



UNIVERSITI PUTRA MALAYSIA

**EFFECTS OF FEEDING SELECTED RUMEN-PROTECTED FATS ON
REPRODUCTIVE PERFORMANCE OF MALE MALIN SHEEP**

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By

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**Thesis Submitted to the School of Graduate Studies,
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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science.

EFFECTS OF FEEDING SELECTED RUMEN-PROTECTED FATS ON MALE REPRODUCTIVE PERFORMANCE OF MALIN SHEEP

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Rumen protected fat have been used in the livestock industry to increase the energy density of the animal feed to compensate the energy deficiency in dairy animal but not normally feed to male animals. Male animals that are used for breeding also required a lot of energy for physical activity and its reproductive system. Though, knowledge on the effect of rumen protected fats to the reproductive system in the male sheep is still limited. Therefore, this study purpose is to evaluate the effects of rumen protected fat (RPF) that is high in fatty acid on reproductive system in Malin rams. Twenty adult Malin rams were randomly assigned to four group namely, T1: control, T2: 2% prilled fat, T3: 2% calcium salt fatty acid (casa) and T4: 2% canola oil respectively. Prilled fat and calcium salt fatty acid (casa) are rumen protected fat made from palm oil. Body weight gain and average daily gain shown no significant different ($P>0.05$) during the experimental period and yet, there was a tendency higher body weight gain in animal fed with calcium salt fatty acid (casa). Results showed that rams received prilled fat have significant higher ($P<0.05$) semen volume compare to casa and canola groups. The sperm concentration of animals received canola oil shown a significant higher ($P<0.05$) than animals received prilled fat and casa. There are significant increased ($P<0.05$) in the sperm membrane integrity and live sperm in prilled and casa group than control. Increase semen volume, sperm membrane integrity and live sperm in prilled and casa group indicated that more fatty acid reach the small intestine for absorption causing more energy production thus improving sperm quality. Testosterone level, testicular traits and histological structure of testes showed no significantly difference ($P>0.05$) among all group. This suggest that usage of fat supplement not only depend on nature or type of fat but also on the amount of fat added in the feed to affect the testosterone production and spermatogenesis in the testes. In conclusion, inclusion of rumen protected fats as a supplement to adult Malin rams have improved the semen volume, sperm membrane integrity and live sperm without affecting testosterone production and spermatogenesis.

Abstrak tesis yang dikemukakan kepada senat Universiti Putra Malaysia Sebagai memenuhi keperluan untuk ijazah Master Sains

KESAN LEMAK DILINDUNGI RUMEN YANG TERPILIH KEPADA PRESTASI PEMBIAKAN PEJANTAN DALAM BIRI-BIRI MALIN

Oleh

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Lemak yang dilindungi rumen (RPF) telah digunakan secara meluas di dalam industri ternakan untuk meningkatkan kandungan tenaga di dalam makanan ternakan bagi menampung kekurangan tenaga terutama didalam ternakan tenusu tetapi tidak dipraktiskan dalam makanan untuk ternakan pejantan. Ternakan pejantan yang digunakan untuk pembiakkan juga memerlukan tenaga yang banyak untuk aktiviti fizikal dan sistem pembiakan. Namun pengetahuan berkaitan kesan kepada prestasi sistem pembiakan pejantan adalah kurang. Oleh sebab itu, tujuan penyelidikan ini adalah untuk menilai kesan lemak yang dilindungi yang tinggi kandungan asid lemak kepada prestasi sistem pembiakan pejantan biri-biri Malin. Sebanyak dua puluh ekor pejantan dewasa biri-biri Malin secara rawak telah ditempatkan kepada empat kumpulan iaitu T1: kawalan, T2: 2% butiran lemak, T3: 2% garam kalsium asid lemak dan T4: 2% minyak canola. Butiran lemak dan garam kalsium asid lemak adalah lemak yang dilindungi dan dibuat daripada minyak kelapa sawit. Kenaikan berat badan dan purata kenaikan harian berat badan tidak menunjukkan kesan yang ketara antara kumpulan ($P > 0.05$) semasa tempoh eksperimen. Namun ada kecenderungan kenaikan berat yang lebih tinggi dapat dilihat pada haiwan yang menerima garam kalsium asid lemak. Kesan ketara pengeluaran semen yang tinggi ($P < 0.05$) ditunjukkan oleh pejantan biri-biri yang menerima butiran lemak berbanding pejantan yang menerima garam kalsium asid lemak dan minyak canola. Kepekatan semen yang tinggi ($P < 0.05$), ditunjukkan oleh pejantan yang menerima minyak canola berbanding ternakan menerima butiran lemak dan garam kalsium asid lemak. Kesan ketara ($P < 0.05$) yang lebih tinggi ditunjukkan pada integriti membran sperma dan sperma hidup oleh pejantan yang menerima butiran lemak dan garam kalsium asid lemak berbanding pejantan kawalan. Peningkatan jumlah semen yang dikeluarkan, integriti membran sperma dan sperma hidup dalam ternakan yang menerima butiran lemak dan garam kalsium asid lemak menunjukkan bahawa lebih banyak asid lemak sampai kepada usus kecil untuk penyerapan dan menghasilkan lebih banyak tenaga dan akhirnya meningkatkan kualiti sperma. Kadar hormon testosterone, ciri-ciri testis dan struktur histologi testis tidak menunjukkan kesan yang ketara ($P < 0.05$) diantara semua kumpulan pejantan. Ini boleh disebabkan penggunaan lemak sebagai makanan tambahan bukan hanya bergantung kepada jenis lemak tetapi juga bergantung

kepada jumlah lemak diberikan untuk memberikan kesan kepada pengeluaran hormon testosteron dan proses pembentukan sperm di testis. Kesimpulannya, pemberian lemak yang dilindungi sebagai makanan tambahan kepada pejantan biri-biri Malin meningkatkan jumlah semen dikeluarkan, integriti membrane sperma dan sperma hidup tanpa memberi kesan kepada pengeluaran hormon testosteron dan proses pembentukan sperma.



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LIST OF ABBREVIATIONS

CASA	Computer Aided Sperm Analyzer
DVS	Department of Veterinary Service
RPF	Rumen protected fat
RPM	Rotation per minute
PUFA	Polyunsaturated fatty acid
ICAR	Indian Council of Agriculture Research
NIANP	National Institute of Animal Nutrition and Physiology





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CHAPTER 1

INTRODUCTION

Nutrient shortage can lead to poor reproductive performance in rams which will decrease animals productivity in the farm. Traditionally, concentrate or grain-based diet has been used as a solution to increase the energy density in the diet of animals. However, there are limits on how much the concentrate and grain can be included in the diet due to high cost of feed ingredient, limited supply and the risk of acidosis. Small ruminant such as goats and sheep are also facing nutrient shortage in Asia country because of unpredictable climatic pattern, declivity in land and feed resources (Ben Salem and Smith, 2008). As a result, there is energy deficiency in ruminant livestock and therefore this deficiency will affect the growth, production, and subsequent breeding performance (Devasena et al., 2007). Nutrition has a major effect on testicular mass especially in mature rams. The change in testicular mass reflects changes in the size of the seminiferous tubule which could result in reduced spermatogenesis efficiency (Martin et al., 2010). In fact, underfeeding in adult rams in 65 days, can reduced spermatogenesis and more likely to cause sperm DNA damage (Guan et al., 2014). Therefore, it is important to gather more information whether feeding any supplement can overcome the problem.

Lipid supplement to the animals can be the solution as fat can give 2.24 times more energy than carbohydrate (NRC, 2001). Lipid is not just important in energy storage but also in other aspect such as hormone synthesis, composition of plasma membrane and function in sperm motility. Lipids have been used to increase the energy density of an animal feed. Lack of energy in ruminants can be due to low quality of the roughages offered or reduced feed intake by the animals. Usage of lipid supplementation have become a common practice to increase the energy density of the diet for ruminant. In Malaysia, palm oil defined product has been mostly used in livestock industry because they do not have the negative effect on rumen fermentation such as unsaturated oils (Manso et al., 2009). Several studied have shown that utilization of lipid supplement could increase milk yield (Alstrup et al., 2015), body condition (Bhatt et al., 2013), conception rate in dairy cows (McNamara et al., 2003) and increased semen concentration in male animals (Fair et al., 2014). Lipid also play a major role in the sperm plasma membrane. It has been showed that percentage of long-chain unsaturated free fatty acid is correlated with the normal morphology of sperm cells (Lenzi et al., 2000).

Different types of lipid supplement have different composition of fatty acids. Fatty acids composition may be related to different effects on production level of the animals. The abundance of long-chain fatty acids alters rumen fermentation, coating the fiber and depressing fiber digestion. Thus, it is recommended that lipid supplement in the animal diet should not be more than 6-7% in dietary dry matter because it can be harmful to rumen microbial fermentation (NRC, 2001). Many studies had used lipid supplement that is high in unsaturated fatty acid due to reason that sperm cell membrane have high content of unsaturated fatty acids. Another studied have showed that saturated fatty acid is also important as source of energy for sperm movement (Amaral et al., 2013). Lipid

supplement that are high in unsaturated fatty acid are mostly from plant source that are not grown locally like linseed. Usage of lipid supplement that have high saturated fatty acid from palm oil can also have some beneficial advantage to the male reproductive system.

Rumen protected fat has been treated through several chemical methods. Rumen protected fat is manufactured to bypass the rumen metabolism, therefore avoid toxicity of the fat to rumen microorganisms and improving energy efficiency compare to conventional natural oil (Ganj Khanlou et al., 2009; Sanz Sampelayo et al., 2002). This protected fat will be digested in the abomasum where the pH is more acidic than that of the rumen. By using protected fat, the amount given to the animals could be safely used up to 7.5% without any adverse effect on dry matter intake and rumen fermentation (Sirohi et al., 2001) although Ramana et al., (2003) have shown the safe inclusion of protected fat with calcium up to 10%. Increasing the percentage of inclusion mean more energy can be given to the animals. Apart from that, using locally produced palm oil-based product could save the feeding cost. This practice will be more affordable to the producers compare to total concentrate or grains feeding and safer since it will not disturb the rumen microbes and metabolism.

1.1 Hypothesis

The usage of rumen protected fat from by-product of palm oil in the diet at 2% dry matter will increase the semen quality, testosterone level in the blood and improve spermatogenesis in Malin rams due to high fatty acid content in rumen protected fat compare to control diet.

1.2 The general objective of the study

To evaluate the effect of rumen protected fat as a supplement in diet on the reproductive system in Malin rams.

1.3 The specific objectives of the study are:

- i. to evaluate the effect of feeding rumen protected fat on semen characteristics in Malin rams;
- ii. to evaluate the effect of feeding rumen protected fat on plasma testosterone level in Malin rams; and
- iii. to examine the effect of rumen protected fat on testicular and histological changes of testis in Malin rams.

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LIST OF PUBLICATIONS

Ahmad, M. H., Loh, T. C., Maidin, M.S., and Samsudin, A. A. 2018. Effect of rumen protected fat on male reproduction performance in Malin sheep. Proceedings Joint Symposium of the 8th International Agriculture Congress and 6th International Symposium for Food and Agriculture, pp 60-62.

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