap haiwan telah direkodkan. Soal selidik berstruktur digunakan untuk mengumpul maklumat mengenai ladang dan maklumat pemilik/pekerja melalui temu bual secara bersemuka. Prevalens ketempangan pada biri-biri, dari kajian ini ialah 42.86% (54/126, 95% selang keyakinan, 95% CI 34.19, 51.98). Daripada empat

ladang, Ladang 4 mencatatkan prevalens tertinggi sebanyak 61.54% (95% CI 40.57, 79.09). Keputusan daripada ujian khi kuasa dua menunjukkan bahawa tiada perkaitan signifikan (P>0.05) antara ketempangan pada biri-biri dengan umur, baka, skor keadaan badan, jantina, nisbah pemakanan berdasarkan status pengeluaran, dan kekerapan pembersihan petak. Walau bagaimanapun, terdapat perkaitan signifikan (P<0.05) antara ketempangan pada biri-biri dengan; status kehamilan haiwan (OR= 6.02, 95% CI 1.58, 22.92), tahun pengalaman penternak (OR= 2.61, 95% CI 1.07, 6.34), sistem pengurusan (OR= 3.40, 95% CI 1.62, 7.11), kekerapan pemangkasan kuku (OR= 0.38, 95% CI 0.16, 0.93) dan adanya mandian kaki (OR= 0.40, 95% CI 0.16, 0.98). Kesimpulannya, kajian ini mendapati prevalens ketempangan pada biri-biri di ladang terpilih di Selangor adalah tinggi dan terkait dengan status bunting dan pengurusan ladang. Hasil dari kajian ini juga boleh digunakan penternak sebagai panduan untuk memperbaiki cara pengurusan di ladang bagi mengurangkan masalah ketempangan melalui kejayaan pelaksanaan langkah pencegahan dan kawalan di ladang.

Kata kunci: Biri-biri, Prevalens, Ketempangan, Faktor Risiko, Selangor

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfilment of the course VPD 4999- Project.

PREVALENCE AND RISK FACTORS OF LAMENESS IN SHEEP IN SELECTED FARMS IN SELANGOR

By

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2023

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Lameness is a common problem in herd animals where the condition may cause pain and distress. Lameness has been a challenge to farmers as it gives negative impact on animal productivity. In Malaysia, studies on lameness in sheep are limited. Therefore, this study was conducted with the objectives to determine the prevalence of lameness and its associated risk factors in sheep in selected farms in Selangor. One hundred twenty-six sheep were sampled from four selected farms under foster farm program of University Veterinary Hospital (UVH). A 4-point locomotion scoring system was used to evaluate lameness and individual animal data were recorded. A structured questionnaire was used to collect farm and farmer/worker information through a face-to-face interview. Overall prevalence of lameness in sheep in this study was 42.86% (54/126, 95% confidence interval, 95% CI 34.19, 51.98). Out of the four farms, Farm 4 recorded the highest prevalence of 61.54% (95% CI 40.57, 79.09). Results from Chi-squared tests showed that there were no significant association (P>0.05) between

lameness in sheep and age, breed, body condition score, gender, feeding ratio based on production status, and frequency of cleaning the pen. However, there were significant association (P<0.05) between the prevalence of lameness and these factors; pregnancy status of the animal (OR= 6.02, 95% CI 1.58, 22.92), years of farmer's experience (OR= 2.61, 95% CI 1.07, 6.34), management system (OR= 3.40, 95% CI 1.62, 7.11), frequency of hoof trimming (OR= 0.38, 95% CI 0.16, 0.93) and presence of footbath (OR= 0.40, 95% CI 0.16, 0.98). In conclusion, there is a high prevalence of lameness in sheep in the selected farms in Selangor. These findings could be used to assist farmers improve the management practices to reduce lameness problem through a successful implementation of prevention and control measures in the farms.

Keywords: Sheep, Prevalence, Lameness, Risk Factors, Selangor

1.0 INTRODUCTION

Lameness can be defined as gait and posture abnormalities or discomfort when there is presence of foot or limb lesions, a result of dysfunction of the locomotor system where the condition may or may not be accompanied by pain and distress (Kaler et al., 2007; Sadiq et al., 2017) . It is a sign rather than a specific disease as lameness may be caused by multiple aetiologies such as injuries, defects or disease that affect the limbs which leads to foot-related lameness (Gelasakis et al., 2019). Evaluating the gait is performed by doing locomotion scoring from visual observation of the animals during standing and walking.

Possible factors contributing towards the occurrence of lameness in sheep can be from the environment, genetics and physiological factors of the animals. Hoof conformation traits, or the shape, size and condition of hooves can also pose as one of the factors causing lameness. Overgrown hooves, misshapen hooves and damaged sole can result in impaired locomotion as there is association between poor hoof conformation traits, bacterial load and lameness (Best et al., 2021). The housing condition as well as management of the farm can also predispose sheep to lameness. Lewis et al. (2021) reported that there is statistical association between the prevalence of lameness in the flock of sheep and management practices in the farm from several studies conducted using retrospective postal and online questionnaires.

Identifying the potential risk factors and understanding how does animals are affected by it is crucial as lameness is a welfare concern because overall health of the animal can be compromised. An animal may experience weight loss, which then cause fertility problem and reproductive problem. It also has economic impact towards the farmers

as animal will have poor productivity as well as high treatment cost for lame animals. The estimated cost of treatment and performance loss in the United Kingdom can reach 24 million pounds annually (Nieuwhof and Bishop, 2005).

The insufficient research on the prevalence of lameness in sheep, especially in Malaysia poses a significant challenge due to lack of understanding on the causes and factors contributing to the occurrence of lameness in a sheep flock. Farmers usually underestimate the occurrence of lameness in their farms, often disregard it and only addressing this problem when the condition is severe. This is due to poor awareness about lameness due to different perception, attitude and knowledge on the problem (Sadiq et al., 2019; Jensen et al., 2022). Therefore, this study aims to explore the prevalence and investigate the potential risk factors, and its association to the prevalence of lameness in sheep.

1.1 Objectives

To determine the:

1. prevalence of lameness in sheep in selected farms in Selangor
2. potential risk factors associated with lameness in sheep in selected farms in Selangor

1.2 Justification

Studies and research conducted about lameness in Malaysia are more focused on cattle, especially dairy cattle. Sadiq et al. (2017) had published a report on prevalence of lameness, claw lesions and associated risk factors in dairy farms in Selangor. However, there are limited to no report available about lameness in sheep in Malaysia as compared to available reports on lameness in cattle even though it is a common

problem seen. This study will provide an insight on the prevalence and potential risk factors that can be associated with occurrence of lameness in sheep. The data and result from this study can be used to help farmers improve the hoof health programme in their farms.

1.3 Hypothesis

Null Hypothesis, H_o: There is no association between the studied risk factors and lameness in sheep from selected farms in Selangor.

Alternative Hypothesis, H_A: There is significant association between the studied risk factors and lameness in sheep from selected farms in Selangor.

2.0 LITERATURE REVIEW

2.1 Definition of Lameness

Lameness can be defined as changes in normal stance or gait of animal. Bergsten (2001) describes lameness as a disorder of the locomotor system, which is a dysfunction and painful process occurring in the limb. The severity of lameness can vary from uneven strides to inability to bear weight (non-weight bearing lameness), and even can be as severe as total recumbency. Mechanical defect and painful lesions can be the disorders located at the limb resulting in physical disability thus causing the animals to have gait problems as a sign of discomfort and pain (Nuffel et al., 2015). It is also described as a clinical sign rather than a disease itself.

2.2 Prevalence of Lameness in Sheep

In 2004, the reported overall mean prevalence of lameness per farm in England was 10.2% , where English sheep farmers were randomly selected to participate in a postal survey (Kaler and Green, 2009). In 2013, Winter et al. (2015) had carried out another study to investigate the changes in prevalence of lameness in England and reported that the mean prevalence of lameness in ewes was 4.9%. Aliyu et al. (2005) investigated the occurrence of small ruminants in Maiduguri, Nigeria and found that the prevalence of lameness in sheep was 7.2%. A cross-sectional study on lameness in intensive dairy sheep farms that was conducted in Greece revealed that the overall prevalence of foot-related lameness is 9% (Moschovas et al, 2021).

2.3 Causes of Lameness

Gelasakis et al (2019) reported that common causes of foot-related lameness in sheep can be from infectious origin and non-infectious origin. The infectious aetiologies of

lameness include; footrot which is a contagious disease caused by *Fusobacterium necrophorum* and *Dichelobacter nodosus*, ovine interdigital dermatitis (OID), also known as scald caused by *Fusobacterium necrophorum*, contagious ovine digital dermatitis (CODD) which is caused by spirochete of *Treponema* spp. and pedal joint abscess that occurs as a result of infection by *Fusobacterium necrophorum* and *Actinomyces pyogenes*. Non-infectious aetiologies include; white line disease (WLD), laminitis, granulomas and other causes such as injuries, foreign bodies and toxins.

Claw deformation and claw size may also play a role in lameness as mentioned by Ajuda et al. (2019), an increased in width of the front claws was associated with an increased likelihood of having claw deformations, which influence the lameness score of the dairy goat. Unbalanced wearing of the claws leads to malformations of the hooves. The malformations, where overgrown hoof is evident can affect the locomotion and muscular skeletal structure resulting in an increased risk of mechanical injury and entry of infectious agents. (Somer et al., 2005).

2.4 Risk Factors of Lameness

2.4.1 Animal Factors

Age, gender and breed are among the risk factors of lameness in sheep. A study from Aliyu et al. (2005) revealed that in Maiduguri, the occurrence of lameness in sheep is higher in animals within the ages of 1 to 3, in females and in Balami breed. Parity, stage of pregnancy and milking status are also associated with lameness. The prevalence of lameness in dairy cows increased with an increasing parity number where animals in theirs first to third parity is 4.1 times more likely to have lameness as compared to heifers. The likelihood of lameness is 1.5, 2.7 and 3.6 times higher in

cows in their first, second and third pregnancy compared to non-pregnant, respectively (Sheferaw et al., 2021).

Nutritional demands in sheep are important for maintenance, growth, milk production, physical activity and thermoregulation. Hooves may be vulnerable towards infections and injuries when there is inappropriate feeding or nutritional deficiencies. The increased nutritional and metabolic requirements that is needed for adult ewes during early stages of lactation may result in malfunction of organs and tissue, then causes disruption towards the immunological response to foot-related lameness caused by pathogens, leading to severe lameness (Gelasakis et al., 2019).

Genetic may also contributes to the occurrence of lameness in sheep. It has been demonstrated that susceptibility and resistance towards footrot is associated with DQA2 loci in the ovine Major Histocompatibility Complex (MHC-DQA2 gene) as the genetic markers used for molecular screening was identified on chromosome 20 at the loci. In Chios sheep, high diversity at the ovine DQA2 gene locus suggest that the breed is less susceptible towards footrot (Gelasakis et al., 2013).

2.4.2 Environmental Factors

Negative impact towards the claw health and locomotion of dairy cows may be caused by insufficient friction and traction concrete floors. Rubber flooring can provide better comfort to the animals. The locomotion performance between lame and non-lame cows, and within lame cows showed differences when observed on different types of flooring system (Sadiq et al., 2017). Rather than concrete, sheep are usually housed in raised-floor house or on straw bedding. There might be distinct risk as the flooring condition varies between dairy cows and sheep. Hoof overgrowth would favor soft,

smooth and wet floors. Increased moisture on the ground is the leading risk factor of foot-related lameness and diseases causing foot-related lameness such as footrot and contagious ovine digital dermatitis (CODD) (Gelasakis et al., 2019).

Gelasakis et al. (2013) reported that high stocking density is a potential risk factor that cause an increase in the development and severity of lameness as there will be inadequate space, coupled with inadequate ventilation and bedding material leading to increased humidity in the pen. This is a major concern during winter season as the sheep would be kept indoors with restricted access to the paddocks. Besides that, winter season pose higher risk in occurrence of lameness because proliferation and transmission of pathogens, such as *Dichelobacter nodosus* and *Fusobacterium necrophorum* is favourable due to compromised hygiene due to insufficient disinfection in the pen (Abbot and Lewis, 2005).

Farming system can also influence the aetiology of foot-related lameness in dairy sheep where intensive farms posed more challenge due to the high stocking density. In a study conducted by Moschovas et al. (2021), higher prevalence of ovine interdigital dermatitis (OID), ocular or nasal discharge, mastitis and udder skin lesions was recorded in sheep kept in intensive system.

2.4.3 Agent factors

Infectious type of lameness is associated with bacterial infections at the foot, hooves or skin between the toes on hooves that causes pain and swelling. Winter (2008) described that there are three important types of foot lameness which are caused by infectious agents; interdigital dermatitis (ID), footrot and contagious ovine digital dermatitis (CODD). Interdigital dermatitis (ID) which is also called as scald is caused

Fusobacterium necrophorum. The infected skin will have moist appearance with reddened or grey colour and loss of hair at the area (Winter, 2008). *Dichelobacter nodosus* is the primary aetiological agent of ovine footrot which causes lameness, usually accompanied with pain. The bacteria can easily spread from infected to non-infected sheep through contaminated pasture (Storms et al., 2022). Staton et al. (2021) explained that *Treponema* species, in particular *Treponema medium, Treponema phagedenis and Treponema pedis* are the three treponemal species consistently found in contagious ovine digital dermatitis (CODD) lesions. The severity of these conditions would depend on the virulence of the agent, environmental conditions and host factors.

Favourable condition for proliferation and transmission of these pathogens is usually related to poor hygiene status and overcrowding. Bacteria that cause footrot and CODD favours wet condition which may be due to overcrowding where there will be increased moisture from the accumulation of faeces and urine in the bedding. inadequate disinfection of equipment used for hoof trimming can also promotes the transmission of pathogens within the flock (Gelasakis et al., 2019).

2.5 Locomotion Scoring System

The method of detecting lameness in cows and small ruminants is by doing locomotion scoring. It is a useful assessment tool to detect lame animals as the fundamental analysis is through observation of gait, stride length, steps, duration of weight bearing in both affected and unaffected limbs, body posture and joint movement.

Kaler et al. (2009) had developed a seven-point locomotion scoring scale, ranging from 0 to 6 where 0 is normal and 6 is unable to stand or move. For each score, there

are required criteria needed to be fulfilled in order to conclude which score to be given to the animal. The locomotion scoring scale is as follows:

1. Score 0: Bears weight evenly on all four feet.
2. Score 1: Uneven posture but no clear shortening or stride and short stride on one leg compared with others.
3. Score 2: Uneven posture but no clear shortening or stride and short stride on one leg compared with others with visible nodding of head in time with short stride.
4. Score 3: Uneven posture but no clear shortening or stride and short stride on one leg compared with others with excessive flicking of head, more than nodding, in time with short stride with not weight bearing on affected limb when standing and discomfort when moving.
5. Score 4: Uneven posture but no clear shortening or stride and short stride on one leg compared with others with excessive flicking of head, more than nodding, in time with short stride with not weight bearing on affected limb when standing and discomfort when moving with addition of not weight bearing on affected limb when moving.
6. Score 5: Uneven posture but no clear shortening or stride and short stride on one leg compared with others with excessive flicking of head, more than nodding, in time with short stride with not weight bearing on affected limb when standing and discomfort when moving and not weight bearing on affected limb when moving. Also, addition of extreme difficulty rising, reluctant to move once standing and more than one limb affected.

7. Score 6: Will not stand or move.

In 2007, DairyCo had also develop their own locomotion scoring due to confusion to assess lameness in dairy cows among farmers as there were a lot of different locomotion scores available. DairyCo mobility score is a four-point system ranging from score 0 to score 3, where; 0 is good mobility, 1 is imperfect mobility (uneven strides), 2 is impaired mobility (uneven weight bearing) and 3 is severely impaired mobility (unable to walk as fast as normal pace).

Angell et al. (2015) had developed a four-point system of locomotion scoring in sheep by combining Kaler system (Kaler et al., 2009) and DairyCo Mobility Scoring System. The locomotion scoring system is as follows:

1. Score 0 (Sound): Bears weight evenly on all four feet and walks with an even rhythm.
2. Score 1 (Mildly Lame): Steps are uneven but it is not clear which limb or limbs are affected.
3. Score 2 (Moderately Lame): Steps are uneven and the stride may be shortened; the affected limb or limbs are identifiable.
4. Score 3 (Severely Lame): Mobility is severely compromised such that the sheep frequently stops walking or lies down due to obvious discomfort. The affected limb or limbs are clearly identifiable and may be held off the ground whilst walking or standing.

3.0 MATERIALS AND METHODS

3.1 Institutional of Animal Care and Use Committee (IACUC)

The protocol had been reviewed and approved by the Institutional Committee for Animal Care and Use (UPM/IACUC/AUP-U023/2023).

3.2 Study Design

This is a cross-sectional study where a structured questionnaire and field observation were conducted in the farm. 4 foster farms of University Veterinary Hospital (UVH) in Selangor were involved to conduct this study.

3.3 Sample Size

The sample size was calculated using the formula by Thrusfield (2005). It is based on the prevalence of 9% (Moschovas et al., 2021) and 95% confidence interval, and the error rate (d) is 0.05. The calculated sample size (N) was 126.

3.4 Data Collection

A face-to-face interview was carried out with the farmers and workers of the visited farms based on a structured questionnaire which comprised of 2 sections; Section 1 were questions about farmer and workers information while Section 2 were the potential risk factors assessment in the farm which includes animal factors and farm factors. The potential farm risk factors chosen to be studied were; years of farmer's experience, management system, feed based on production stage, hoof trimming, frequency of cleaning the pen and presence of footbath.

A total of 126 sheep were sampled where 38 sheep were from Farm 1, 32 sheep from Farm 2, 30 sheep from Farm 3 and 26 sheep from Farm 4. The animals were selected using purposive sampling. Locomotion scoring was performed by visual observation

of the animals' gait and posture based on a 4-point scoring system (Angell et al., 2015). Each individual animal's data which were gender, age, BCS, breed and pregnancy status were recorded.

3.5 Data Analysis

The data collected was managed in Microsoft Excel 2019. Prevalence of lameness calculation was also done in Microsoft Excel by dividing the number of lame sheep with the total number of sheep sampled. 95% confidence interval were calculated using exact binomial method, using an Excel calculator.

In IBM SPSS Statistics Version 29, the potential risk factors association were evaluated using Pearson's chi-squared test and odds ratio (OR) if necessary. A factor is statistically significant when the p-value is less than 0.05 ($P < 0.05$). The association between prevalence of lameness (categorical outcome) were evaluated with the following potential risk factors (categorical variables) studied; gender, age, body condition score, breed, pregnancy status, years of farmer's experience, management system, feed based on production stage, hoof trimming, frequency of cleaning the pen and presence of footbath. For each potential risk factors that showed significant association ($P<0.05$), the odds ratio and its 95% confidence interval (CI) were calculated using risk estimate procedure.

4.0 RESULTS

4.1 Farm Demography

Farm 1- This farm is located in Teras Jernang, Bangi, Selangor. The herd size in this farm is 150 sheep. This farm practised mixed animal rearing where there are both goats and sheep. The management system practised is intensive farming. The pen condition is dry and clean with raised-floor. The frequency of cleaning the pen in this farm is 2-3 times a week. The farmer had 10 years of experience in sheep farming. Hoof trimming was done only when needed based on visual observation where the farmer will do it when he observed any overgrowth of the hoof.

Farm 2 – This farm is located Hulu Langat, Selangor. The herd size in this farm is 200 sheep. This farm practised semi-intensive farming, where the animals were allowed to go to the pastures for a maximum of 2 hours every day. The pen is in clean and dry condition, with raised-floor type. The frequency of cleaning the pen depends on the pen condition as there was no fixed schedule on when to clean the pen. The farmer had 10 years of experience in sheep farming. Hoof trimming was done once or twice a year, based on the animal's hoof condition.

Farm 3 – This farm is located in Hulu Langat, Selangor. The herd size is 110 sheep. This farm practised intensive farming. The pen condition is clean and dry, with raised floor. The pen was cleaned once a week. The flooring had holes in certain pen. The farmer had 12 years of experience in sheep farming. Hoof trimming was done once in 3 months.

Farm 4 – This farm is located in Kajang, Selangor. The herd size is 200 sheep. This farm practised semi-intensive farming, where the animals were released to the pasture

for an hour, every day. The pen condition is clean and dry, with raised-floor. The pen was cleaned once in a week. The farmer had 6 years of experience in sheep farming. No hoof trimming was done in this farm, except when there was a visit by the veterinarian.

4.2 Animal Characteristics

In this study, only adult sheep were sampled with the ages ranging between 1 year old to 4 years old. Various breeds which are; Black Belly, Santa Ines, Merino, Damara, Dorper and Morada Nova were used in the study. Both genders were sampled where most of it were females with only 9 out of 126 sheep were males while the rest were females. Body condition score (BCS) of the sheep ranges between score 1.5 to 4. Pregnant ewes that were sampled were only 14 out of 117 females.

4.3 Prevalence and Risk Factors of Lameness

A total of 126 sheep were observed and the locomotion scoring were assessed. It was found that 54 out of 126 sheep that were sampled were lame. In Score 0 there were 72 sheep, score 1 were 33 sheep, score 2 were 19 sheep and Score 3 were 2 sheep. Score 0 were considered as not lame while Score 1 to Score 3 were considered as lame. The overall prevalence of lameness in sheep is 42.86% (95% CI 34.19 to 51.98).

Farm 4 recorded the highest prevalence which was 61.54% (95% CI 40.57 to 79.09) followed by Farm 2, Farm 1 and Farm 3 with the prevalence of 56.25% (95% CI 37.88 to 73.17), 31.58% (95% CI 18.03 to 48.79) and 26.67% (95% CI 12.98 to 46.18) respectively, as shown in Table 1.

Table 1: Overall prevalence and prevalence of lameness by farm

	Number of lame (n)	Number of non-lame (n)	Total (n)	Prevalence (%)	95% Confidence Interval (%)
Overall	54	72	126	42.86	34.19 - 51.98
Farm					
Farm 1	12	26	38	31.58	18.03 - 48.79
Farm 2	18	14	32	56.25	37.88 - 73.17
Farm 3	8	22	30	26.67	12.98 - 46.18
Farm 4	16	10	26	61.54	40.57 - 79.09

The results of association between the potential risk factors studied with the prevalence of lameness in sheep are shown in Table 2. These potential risk factors; age, breed, gender, body condition score, feed based on production stage and frequency of cleaning the pen showed no statistical significant association with the prevalence of lameness ($P>0.05$). However, five of the risk factors; pregnancy status, years of farmers experience, management system, hoof trimming and presence of footbath showed statistically significant association ($P<0.05$).

Odds ratio for the significant risk factors are; pregnant ewes were 6.02 times more likely to have lameness compared to non-pregnant ewes (95% CI 1.58-22.92); farmers with less than 10 years of experience in sheep farming were 2.61 times more likely to have lameness in their farm compared to farmers with more than 10 years of experience (95% CI 1.07-6.34); farms with semi-intensive management system were

3.40 times more likely to have lameness compared to farm with intensive management system (95% CI 1.62-7.11); farms that practised hoof trimming were 0.38 times less likely to have lameness compared to farms that did not practise hoof trimming (95% CI 0.16-0.93); farms that haves footbath were 0.40 times less likely to have lameness compared to farms that did not have footbath (95% CI 0.16-0.98). Hence, hoof trimming and footbath practices were found to be protective factors for lameness in the studied farms.

Table 2: Prevalence of lameness based on studied potential risk factors and its association

Potential risk factors	Number of lame (n)	Number of non-lame (n)	Prevalence (%)	95% Confidence Interval (%)	$\chi 2$ value	p-value	Odds Ratio (95% CI)
Age							
≤2 years	22	19	53.66	37.61-69.03			
>2 years	32	53	37.65	27.56-48.89	2.895	0.089	-
Breed							
Damara	25	24	38.78	25.55-53.76			
Others*	29	48	45.45	34.20-57.15	2.182	0.140	-
Gender							
Male	4	5	44.44	15.34-77.37			
Female	50	67	42.74	33.74-52.22	0.010	0.920	-
Body Condition Score							
<3	27	37	42.19	30.16-55.16			
>3	27	35	43.55	31.21-56.69	0.024	0.877	-
Pregnancy Status							
Pregnant	11	3	78.57	48.81-94.30			6.02
Not pregnant	39	64	37.86	28.64-47.00	8.24	0.004*	(1.58-22.92) Reference

Years of Farmer's Experience							
<10 years	16	10	61.54	40.73-79.09			2.61
≥10 years	38	62	38.00	28.64-48.29	4.668	0.031*	(1.07-6.34)
Management System							
Semi-intensive	34	24	58.62	44.96-71.11			3.40
Intensive	20	48	29.41	27.22-51.16	10.905	<0.001*	(1.62-7.11)
Feed Based on Production Stage							
Yes	17	13	56.67	37.66-74.03			
No	37	59	38.54	28.95-49.06	3.066	0.080	-
Hoof Trimming							
Yes	38	62	38.00	28.64-48.29			0.38
No	16	10	61.54	40.73-79.09	4.668	0.031*	(0.16-0.93)
Presence of Footbath							
Yes	8	22	26.67	12.98-46.18			0.40
No	46	50	47.92	37.70-58.30	4.215	0.040*	(0.16-0.98)
Frequency of Cleaning the Pen							
Once a week	24	32	42.86	29.97-56.73			
More than once a week	30	40	42.86	31.28-55.22	0.000	1.000	-

5.0 DISCUSSION

The prevalence of lameness in sheep in the studied farms is high compared to the prevalence reported by Moschovas et al. (2021) where the overall prevalence of foot-related lameness in the sheep flocks in Greece was 9%. Different findings in prevalence of lameness could be due to different herd size and management systems where they used larger herd size and all of their studied farms practised intensive system while in our study, smaller herd size was used and the four studied farms have both intensive and semi-intensive system. The prevalence of lameness in this study was also higher compared to the occurrence of lameness in sheep in Maiduguri, Nigeria reported by Aliyu et al. (2005) which is 7.2%. The varied findings could be due to different diagnostic criteria of determining lameness in sheep as that they did not use locomotion scoring to detect lameness like what was used in this study. Instead, they consider an animal is lame when there is presence of at least one foot lesion or condition.

This study showed no association between the age, gender, breed and body condition score with the occurrence of lameness. This contradicts with the findings from a study conducted in Maiduguri, Nigeria where higher percentage of lameness were recorded in sheep within 1 to 3 years old compared to sheep above 3 years old, females compared to males and Balami breed compared to other breeds (Yankasa and Uda). This contrast may be due to differences in the average age of sheep sampled and differences in the sheep's breed sampled where in this study, the average age were 2 years old and the breed of sheep involved were Damara, Black Belly, Santa Ines, Morada Nova, Merino and Dorper.

Association of pregnancy status with the occurrence of lameness is in agreement with a study conducted by Chapinal et al. (2009) where it was found that the gait scores and weight distribution of the legs were affected when the animal is in a late stage of pregnancy. This can further be supported with a study which reported that there are greater incidence of lameness and hoof injury as pregnancy progressed due to the increasing pressures applied on the digits during pregnancy (Scott, 1988).

Years of farmer's experience which showed association with the prevalence of lameness in this study can be supported by O'Kane et al. (2017) where in their study, they described that farmers with more knowledge and experience tend to treat the sheep within three days of them detected lameness, which indicative of 'best-practise'.

According to Gelasakis et al. (2019), extensive and semi-intensive farming system has higher risk of getting foot-related lameness as the animals were exposed to the environment where the common causes may be due to injuries and foreign bodies penetrating the sole. Flocks that were managed semi-intensively predisposed to lameness due to interdigital pouch inflammation and other foot condition, caused by tough rugged terrain during long dry season (Aliyu et al, 2005). These findings are similar to the findings in this study where there is an increased of prevalence in farms that practised semi-intensive farming.

A study that was carried out in dairy goats showed that hoof wall overgrowth cannot be prevented even when hoof trimming was done every 4 months, and starting to trim the goats' hoof at 5 months of age appeared to have only minor effect toward the hoof conformation (Deeming et al., 2023). Prosser et al. (2019) also revealed that the prevalence of lameness in sheep flocks in England was significantly higher in 2015

(4.1%) when compared to the year 2013 and 2014 (3.3% and 3.2% respectively) when the proportion of farmers who practised routine foot trimming was significantly reduced. Both of these studies support the findings in this study where hoof trimming showed association with the prevalence of lameness, where lower prevalence was observed in farms that practised hoof trimming.

Routine footbathing is associated with higher prevalence of lameness as it is not an effective treatment for footrot and contagious ovine digital dermatitis (CODD) (Winter et al., 2015). Clifton (2021) mentioned that the prevalence of granulomas and shelly hoof can be reduced when routine footbathing is not practised. It is contradicting with this study that showed animals with no routine footbathing had higher prevalence of lameness. However, the result from this study, which is farms that do have footbath was less likely to have lameness is in agreement with the study from Gelasakis et al. (2019) where they explained that the application of footbaths is one of the measures to control footrot and contagious ovine digital dermatitis (CODD) where it is effective to cure mild infections and able to remove mud and manure from the hooves.

6.0 CONCLUSIONS

This study revealed that the overall prevalence of lameness in sheep is high (42.86%). The prevalence of lameness in all four farms visited were also high (31 to 62%). This study revealed pregnancy status, years of farmers experience, management system, hoof trimming and presence of footbath were the associated risk factors of lameness in the sheep farms studied. Based on these findings, farmers can be advised on the appropriate hoof health programme for control and prevention of lameness problem in the farm. Besides that, farmers should be made aware that lameness is a major problem affecting their herds and locomotion scoring should be taught to the farmers so that early detection of lameness will initiate prompt action and treatment to be taken.

7.0 RECOMMENDATIONS AND FUTURE STUDY

The high prevalence of lameness in this study suggests that lameness is a serious issue in all of the studied farms. Thus, farmers need to be educated about lameness as well as its control and preventive measures. Locomotion scoring in the farm is also recommended to be conducted as well as keeping the pen in a safe and clean condition. Routine hoof trimming and footbath are suggested to be practised to reduce this problem.

If this study shall be continued in the future, more farms from wider geographical locations should be included so that more comprehensive data and findings can be obtained.

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APPENDIX

QUESTIONNAIRE

PROJECT TITLE: PREVALENCE AND RISK FACTORS OF LAMENESS IN SHEEP IN SELECTED FARMS IN SELANGOR

SECTION 1

1. What position do you hold at the farm?
2. How many years of operating/ experience do you have in sheep farming?
3. What is your highest education level?
4. Are you familiar with lameness in sheep?

SECTION 2: POTENTIAL RISK FACTORS OF LAMENESS

1. Breed of the sheep:
   (a) Malin (Malaysian Indigenous)
   (b) Dorper
   (c) Dorset Horn
   (d) Suffolk
   (e) Romney
   (f) Others: _____
2. Average age of the sheep: _____
3. Sex:
   (a) Male
   (b) Female
   (c) Both
4. Average body condition score:
   (a) 1/5
   (b) 2/5
   (c) 3/5

(d) 4/5
(e) 5/5

5. Parity:
   (a) One
   (b) Two
   (c) Three
   (d) More than three

6. Rearing system practiced
   (a) Free range
   (b) Intensive
   (c) Semi-intensive

7. What type of feed given to the sheep?
   (a) Forages
   (b) Hays
   (c) Pellets
   (d) Others: _____

8. Are all sheep in the farm fed the same ration?
   (a) Yes
   (b) No (Please specify: _____)

9. Do the sheep allowed to pasture?
   (a) Yes
   (b) No

10. Outdoor walking surfaces
   (a) Concrete track on roadways
   (b) Rough stones or dirt tracks
   (c) No track (direct to field)

11. Are the hooves examined when back from the field?
   (a) Yes
   (b) No

12. Is there any foot dip/ foot bath for the animals?
   (a) Yes
   (b) No

13. Are the barns well protected from rain and kept dry during rainfall?
    (a) Yes
    (b) No

14. What do you use as bedding for the sheep in the pen?
    (a) Sawdust
    (b) Straw
    (c) Pelleted bedding
    (d) Wood chips
    (e) Sand
    (f) None
    (g) Others: please specify

15. How often is the bedding changed?
    (a) Every 10-14 days
    (b) Every month once
    (c) Every 6 months once
    (d) Others: _____

16. What type of material used for the flooring?
    _____

17. How often are the pens cleaned?
    (a) Once daily
    (b) Twice daily
    (c) 2-3 times a week
    (d) Others: please specify

18. Are the sheep moved to a dry pen before washing the pen?
    (a) Yes
    (b) No

19. How often are the hooves trimmed?
    (a) Every 6 months
    (b) Once a year
    (c) Every 6-8 weeks
    (d) Never
    (e) Others: _____

20. Do many sheep frequently show signs of lameness (weekly/ monthly)?
    (a) Yes
    (b) No

21. Is locomotion scoring done in the farm?
    (a) Yes
    (b) No

22. Do you call the veterinarian when lameness is detected?
    (a) Yes
    (b) No

23. How soon will the lameness be treated (after you detect lameness in an individual sheep/herd)?
    (a) Immediately
    (b) In 24 hours
    (c) In 48 hours
    (d) Wait until the veterinarian to come
    (e) Others: _____

24. What causes lameness in sheep, in your farm?
    _____

25. When a sheep shows sign of lameness, do you check the hooves for any lesions (puncture wounds, trauma, fracture)?
    (a) Yes
    (b) No

26. What causes hoof conditions in sheep?
    _____

27. How do you treat lameness in sheep at the farm?
    _____