LIVESTOCK Production in CHALLENGING ENVIRONMENT

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PROCEEDINGS (ABSTRACT BOOK)

The Malaysian Society of Animal Production

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Welcome Notes



On behalf of the Malaysian Society of Animal Production I am pleased to welcome all participants to the 4th ASEAN Regional Conference on Animal Production (ARCAP) and the 38th Annual Conference 2017 in Johor Bahru.

MSAP takes pride in organizing these important conferences not only as an avenue for scientists to present their research findings but also as a platform where players of the animal industry meet and share their concerns and experiences. The theme of the conference "**Livestock Production in Challenging Environment**" was chosen by the Society as an expression of concern with regards to the global development of the livestock production and related industry which is facing numerous challenges due to recent global uncertainty. Constraints to animal production in tropical and developing countries are complex and include environmental, political, sociological, economical, legal, and technical (management). In tropical countries environmental constraints are focused towards global warming and adaptation to heat stress, water and soil pollution and water issues. The manipulation of physical and biological parameters is essential in order to optimize farm productivity and economic output. However, socioeconomic conditions may interfere with environmental constraints and affect the overall output of the ecosystems on a sustainable basis. In ASEAN region, livestock production is likely to be increasingly affected by carbon constraints and environmental and animal welfare legislation. Demand for livestock products in the future could be heavily moderated by socio-economic factors such as human health concerns and changing socio-cultural values. There is considerable uncertainty as to how these factors affect different this region in the coming decades. The livestock sector globally is highly dynamic and in developing countries, it is evolving in response to rapidly increasing demand for livestock products.

In developed countries, demand for livestock products is stagnating, while many production systems are increasing their efficiency and environmental sustainability. Changes in the demand for livestock products have been largely driven by human population growth, income growth and urbanization. This is true for the ASEAN region, where livestock numbers have increased significantly in the last decade, possibly due to improved in farming systems and science and technology. Nevertheless, livestock production will increasingly be affected by competition for land and water, for food and feed and by the need to operate in a carbon-constrained economy.

Farming systems will also increasingly be affected by legislation on environment and animal welfare. These issues are pertinent to livestock production especially with changing global political scenario thus, this conference will cover all aspects of scientific achievements within the field of animal production, including genetics, nutrition, management, health and other related areas to addres the issues.

Participants will have the opportunity to attend a number of plenary papers and oral presentations from speakers, local and abroad, and view exciting posters from research conducted by local scientists and post-graduate students. Livestock plays an important role in the economy, both at the rural and national level. For the farmers, profitability is of utmost importance and this could possibly be achieved through application of technology and knowledge no matter how challenging the circumstances are be it environmentally, financially as well as politically. For this, we have also organized a special session with the theme "**Profitable Dairy Farming in Challenging Environment**" particularly for dairy farmers on the 30th to discuss the latest technology, policy as well as other related issues on dairy farming.

Besides organizing the annual conference, MSAP will continue to organize training workshops and other events that are of benefits to members, stakeholders and farmers. MSAP would like to welcome inputs, suggestions and requirements from various interest groups so that activities can be organized for the betterment of the livestock industry. For those who are involved in the industry you are most welcomed to join the Society and share your passion and vision with us.

Last but not least, I wish to thank the Organizing Committee, the director and staff of MARDI, UPM, DVS, participants and others for their contributions and hard work in making this conference a success. I am sure that all of us will have a productive meeting and also enjoy the social events, networking and hospitality here in Johor.

Y.Bhg.
Dr. Abd Wahid Haron
PRESIDENT, MALAYSIAN SOCIETY OF ANIMAL PRODUCTION 2016/2018
cum *CHAIRMAN OF ORGANIZING COMMITTEE, 4th ARCAP & 38th MSAP ANNUAL CONFERENCE*

4th ASEAN REGIONAL CONFERENCE ON ANIMAL PRODUCTION (ARCAP)
&
MALAYSIAN SOCIETY OF ANIMAL PRODUCTION (MSAP)
38th ANNUAL CONFERENCE 2017
Le Grandeur Palm Resort, Senai, Johor

PROGRAMME

27th August 2017 (Sunday)	
1500 onwards	HOTEL – CHECK IN
2000 – 2200	CONFERENCE REGISTRATION
28th August 2017 (Monday)	
0800 – 0900	CONFERENCE REGISTRATION (4TH ARCAP AND 38TH MSAP Annual Conference 2017)
0900 – 0915	WELCOMING SPEECH
KEYNOTE SESSION	
CHAIRMAN: PROF DR ABD WAHID HARON	
0915 – 1000	Keynote Lecture **LIVESTOCK PRODUCTION IN CHALLENGING ENVIRONMENT** Dato' Dr. Quaza Nizamuddin Bin Hassan Nizam, *Director General, Department of Veterinary Services Malaysia*
1000 – 1030	MORNING COFFEE
SCIENTIFIC SESSION 1	
CHAIRMAN: DR. ABU HASSAN MUHAMMAD ALI	
1030 – 1100	Plenary 1: **R&D DIRECTION OF THE MALAYSIAN DAIRY INDUSTRY** Dr. Shanmugavelu Sithambaram *Malaysian Agricultural Research and Development Institute*
1100 – 1130	Plenary 2: **DAIRY GOAT FARMING UNDER CHANGING THE ENVIRONMENT IN SOUTHERN THAILAND** Dr Bodee Khamseekhiew, *Prince of Songkla University, Thailand*

1130 – 1145	THE EFFECTS OF SUPPLEMENTATION OF CALCIUM SALT OF FATTY ACID ON THE DIGESTIBILITY OF NUTRIENTS IN DAIRY GOATS Siti Aisyah, S., H. Yaakub and A.R. Alimon
1145 – 1200	EFFECTS OF MEDICATED AND NON-MEDICATED UREA MOLASSES MULTI-NUTRIENT BLOCK SUPPLEMENTATION ON NUTRIENT DIGESTIBILITY OF SAANEN LACTATING DOES RAISED UNDER CONVENTIONAL DIETS. Mira, P., Wan Zahari, M., Rusli, N.D. and K. Mat
1200 – 1215	COW LEVEL PREVALENCE OF CLINICAL LAMENESS, CLAW LESIONS AND ASSOCIATED RISK FACTORS IN EIGHT DAIRY FARMS IN SELANGOR, MALAYSIA Sadiq, M.B., S.Z. Ramanoon, R. Mansor, S.S. Syed-Hussain, W.M. Shaik Mossadeq
1215 – 1230	ASSOCIATION ANALYSIS OF TEAT MORPHOLOGY AND UDDER QUARTER MASTITIS STATUS IN FRESIAN AND JERSEY COWS Sani, U.M., J.M. Panandam, H. Yaakub, S. Sumita and Z.A. Rahman
1230 – 1300	POSTER SESSION 1
1300 – 1400	LUNCH
SCIENTIFIC SESSION 2	
CHAIRMAN: ASSOC PROF DR HALIMATUN YAAKUB	
1400 – 1430	Plenary 3: **FACTORS AFFECTING LIVESTOCK PRODUCTION IN THE TROPICS AND POTENTIAL SOLUTIONS** Prof Dr Chin Nyean Lee, *University of Hawaii, Manoa, USA*
1430 – 1500	Plenary 4: **MEETING THE CHALLENGE OF FORAGE RESOURCES FOR CATTLE IN MALAYSIA WITH AN OIL PALM FROND (OPF) BASED TMR PELLET** Dr Mohd Azid Kabul *Sawit Kinabalu, Sabah*
1500 – 1515	EFFECT OF PROBIOTIC ADDITION IN DIFFERENT FEED FORMULATION ON RUMEN FERMENTATION IN VITRO Nurfitriani, R.A., R. Ridwan, A. Jayanegara and N. Kumalasari
1515 – 1530	NUTRITIVE VALUE OF NAPIER (Pennisetum purpureum Schumach.) CULTIVARS AS FRESH AND ENSILED FODDER Zailan, M. Z., H. Yaakub and S. Jusoh
1530 – 1545	IN VITRO EVALUATION OF Gliricidia sepium, Sapindus rarak OR Hibiscus sp. SUPPLEMENTATION TO NAPIER GRASS

	Yuliana, P., E. B. Laconi, A. Jayanegara and A. A. Samsudin
1545 – 1600	LIPOGENIC GENES EXPRESSION IN GOATS FED FATTENING DIET SUPPLEMENTED WITH LINSEED OIL Candyrine, S.C.L., M.F. Jahromi, M. Ebrahimi, N. Abdullah, Y.M. Goh and J.B. Liang
1600 – 1615	PHYSICAL AND CHEMICAL CHARACTERISTICS OF EMPTY FRUIT BUNCH-BASED BEEF CATTLE FEED PELLET 'Abidah, M.N., W.M. Wan Nooraida and I. Nur Atikah
1615 – 1630	RESPONSE OF SUPEROVULATION BY USING FSH (FOLLICLE STIMULATING HORMONE) AND SEX DETERMINATION OF PESISIR CATTLE EMBRYOS USING PCR METHOD AS GERMPLASM FROM WEST SUMATRA Afriani, T., F.L. Syaiful, D.E. Putra and E. Purwati
1630 – 1700	TEA BREAK & POSTER SESSION 2
1700 – 1800	**MSAP Annual General Meeting**
1930 – 2230	CONFERENCE OPENING CEREMONY & DINNER
29th August 2017 (Tuesday)	
0800 – 0900	REGISTRATION (Technical visit)
SCIENTIFIC SESSION 3	
CHAIRMAN: PROF DR ABD RAZAK ALIMON	
0900 – 0930	Plenary 5: **APPLICATION OF PROBIOTIC ISOLATED FROM DADIH FOR ANIMAL HEALTH AND ENVIRONMENT** Prof Drh Hjh Endang Purwati *University of Andalas, Indonesia*
0930 – 0945	CAN THE COMBINATION BETWEEN Panax ginseng AND Eurycoma longifolia AQUEOUS EXTRACTS IMPROVE CRYOPRESERVED SPERM? Biaee, F. H., H. Wahid, Y. Rosnina, O. Ariff, O. N. Yimer, Kh. Zaid, A.A. Tarig, H. Salman, and M.A. Khumran
0945 – 1000	COMPARISON OF SAMPLE PREPARATION METHODS FOR DETERMINATION OF TITANIUM, PHOSPHORUS AND CALCIUM IN BROILER DIETS AND DIGESTA Samat, N. and H. Miller
1000 – 1015	IMMUNOSENSOR FOR ELECTROCHEMICAL DETECTION OF CLENBUTEROL Talib, N.A.A., Salam, F., Yusof, N.A., Ahmad, S.A.A., Azid, M.A., Mirad, R. and Y. Sulaiman

1015 – 11.15	MORNING COFFEE & POSTER SESSION 3 (JUDGING SESSION)
SCIENTIFIC SESSION 4	
CHAIRMAN: PROF DR LOH TECK CHWEN	
1115 – 1130	EFFECT OF PALM KERNEL EXPELLER AND PALM KERNEL EXTRACT (OLIGOPKE) ON INTESTINAL MONOSACCHARIDES TRANSPORTER GENE OF BROILER CHICKS Chen, W.L, A. Norhani, I. Zulkifli, and J.B. Liang
1130 – 1145	EFFECT OF AGE ON EGG QUALITY PARAMETERS OF ISA BROWN LAYER STRAIN REARED UNDER CLOSED BATTERY CAGE HOUSING SYSTEM. Garba, S., J.O. Olubodun, D. S. Jibia and A. Garba
1145 - 1200	GROWTH PERFORMANCE AND MEAT QUALITY OF BROILER FED DIETS WITH DIFFERENT SOURCES OF OIL AND L-ARGININE Khatun, J., T. C. Loh, H. Akit, H. L. Foo and R. Mohamad
1200 - 1215	BIOMASS PRODUCTION OF Spirulina sp. STRAINS ON DIFFERENT MEDIA AS SUPPLEMENT FOR BROILER Ghofar, H.S.A., Jahromi, M.J., Ikhsan, F.N.M., Samsudin, A.A.
1215 - 1230	SEMEN CHARACTERISTICS, ANTLER STAGE AND SCROTAL CIRCUMFERENCE OF RUSA TIMORENSIS DURING BREEDING AND NON-BREEDING SEASONS Fitri, W.N., H. Wahid, Y. Rosnina, F.F.A. Jesse, Z.A. Aimi-Sarah, M.L. Mohd-Azmi, C.A. Azlan and M.R. Azrolharith
1230 – 1245	EDIBLE BIRD'S NEST (EBN) SUPPLEMENT IN RATS MODULATES UTERINE FUNCTION AND EMBRYO IMPLANTATION Abdulla, A.A., Yimer, N., Zakaria, Md. Z.A., Haron, A.W., Rosnina, Y. and A.S. Babji
1245 – 1400	LUNCH
TECHNICAL VISIT	
1400 – 1800	TECHNICAL VISIT (Limited for 40 person only) OSMAN GOAT FARM 38, Jalan Enau, Kangkar Tebrau, JB (30 minutes from Conference Venue)
1930 – 2230	FREE TIME

FARMERS SESSION

PROFITABLE DAIRY FARMING IN CHALLENGING ENVIRONMENT

30th August 2017 (Wednesday)	
0800 – 0900	REGISTRATION (FARMERS SESSION) & MORNING COFFEE
0900 – 0910	OPENING CEREMONY OF FARMERS SESSION
CHAIRMAN & FORUM MODERATOR: DR. ABU HASSAN MUHAMMAD ALI	
	FORUM (SPEAKER PRESENTATIONS)
0910 – 0950	Penternakan Tenusu: Pengalaman di Malaysia Dairy Farming: Experience in Malaysia - En. Qassim, Ulu Yam
0950 – 1030	Pengurusan Anak Lembu Tenusu Dairy Calf Management – Prof Madya Dr. Halimatun Yaakub, UPM)
1030 – 1110	Penyakit dalam Tenusu Diseases in Dairy - Dr. Maria Jamli, IVM
1110 – 1150	Pembangunan Kooperatif Tenusu di Malaysia Development of Dairy Cooperative in Malaysia - Dato' Dr. Azizan Ab Rashid
1150 – 1230	FORUM (Q & A)
1230 – 1300	CLOSING CEREMONY & AWARDS PRESENTATION
1300 – 1400	LUNCH

List of Poster Presenters

1. **LEVEL OF THE TECHNOLOGY USAGE IN SMALL-RUMINANT FARM MANAGEMENT IN MALAYSIA**

   Amna A'liah, N.M.N, R.M. Hifzan and S. Nurul Huda

2. **SCREENING FOR MICROBIOLOGICAL SAFETY AND QUALITY OF GOAT MILK FROM JOHOR**

   Khairunnisak, M., Putri Nur Atifi, M. N., Sarol, K., Nursyuhada, M. R. and S. Saudah

3. **COMPARISON ON PERFORMANCE OF JAMNAPARI GOAT FED WITH GUINEA GRASS (*Megathrysus maximus*) AND NAPIER GRASS (*Pennisetum purpureum*)**

   Aswanimiyuni, A. , I. Mohamad Noor, H. Haryani , F. Norfadzrin and M. Nurzillah

4. **PRE-AND POST-WEANING GROWTH PERFORMANCE OF KATJANG X BOER GOATS**

   Hifzan R.M. A.W. Mohd Hafiz, A.J. Izuan Bahtiar, A. B. Amie Marini and J.M. Nasir

5. **COMPARISON OF GROWTH CURVE PARAMETERS OF BRAKMAS AND BALI COWS**

   Mohd. Hafiz, A.W., Izuan Bahtiar, A.J., Mohamad Hifzan, R., Ariff, O.M. and A.L. Faezal Ashraff

6. **EFFECT OF BREED, LACTATION STAGE AND BODY CONDITION SCORE ON MILK COMPOSITION**

   Amer, A. H. Wahid, M. Mardhati, Z. Siti Hajar, Z.A, Rahman and H. Yaakub

7. **PRELIMINARY STUDY ON NUTRIENT CONTENT OF LOCAL GRASS IN INTEGRATED FARMING IN JOHOR**

   Norlindawati, A.P., Haryani, H, Sabariah, B., M. Noor, I, Samijah, A. and M.J. Supie

8. **THE EFFECTS OF ADDING POME (PALM OIL MILL EFFLUENT) IN THE SOIL ON YIELD AND NUTRITIVE VALUES OF NAPIER GRASS (*Pennisetum purpureum cv. Taiwan*)**

   Haryani, H., F. Norfadzrin, A. Aswanimiyuni and A. Azman

9. **AGRONOMIC PROPERTIES AND YIELD OF FIVE VARIETIES OF NAPIER GRASS**

   Jusoh, S. and R. Anisah

10. **OPTIMUM ENSILAGING PERIOD OF SIXTH WEEKS OLD NAPIER GRASS HYBRID**

    Fitri Rimi, H.M., Habsah, B., Mardhati, M., S. Mohd Rosly, S., Noraini, S. and A.H. Norsuhana

11. **EFFECTS OF FEEDING OIL PALM TRUNK CORE BASED DIET ON PERFORMANCE OF COLORED SASSO CROSSBRED BROILER ("VILLAGE") CHICKENS**

Azizan A.R., A. Mohd Shafiq and C.C. Goh

12. **EFFECT OF DIFFERENT DIETARY OILS ON GROWTH PERFORMANCE OF BROILER CHICKEN**

Wan Nooraida, W.M., M.N. 'Abidah and I. Nur Atikah

13. **EFFECT OF FEEDING PALM FATTY ACID DISTILLATE AS LIPID SOURCE ON GROWTH PERFORMANCE OF RED HYBRID TILAPIA**

Farahiyah, I.J., M. Mardhati and A.A.R. Zainal

14. **APPARENT DIGESTIBILITY COEFFICIENTS OF POULTRY OFFAL MEAL, PALM KERNEL CAKE AND RICE BRAN IN JELAWAT (*Leptobarbus hoevenii*)**

Farahiyah, I.J., A.A.R. Zainal and A. Ahmad

15. **CARCASS CHARACTERISTICS OF MALE DORPER SHEEP WEANED AT DIFFERENT AGES**

Norhayati, Z., Wan Zahari, M., Nooraisyah, S., Shanmugavelu, S. and Abdul A. Rahman

16. **SENSORY EVALUATION OF MEAT FROM GOATS FED WITH OIL PALM BY-PRODUCTS: A PRELIMINARY STUDY**

Nur Atikah, I., M.R. Md Zainal Rasyidi, A.H. Rafidah, M.N. Abidah, and W.M. Wan Nooraida

17. **EFFECTS OF RAW *Aleurites moluccana* (L.) Willd. KERNEL MEAL ON FATTY ACID PROFILE OF *PECTORALIS* AND *ILIOTIBIALIS* MUSCLES OF QUAIL**

Rohaida, A. R., Abdul Rashid, B., Nurul'azah, M. Y. and Abd Rahman, M.

18. **OESTRUS RESPONSE OF DORPER CROSS EWES SYNCRONISED USING INTRAVAGINAL SPONGE FGA WITH DIFFERENT BACKFAT THICKNESS AND OESTRADIOL BENZOATE DOSES**

Hazlinda, H., Panandam, J. M., Abdul Mu'in and H. Yaakub

19. **ASSESSMENT OF SEMEN QUALITY OF KATJANG X BOER F1 BUCK IN MARDI KLUANG**

Julie Marzlinda, M.R., R.M. Hifzan, P. Mohd Azlan, M.A. Noor Athirah and M.S. Mohd Azlan.

20. **MULTIPLE OVULATION EMBRYO TRANSFER (MOET) IN DAIRY CATTLE: A CASE REPORT**

Faizah, H.M.S., Richard, F., Meena, P., Stanley K.L., Amriana, H., Alhassany, A., Yadav, S.B., Marie, L., Crouch, B. and B.A.R. Saipul

21. **MATERNITY DNA TESTING IN CATTLE USING MICROSATELLITE MARKERS**

Suriaty, R., A.R. Mohd Hafiz, I. Zawawi, A.B. Amie Marini, M.A. Ernie Muneerah, T. Halimaton Sa'adiah and R. Roslaini

22. **DETECTION OF *CAMPYLOBACTER* USING LATERAL FLOW IMMUNOASSAY KIT**

Noor Azlina, M., Mohd Afendy, A., Lau, H.Y., Norzila, K., Noor Aseha, Y., and I. Mohammad Rejab

23. **SURFACE MODIFICATION STUDIES FOR ANTI-T2 TOXIN ANTIBODY IMMOBILIZATION ON GOLD MACROELECTRODE FOR THE DETECTION OF T-2/HT-2 MYCOTOXIN**

Nur Azura M.S., K. Twomey and V.I. Ogurtsov

24. **OVICIDAL EFFECT OF *Sesbania grandiflora* LEAF EXTRACT ON NEMATODES' EGGS FROM NATURALLY INFECTED GOATS**

Azrul, L.M., Poungpong, K., Jittapalapong, S. and S. Prasanpanich

25. **ESTABLISHMENT OF MULTIPLEX PCR FOR IDENTIFIYING *Salmonella* SPP., *Salmonella* Typhimurium & *Salmonella* Enteritidis**

Mohd Afendy, A.T., N.A. Nor Fazmimi, M. Noor Azlina and R. Son

26. **SURVEY OF FEEDING PRACTICES AMONG A SUBPOPULATION OF HORSE STABLE MANAGERS IN SELANGOR AND WILAYAH PERSEKUTUAN KUALA LUMPUR**

Akit, H., N. S. Mohamad and N. S. Zailani

27. **THE EFFECT OF *Leucaena leucocephala* SUPPLEMENTED DIET ON RUMEN MICROBIAL POPULATION OF GOATS**

Nur Liyana, A.H., Alimon, A.R., Jehromi, M.F., Goh, Y.M. and A.A. Samsudin

28. **COMPARATIVE STUDY ON THE EFFECTS OF FEEDING FORMULATED RATIONS BASED ON LOCAL BY-PRODUCTS AND IMPORTED FEEDSTUFFS ON GROWTH RATE AND MILK YIELD OF LACTATING DORPER EWES**

Nurulhuda, M.O., M. Wan Zahari, and S. Shanmugavelu

29. **EFFECTS OF SUPEROVULATION HORMONES ON *IN VIVO* BOVINE EMBRYO PRODUCTION**

Habsah, B., Ahmad, J., Ajis, H., Hairul Akmal, A.M. and K. Musaddin

30. **FIRST REPORT ON DEVELOPMENT OF GOAT BREED IDENTIFICATION MARKERS BASED ON COMMERCIAL SNP ARRAY**

Azwan, J., M. Najihah, R.M. Hifzan, A.B. Amie Marini, O. Mohd Firdaus, S. Mohd Rosly, and A. Norzihan

31. **EFFECT OF INCLUSION OF PALM KERNEL MEAL IN EXTRUDED PELLET FEED ON THE GROWTH OF TILAPIA**

Yong, S.T., I.J. Farahiyah and S. Noraini

32. **DETECTION OF *EIMERIA* SPECIES BY POLYMERASE CHAIN REACTION BASED ON SPECIES-SPECIFIC SCAR MARKERS IN COMMERCIALLY-REARED CHICKENS IN SELANGOR, MALAYSIA**

Adlin Azlina, A.K, Kiew Lian Wan and Sheila Nathan

33. **THE EFFECTIVENESS OF ENCLOSED POULTRY HOUSE WITH EVAPORATIVE COOLING PAD SYSTEM DURING EL-NINO HEATWAVE IN MALAYSIA**

Mohd Azri, A., Azlian, M.N., Noraini, S., Siti Masidayu, M.S., and H. Zainodin

34. **MARDI NANOSENS ANTIBIOTIC: RAPID AND COST-EFFECTIVE METHOD FOR THE ANALYSIS OF ANTIBIOTIC RESIDUES IN CHICKEN SAMPLE**

Faridah, S., M.S. Nur Azura, R. Hazana, A.R. Gayah, A. Azima and M.R. Syah Noor

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4th ARCAP & 38th MSAP ANNUAL CONFERENCE
Organizing Committee

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The organising committee for

4th ASEAN Regional Conference on Animal Production (ARCAP)
&
Malaysian Society of Animal Production (MSAP)
38th Annual Conference

wishes to thank the following for their support and commitment:

Distinguished chairpersons, all speakers, judges, participants, participating agencies and institutions, foreign and local

Our co-organisers
Universiti Putra Malaysia | Malaysian Agricultural Research and Development Institute (MARDI) | Department of Veterinary Services Malaysia

All committee members for their time and effort and all those relevant parties and individuals who have contributed to the success of this event in one way or another.
Looking forward to seeing you again in our future conferences.

About MSAP

The Malaysian Society of Animal Production (MSAP) was formally established in 1971. Members of the society comprises personnel and individuals from the government, semi-government and private organization with interest in animal production, either in research, education, consultancy or associated with the practical and trading industries. All private and public organization and companies involved in any aspect of animal production are eligible for corporate membership of the society.



The objectives of the Society are:

To give due importance and status to the science and state of the art of animal production as a profession in the country's agricultural and economic development

To act as a body by and through which persons associated and/or interested in the general field of animal production could meet to forge and establish social contact and a sense of mutual fellowship with each other

To act as a body that would provide the opportunities for personal development of personnel involved and/or interested in the field of animal production

To act as a body that would represent all members, in matters related to their interests as professionals in this field

To identify problems in various areas of animal production and to encourage investigations into these

To encourage co-operation between science, education, extension and commerce in the field of animal production

To encourage animal production and to stimulate the incorporation into practice of advances from research

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We welcome and encourage all individuals and professionals, from academicians to industry personnel, government or private institution or just about anyone interested to join us and become a member of MSAP. All members will get special benefits and privileges in all society activities all year round.

Select from 2 types of membership that fit your needs and budget

Annual membership RM50 (USD20)	**Lifetime membership RM500 (USD180)**	**For more information please e-mail us at: *info@msap.my* or visit our Facebook @msapmy Or visit the secretariat counter during our annual conference for membership form and enquiries**

PERSATUAN PRODUKSI HAIWAN MALAYSIA

Malaysian Society of Animal Production

BORANG PERMOHONAN KEAHLIAN

Membership Application Form

Saya ingin menjadi ahli MSAP *(I would like to be a member of MSAP)*:

☐ Biasa *(Ordinary)* ☐ Korporat *(Corporate)* ☐ Seumur Hidup *(Life)* ☐ Pelajar *(Student)*

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LIVESTOCK PRODUCTION IN CHALLENGING ENVIRONMENT

Proceeding of the 4th ASEAN Regional Conference on Animal Production and 38th Annual Conference of the Malaysian Society of Animal 2017

28 – 30 August 2017

Senai, Johor, Malaysia

Editors:

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PREFACE

Constraints to animal production in tropical and developing countries are complex and include environmental, political, sociological, economical, legal, and technical (management). In tropical countries environmental constraints are focused towards global warming and adaptation to heat stress, water and soil pollution and water issues. The manipulation of physical and biological parameters is essential in order to optimise farm productivity and economic output. However, socio-economic conditions may interfere with environmental constraints and affect the overall output of the ecosystems on a sustainable basis. In ASEAN region, livestock production is likely to be increasingly affected by carbon constraints and environmental and animal welfare legislation. Demand for livestock products in the future could be heavily moderated by socio-economic factors such as human health concerns and changing socio-cultural values. In view of this, MSAP is organising the 4th ASEAN Regional Conference on Animal Production in conjunction with its 38th Annual conference of Malaysia Society of Animal Production, with the theme **Livestock Production in Challenging Environment.**

There is considerable uncertainty as to how these factors affect different this region in the coming decades. The livestock sector globally is highly dynamic and in developing countries, it is evolving in response to rapidly increasing demand for livestock products. In developed countries, demand for livestock products is stagnating, while many production systems are increasing their efficiency and environmental sustainability. Changes in the demand for livestock products have been largely driven by human population growth, income growth and urbanisation. This is true for the ASEAN region, where livestock numbers have increased significantly in the last decade, possibly due to improve in farming systems and science and technology. Nevertheless, livestock production will increasingly be af The theme this year is hopes to discuss new technologies, the link between the applied technologies and their relationships with environment-friendly livestock industry, rural and urban environmental concerns; rural income and gender dimensions, and of course livestock production with minimal use of chemicals, fossil fuels, zero waste and decreased methane production, and above all sustainable.

This publications is compilation of the scientific papers presented at the conference. It is hoped that the information contained herein will contribute towards the knowledge required to implement the activities to enhance the development of the Malaysian livestock industries.

Editors

The organising committee would like to thank all participants for the Abstracts submitted. However, due to the time constraint, it was not possible for the Editors to edit all the Abstracts thoroughly. The Editors are not responsible for any errors in the published Abstracts.

LIVESTOCK PRODUCTION IN CHALLENGING ENVIRONMENT

Quaza Nizamuddin H.N. and M. D. Muhammad Safaruddin

Department of Veterinary Services, Malaysia

Livestock are domesticated animals raised in an agricultural setting to produce commodities such as food, fibre, and labour. The term is often used to refer solely to those raised for food, and sometimes only farmed ruminants, such as cattle and goats.

Food Security: The Challenge of Feeding 9 Billion People

Continuing population and consumption growth will mean that the global demand for food will increase for at least another 40 years. Growing competition for land, water, and energy, in addition to the overexploitation of fisheries, will affect our ability to produce food, as will the urgent requirement to reduce the impact of the food system on the environment. The effects of climate change are a further threat. But the world can produce more food and can ensure that it is used more efficiently and equitably. A multifaceted and linked global strategy is needed to ensure sustainable and equitable food security.

Thermal Challenges to Livestock Production System Management

The adaptive capabilities of animals and livestock production systems have a key role to meet the challenges of thermal environments. The care and feeding of livestock is impacted by climate and weather factors. While our focus is primarily on cattle in warm and hot humid climates, the importance of dynamic animal responses to environmental challenges applies to all species and climates. Methods used to mitigate environmental challenges focus on heat loss/heat production balance. Under cold stress, reduction of heat loss is the key. Under heat stress, reductions of heat load or increasing heat loss are the primary management tools, although heat-tolerant animals are also available. In general, livestock with health problems and the most productive animals are at greatest risk of heat stress, thereby requiring the most attention. Risk management, by considering perceived thermal challenges, then assessing the potential consequences and acting accordingly, will reduce the impact of such challenges. Appropriate actions include: shade, sprinkling, air movement, or active cooling. The most important element of proactive environmental management to reduce risk is preparation: be informed, develop a strategic plan, observe and recognize animals in distress, and take appropriate tactical action

Management Practices

Proactive environmental management can reduce or eliminate potential losses resulting from thermal challenges. The concept of risk associated with threshold limits for performance losses and increased levels of vulnerability as influenced by animal and environmental parameters can be described as follows:

(1) When genetic, performance level and environmental influences combine to create a low level of vulnerability, there is little risk of performance losses or death;

(2) An increased performance level, such as in a moderately high-producing dairy cow, or a fast-growing beef animal near market weight, increases the

vulnerability of the animal; coupling that with an adverse environmental situation can put the animal at risk;

(3) A high-performance animal, even in a moderate environment, can be at increased risk;

(4) Combining an adverse environment with high performance

Sustainable Intensification.

Producing more food from the same area of land while reducing the environmental impacts is called "sustainable intensification". In exactly the same way that yields can be increased with the use of existing technologies, many options currently exist to reduce negative externalities. Some examples are:

(1) net reductions in some greenhouse gas emissions can potentially be achieved by changing agronomic practices,

(2) the adoption of integrated pest management methods,

(3) the integrated management of waste in livestock production, and

(4) the use of agroforestry.

However, the effects of different agronomic practices on greenhouse gases are complex and depend on the scale of production. Strategies such as zero or reduced tillage (the reduction in inversion ploughing), contour farming, mulches, and cover crops improve water and soil conservation, but they may not increase stocks of soil carbon or reduce emissions of nitrous oxide.

Sustainable production of livestock requires advanced planning of production management systems and the ability to implement appropriate practices to ameliorate stress effects. Thermal challenges and responses is species- and life-cycle-dependent. Livestock managers had to address such challenges for the benefit of their animals from the standpoints of managerial acceptability, technological feasibility, and economic return. Modern production systems can be designed to manage thermal challenges however, sustainability ultimately determines which options are most appropriate.

Precision Agriculture refers to a series of technologies that allow the application of water, nutrients, and pesticides only to the places and at the times they are required, thereby optimizing the use of inputs.

Precision agriculture will become more prevalent in livestock production system management. High lights several such potential applications. Future management will be increasingly based on biological information. The concept of "management by exception," attempt to implement precision agriculture with respect to identification of low-producing dairy cows on the basis of feeding behaviour. Agricultural land and water bodies used for aquaculture and fisheries can be managed in ways specifically designed to reduce negative impacts on biodiversity.

Ethical Challenges for Livestock Production:

Meeting consumer concerns about product safety and animal welfare are key attention points for future livestock production. Livestock production today faces the difficult task of effectively meeting emerging consumer concerns while remaining competitive on major target markets.

Product Safety The relevance of these issues pertains to production efficiency and economic benefits and to re-establishing meat sector image and consumer trust. Key attention points identified for the livestock sector and public policy should aims at re-establishing consumer trust in meat and delivering products that meet emerging consumer demands.

Consumer concerns about food-related hazards, food safety risks, and the impact of food consumption on human health have continuously increased. The importance attached by consumers to product safety, including increasing health concerns, risk perception, communication impact, and changing taste and preference patterns specifically with respect to food from animal origin, extends beyond intrinsic food safety alone.

Animal Welfare Related and emerging issues on animal welfare and effects from today's common livestock production methods, with respect to the attribute "animal welfare," is a growing importance to be expected in the near future and animal welfare as ethical issues in commercial livestock production.

R&D for the Malaysian Dairy Industry

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ABSTRACT

The Malaysian dairy industry has yet to meet the increasing domestic demands and its SSL has been steadily low. A structured dairy industry in Malaysia, initiated under the NDDP in 1974, resulted in an increase in local milk production. However, this production was not sustained and started to decline after 1994. The major factors that led to the reduction in SSL were low lactation and reproduction performance, harsh environmental conditions, high cost of quality feed and generally poor farm management. In order to realize the renewed aspirations of the NAP4 (2011-2020) for the dairy sector, R&D strategies has to be reassessed.

The Malaysian Dairy Industry

The structured Dairy industry in Malaysia began with the implementation of the National Dairy Development Programme (NDDP) in 1974 under the New Economic Policy (1). The NDDP was introduced to encourage the development of the smallholder dairy farms to meet the local demand for fresh milk. The establishment of milk collection centres, creation of fresh milk market outlets and the importation of dairy cattle were initiated under the NDDP programme (1). With the inception of the NDDP, the SSL of milk increased from 0.4% in 1974 to 5% in 1994. With NDDP, R&D initiatives on major areas of breed, feed and environment were intensified with a number of relevant publications and recommendations. However, the dairy sector took a backstage since the 1990's with almost no public R&D budget until recently. Some major R&D since the late 1970's is briefly described to have a retrospective view of research on dairy cattle in the past to take stock of future R&D needs.

Breeding and reproduction

The local dairy breed was known as The Local Indian Dairy (LID) and had their origins from a variety of Indian Zebu breeds, imported into Malaysia in the late 19th century. These animals were highly adaptable to the harsh tropical environment (2, 3) but with very low milk yields, averaging 502 kg/lactation (4). To improve its milk yield, the LID was crossed with other breeds such as Friesian, Red Sindhi and Jersey. However, the outcome was not satisfactory due to low base population (4) dispersed throughout the country. To overcome this, temperate dairy cattle were imported for evaluation under the local environment. However the temperate purebred dairy cattle did not perform well under the local environment with lowered milk yields and poor reproductive performance (5). These failures were attributed to inconsistent supply of quality feed and the harsh environmental conditions (6, 7, 8).

The R&D focus on breed then concentrated on the evaluation of temperate and tropical crossbred dairy cattle. Between 1986 and 1989, a total of 36,700 heads of Sahiwal Friesian F1 crossbreds were imported from Australia and New Zealand for evaluation, mainly under the smallholder environment. Although the F1 exhibited improved milk production, the lactation and breeding performance of the F2 animals

were reduced significantly (9). In fact it was observed that the milk yield of about 30 % of the Sahiwal Friesian cows decreased to negligible levels within the first 8 weeks *post partum* (10). This led to the recommendation that crossbred animals should have 60-75% Friesian genes. Besides the Sahiwal-Friesian, the Mafriwal was developed by the Department of Veterinary Services Malaysia. The Mafriwal was created from the Friesian genetic source of North America and the Zebu breeds of Kenya and Brazil, based on their dairy production characteristics. The Mafriwal with 60-75% Friesian blood was observed to be easily managed and highly adaptable to the local environment. The average milk yield of the Mafriwal was 2,337 kg/lactation with a lactation length of 260 days. However, this breed was not very popular as local producers were still looking for breeds with high production above 4,000 kg/lactation. Therefore Friesian crosses such as Thai Friesian and Jersey-Friesian became more popular.

Feeding and production systems

The LID cattle have thrived well under low nutritional inputs (2) with a concurrent low level of milk production. However, with crossbreeding and the anticipated increase in milk output, there was a need to match the nutritional requirements of the increased milk yields. Due to lack of extensive pasture land, attention was targeted to source feed from agro-industrial by-products, from the oil palm industry. This resulted in the development of oil-palm based by-products, mainly palm kernel meal (PKE), as feed resources which at present form the major base feed components in the ruminant industry. Complete ruminant feeds have also been developed based on these oil-palm based by products (Table 1). For instance, it was demonstrated that oil palm fronds (OPF) can be included up to 30 % in dairy rations (11) without any nutritional disorders or negative effects on animal performances and that it was comparable to animals fed cut grass. However, as the export or PKE became a lucrative market, its price has escalated, making it expensive in nutritional value.

Table 1. Nutritive values of oil palm based by-products (% of dry matter)

By-products	CP	CF	NDF	ADF	EE	Ash	ME (MJ/kg)
Palm kernel meal	17.2	17.1	74.3	52.9	1.5	4.3	11.13
Palm oil mill effluent	12.5	20.1	63.0	51.8	11.7	19.5	8.37
Palm press fibre	4.0	41.2	84.5	69.3	3.5	5.3	4.21
Oil-palm fronds	4.7	38.5	78.7	55.6	2.1	3.2	5.65
Oil-palm trunks	2.8	37.6	79.8	52.4	1.1	2.8	5.95
Empty fruit bunches	3.7	48.8	81.8	61.6	3.2	-	-

CP: Crude protein, CF: Crude fibre, NDF: Neutral detergent fibre, ADF: Acid detergent fibre, EE: Ether extract and ME: Metabolisable energy. Source: Wan Zahari *et al*. (16)

Environmental adaptations

The humid tropics pose one of the harshest environments for the dairy cattle with high temperatures as well as humidity. The maximum temperature limit for temperate dairy cattle is 24^{o}C which unfortunately is the minimum daily temperature. Studies were initiated to attempt to force cool the dairy animals to enhance their milk production. The forced cooling of purebred Friesian cows with a fine water spray plus fan system was observed to significantly improve (Table 2) the level of milk production (12), but it was way below the breeds' genetic potential. Enclosed house with fan and pad cooling

systems (13), was shown to be bring the dairy cattle THI by almost 5 points (Figure 1), but was not widely adopted due to high capital costs.

Table 2. Means (SD) of milk production of purebred Friesian cows under different cooling systems.

Milk production	Control		Fan		Fan + Water Spray	
	Mean	SD	Mean	SD	Mean	SD
Total milk production (kg)						
60 days lactation	486[a]	15	555[b]	20	581[bc]	23
120 days lactation	926[a]	25	1092[b]	30	1212[c]	32
200 days lactation	1418[a]	45	1659[b]	40	1776[c]	45
Average daily milk yield (kg)						
60 days lactation	8.2[a]	1.2	9.2[b]	1.3	10.3[c]	2.2
120 days lactation	8.4[a]	1.5	9.4[b]	1.4	10.4[c]	2.1
200 days lactation	7.2[a]	2.0	8.3[b]	2.0	9.5[bc]	2.5

[a,b,c] comparison of means between columns within row significant at $p<0.05$

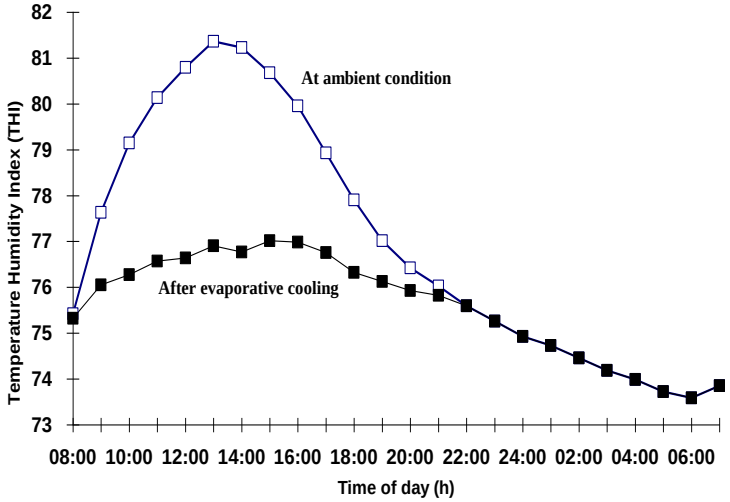


Figure 1. Effect of evaporative cooling on the Dairy Cattle THI

Future R&D Direction

It cannot be denied that the dairy industry in Malaysia has made little progress since the implementation of the NDDP in 1974 based on the trends of the SSL of milk. In fact, Dong (14) concluded that investment in the dairy industry in Malaysia is a risky business and the prospect for future growth was not bright. Therefore, it is extremely hard to find local literature on dairy cattle after the 1990's. Despite this, dairy cattle production has made progress and recent studies report improved milk yields exceeding 3,800 litres/lactation with breed and feed improvements (15). Nevertheless without government intervention, it is quite difficult to take this industry to the next step. Realising this issue, the NAP4 outlined measures to increase local production to reduce the food import bill and the government has initiated the formation of the Dairy Board to assist the industry. In fact, a small number of anchor companies have been successful with assistance from the government sector. What then should be the R&D direction of the future dairy industry? It is without doubt that we cannot run away from the three

major components of breed, feed and environment. However, the R&D strategies should address the present issues.

R&D on Breed

Every country has in general developed its own adapted breed, even if its origin was elsewhere. As example genetics of the Thai Friesian, Taiwan Holstein and Jamaican Hope were sourced from outside their country and adapted locally. We had the opportunity to upgrade our indigenous LID but have lost it and are now left with improving and adapting imported breeds mainly of Jersey and Holstein blood mix. However, a small population of Mafriwal breed is still available and we should not allow it to experience the same fate as the LID. In order not to fail, the country should embark on a long term breed improvement policy utilizing the available adapted animals as base populations. Breeding records should be made mandatory for all farms registered for supply of breeder animals. All relevant R&D agencies should collaborate and not compete in these R&D initiatives.

R&D on Feed

In almost all dairy producing countries, dairy cattle are raised under extensive system to keep the cost of production low. In New Zealand for example, more than 85% of the feed is from forage. In Malaysia, land for extensive production is scarce and therefore forage availability is limited resorting to concentrate feeds which indirectly increase the cost of production. R&D on feed should be focused on developing high quality forage within the limited land resources, bio prospecting new feed resources and moving towards precision feeding systems to keep production costs low.

R&D on Environment

As we have learned in the past, it is cheaper to adapt a breed to the environment rather than the reverse; R&D should focus on matching the breed to the environment under different production conditions available within the country. The use of modified environmental conditions should be restricted to selected stages of production.

Policy of R&D

The government should formulate a long term dairy R&D policy and make funds available and ensure its sustainability. This policy should stay in force for at least 30 years with regular appraisals. Most countries take between 30 to 100 years to develop an adaptable breed. Unless this intention is enforced, we would be loose potential genetics and restart local dairy breed development all over again.

CONCLUSION

The dairy industry in Malaysia has a good potential but policy and R&D efforts must be enforced over a long period to avoid failures as in the past. All government agencies and universities should collaborate rather that compete to ensure the success of the Malaysian dairy industry.

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DAIRY GOATS UNDER THE CHALLENGING IN UPPER SOUTHERN THAILAND

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ABSTRACT

Dairy goat plays an importance crucial socio-economic role contributing the niche product in southern Thailand for many decades. The consumption of milk and its products are increased with the increasing domestic population and tourist arrivals. Production cost is relatively high due to several factors including management of feed and feeding, breed and breeding as well as the changing of environments**.** This paper reports factor affecting dairy goat farms challenge and its alternation solutions in upper southern Thailand.

Key Words: dairy goat farm, marketing channel, southern Thailand

INTRODUCTION

Dairy goat is of Thailand important small ruminants play a crucial socio-economic role contributing the niche product in southern part for many decades. The demanding of goat milk and its products are increased with the increasing local population and number of tourist attracting provinces like Hat Yai, Surat thani and Phuket every year. Due to the size of dairy goats is small and less in yield of milk, the farmers have so far been introduced the exotic breed such as Saanen for cross breeding to improve the quantity and quality of milk. Most of daily goat milk is sold and consumed in the local and adjacent areas in fresh and pasteurized forms at the price of 50 - 80 baht per liter. However, a large numbers of dairy goat farmers in particular small holder farmer have been facing a high challenge especially cost of production, the change of turbulent environments and production management efficiency which individual farm need to struggling themselves resulted in only some dairy goat farms able to remain their business. Our survey research during the past a few years in upper southern Thailand, we noticed that the constraint for dairy goat were very varied from farm to farm (1). This demonstrated scenario is of great promise for enhancing or even maintain the dairy goat population. In the present paper we are focusing on the recent raising system, resources and many challenges in dairy goats' aspect which would lead to the future suggestions.

Distribution of dairy goats in UST

Table 1, presented the numbers of dairy goats and farmers in Thailand from year 2013 to 2016 (2). Numbers of dairy goats in the UST were decreased around 17.3% during year 2011 to 2015 (Table 2). The number of goat per farm was 12.2 and decreased for -25.4% as compared with 2015. Distribution of goats categorized by provinces in UST is showed in Table 3. Throughout the country and only in UST, the numbers of dairy goats changed were -37.6 and 78.0%, respectively.

Table 1. Number of dairy goats and farmers in Thailand during 2012 to 2015.

Years	Dairy Goats (heads)			Farms)heads(	Mean (head/farm)
	Male	Female	Total		
2012	7,513	25,850	33,363	1,113	29.9
2013	7,556	22,409	29,965	2,035	14.7
2014	4,998	15,015	20,013	3,588	5.6
2015	5,404	15,427	20,831	1,425	14.6
Mean	6,132	18,358	24,490	1,364	17.9

Adapted from DLD (2015)

Table 2. Number of dairy goats and farmers in UST during 2012 to 2015.

Years *	Dairy Goats (heads)			Farms)heads(	Mean (head/farm)
	Male	Female	Total		
2011	673	1,596	2,269	185	12.3
2012	663	1,483	2,146	178	12.1
2013	603	1,353	2,016	138	14.6
2014	1,336	2,196	3,528	272	12.9
2015	1,543	2,496	4,039	282	14.3
%changed	155.9	84.4	100.3	52.4	13.5

Adapted from DLD (2015).
* = excluding of Trang and Pattalung provinces.

Table 3. Distribution of dairy goats categorized by provinces in UST in 2015.

Provinces	Dairy Goats (heads)			Farms)heads(	Mean (h/f)
	Male	Female	Total		
Nakorn Si Thamarat	422	848	1270	71	17.9
Krabi	293	402	695	35	19.9
Phang Nga	781	174	955	13	73.5
Phuket	140	640	780	25	31.2
Surat Thani	52	138	190	16	11.9
Ranong	20	52	72	3	24.0
Chumporn	29	34	63	71	0.9
Trang	33	61	94	35	2.7
Pattalung	476	147	623	13	47.9
Total	2,246	2,496	4,742	282	16.8

Adapted from DLD (2015).

Dairy goat raising systems in UST

Of the dairy goat farm, most of them are small holder farm who has 18.0 head per farm, implicating the small holder farm plays an importance role to this system. And each of this small farm is very difference in breeding, feeding and management system. To start or stop the farms business is happened easily. Most of the farmers aging between 40 -50 years and had experienced between 2.5-7.5 years. The labour used in farm was highly relied on the family members. Saanen and its cross-bred are prevailing to this area due to its easily adapted to environments, friendly to the farmers and provided a high milk yield per year. Cross-bred of Saanen with Anglo Nubian, Native and Black Bengal are preferably in many farms. Good performance of female goat kids was selected for substitute of dairy herd while male kids was kept for later fattening and/ or sale to the other farms.

As UST region recognized as the country number one in both oil palm and Para plantations, the medium and big goat farm sizes often allows buck and unmilking goats grazed under these plantation especially in the sunny afternoon. While the small holder farms conducted simple practice by tethering their male goats on public and arable lands. And the dairy goats always stayed on pen to avoid of teat damage by grass or hard objects. Pasture and weeds were the first two main local natural resources for dairy goat, whilst crop residues and agro-industrial by-product are traditionally used in goat feeding. As leucaena forages is well accepted by many farms due to its easily natural grown in the roadside, high crude protein contents, easily for cut-and-carry therefore widely observed in many farm used. Commercial feed, concentrates and feed grain were available in the local animal feed shop. The farm purchased feed from the local shop, and provided of about 1.0-1.5 kg of concentrate per head per day. Most of the fresh milk goat was consumed in Muslim community. Phuket and Krabi are the two high potential milk goat demanding due to big community of Muslim and many tourists visited. The marketing of goat milk products to the two provinces mostly through the personal contact and agent.

Some challenging factors affecting dairy goat production in UST

There are many challenging to dairy goat production in UST. To reduce the cost of production is very first and of highly challenged. Some of the possible options in reduce the cost of production should pay attention on reducing feed price, management budget properly, animal health caring, handle farm laboring efficiency, professional do breed and breeding goat program. Other constraints yet to be properly solved including no appropriate farm zoning arrangement, lack of long term breed selection and improvement, less properly technology application and inconsistent marketing management, lacking of grouping system as well as in active of next generation to run the farm. The farm should also positioning themselves either as one, two or covering all chain like fresh milk producer, milk product processing part and marketing agent.

At the farm level, the factors affecting milk yield and each farm was trying to settle their own way. In evaluation of milk yield, farm in Surat Thani and Chumporn, for instance, demonstrated two times milking per day (700-850 ml) had a higher milk yield than that of one time milking per day (600-750 ml). While dairy goat farm in Nakorn Si Thammaraj and Phuket did one time milking per day. Many of the goat farms were processed fresh milk in farm to various products. Fresh goat milk was sent for every morning hot tea shop, whilst pasteurized milk, milk yogurt and milk ice-scream were the most three found products in the studied areas. During the survey, we sampled goat milk yogurt from some farms and observed that the sweetness value were between 12-15 brix.

Goat milk pH of pasteurized and yogurt were ranged for 6.55-6.70 and 3.70-4.20, respectively. Goat milk acidity of pasteurized and yogurt were between 0.0165- 0.0215 and 0.0705-0.1100, respectively.

Some of the home made goat milk product were sold in the village and some distributed to the adjacent provinces. The average prices of dairy goat products in the studied areas for one liter fresh goat milk, 150 ml bottled pasteurized, 150 ml bottled yogurt and ice-cream clone were about, 70.0, 20.0, 25.0 and 10.0 Baht, respectively. We also attempted to determine the whole cost from farm business generating to shop in some goat farms and the results showed that studied farms were deficit minus 25.0-45.0%. Not many goat famers able to carry on their business, possible implied the above interesting deficit value.

Attention should be paid on effective production process, proper farm management and sustainable marketing settle to develop the dairy goat raising system. Supporting these dairy goat farms from poor to stronger level, increase the proficiency of self-support as well as help them to help themselves in appropriate approach would be crucial challenged. As for the smallholder dairy goat farms, the market is a big concern and solution should be emphasis on increasing the local consumption and requires government sector support.

CONCLUSION

Small holder dairy goat farmers in UST are challenged by cost of production and uncertainty future. Improving the efficiency of breeding system, enhancing the efficiency of management systems, development of goat farm cluster among local levels would be of great alternative support.

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FACTORS AFFECTING LIVESTOCK PRODUCTION IN THE TROPICS AND POTENTIAL SOLUTIONS.

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ABSTRACT

This paper seek to highlight the challenges imposed on livestock production in the presence of climate change and the resources available for producers in the tropics. Constrains of space and time would limit the discussion to feed, genetics and management tools available to alleviate some of the challenges. It is by no means finite and definitive given that the knowledge in the arena is dynamic. The focus will be on beef and dairy production in the sub-tropics and tropical regions of the world.

INTRODUCTION

The world's population of 7.6 billion is projected to reach 9.8 billion by 2050 (1). The least developed nations have some of the highest growth rates. Most of these countries are in the tropical and sub-tropical regions of the world. Two factors that contribute to the rising growth of humans on earth are birth rates and longevity. South East Asia countries are part of this parcel with a current estimate of 648 million people; an average growth rate of 1.09% (6.97 million) increase annually (2). The population generate new demands for milk (3) and beef (4, 5). The ability to produce locally means import replacement, job creation, alternatives for consumers and in plugging the flow of currency overseas. However several issues must be addressed.

MATERIALS AND METHODS

Feeds

The C4 grasses have tremendous biomass production. With proper fertilization and management some species were able to product over 35 tons of dry matter per year (6). Often the huge yield is offset by higher acid detergent fiber (ADF) and nutrient detergent fiber (NDF) in the nutrient composition along with lower crude protein (CP) values. These factors couple with high heat and humidity can reduce feed intake, rumen and gut motility as blood flow at the epithelia region increased in an attempt to achieve homeostasis (7). However, there are management strategies which one can employ to mitigate some of these challenges. Example of these are: a) ammonia treatment of forages, b) age of harvest or harvest intervals, c) height of cut and d) more recently the time of harvest within a day (8).

Studies by our group also suggest that the values of non-fibrous carbohydrates (NFC) also play a role feed quality and grazing behavior (unpublished).

Studies we have conducted showed that nutritional needs of beef cattle after breeding did not affect the pregnancy rate at days 30 but examination of embryos recovered from the cows at slaughtered suggested that embryos from cows with poor nutrition were "disintegrating". Blood plasma for non-esterified fatty acids were higher

in cows exposed to poor pasture (data unpublished). Hence, management of animals and feed are crucial for successful cattle enterprises in the tropics.

Genetics

In this modern era, producers have an array of opportunities to select beef breeds for their production needs. Beef cattle are adapted to the higher temperature and humidity than dairy due to physiological demands. In addition, there are many breeds that are adapted to tropics and perform to expectations. There are differences within a breed due to location or regional adaptability. This was demonstrated with Angus cattle raised in two different regions and their responses to heat stress environment (9). Hair coat color and thickness play a role in animal performance at this can be a barrier to evaporative cooling (10, 11). The selection of breed suited for the environment would there include hair coat color, skin color besides the normal parameters for growth performance. Hence, one should consider many desirable traits of local animals and develop a long term breeding/selection program for these breeds.

Dairy Cows

The offerings of genetic diversity is more limited in dairy animals as the world dairy production is dominated by the Holstein breed or its crosses. The other breeds, namely Jersey and Brown Swiss play a smaller role. The ability of small holders to meet the maintenance requirements of high producing cows where land and grain supply are scare can be taunting. Most studies (12, 13) include ours (14) suggest that the Jersey are more heat tolerant. There are also difference within a breed and more investigation is needed to the mechanism of thermal regulation within the sub-groups to take advantage of their uniqueness. The technologies exist for the capitalization of these special traits.

The use of the right type of fans and misters can also help to alleviate the negative impact of heat stress once proper shade is provided to the animals. It is the combination of air velocity and frequency of water application on the animals. Excessive water application can lead to hoof problems and other challenges. In the absence of these environmental modifiers, one would disrupt endocrine physiology of the high producing cows leading to infertility and low milk production.

While cross bred animals e.g. the AMZ, have been promoted for Asia, such programs have not been successful. Besides the management and feed needs, there is an issue of “genetic stability”. Hence, there is a need for long term policy to study local breeds and to perform selection of cross-bred suited for the environment.

Beef Production

Research conducted by my colleagues have shown that it is possible to produce quality beef in the sub-tropics. The key to this are: a) genetics, b) management and feed. At our research station we have consistently produce high percentage of choice beef from 100% forage base diet and under 24 months of age. The incorporation of leuceana (a tropical tree legume of the mimosoid clade sub family into the pasture has increase carry capacity and rate of gain in cattle.

SUMMARY

In summary, production of beef cattle in the tropics may be easier than dairy given the challenges in thermal physiology of lactating cattle. Several tools are available but not all tool are equal. Successful production would require one to tailor the appropriate

tools and implement them with precision to allow one to successfully manage the challenges of heat stress. There is a continuous need to breed forages that meet the nutritional needs of high producing cattle. Likewise, there must be a long term strategy to develop a breeding program to conserve as well as to improve local genetics. There is no single solution to address the dynamic multi-facet challenges of cattle production in the tropics.

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MEETING THE CHALLENGE OF FORAGE RESOURCES FOR CATTLE IN MALAYSIA WITH AN OIL PALM FROND (OPF) BASED TMR PELLET

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INTRODUCTION

Farming systems are increasingly being challenged by legislation and market pressures to be environmentally sustainable. Malaysian 'Golden' palm oil is no exception, as are its other agro-food sectors including livestock. It is frequently stated that a major constraint to ruminant animal production in Malaysia is a lack of forage resources (Wan Zahari et al., 2003). The huge amount of undergrowth vegetation and palm fronds in the oil palm plantations offer an alternative, and perhaps a solution to the constraint. Sawit Kinabalu Group is committed to the three basic conditions of oil palm's sustainable production system i.e. *Environmentally Sound, Economically Viable and Socially Acceptable* (Sharma, 2013 as cited by Kabul, 2013). The group has initiated and successfully integrated more than 12,000 cattle into their plantations as *biological lawn mower*, reducing its chemical usage in weed control, and is now going further in utilizing the oil palm fronds as additional source of forage combined with formulated concentrate ingredients to become oil palm frond based Total-Mixed-Ration (OPF-TMR) pellet.

Oil Palm Frond (OPF)

Wan Zahari et al. (2003) reviewed research on feeding OPF to cattle, which described and confirmed that OPF can substitute grasses for both beef and dairy cattle. They suggest that OPF is a promising source of roughage to remedy the perceived lack of ruminant feed resources in Malaysia. Considered as a poor quality forage due to its high lignin content (19.2-36%, Islam et al. 2000), it is often assumed that OPF is unlikely to deliver high feedlot growth rates or high milk yields in cattle. Mohd. Sukri et al. (1999, cited by Wan Zahari et al., 2003) fed OPF and a PKC-based concentrate mix to Australian Commercial Cross Brahman (ACC) cattle. Dry matter intakes were 6 - 7.5 kg/day that is equivalent to 2 – 2.4% of liveweight, and best growth results were achieved when OPF content was between 20-40%. Their reported growth rates of 0.61 – 0.85kg/day is too low compared to the 1 kg/day required for profitable commercial feedlots in Indonesia and Vietnam (Sutherland 2017, pers. comm). On the other hand, Abu Bakar et al. (2001) as cited by Wan Zahari et al., (2003) reported high milk yields of 13.07 liters/day in Friesian-Sahiwal cows fed fully on a 30%OPF based complete feed pellet. The studies reported in this paper will show that OPF is suitable forage base in a total mixed ration (TMR) pellet that is highly palatable and supportive of high feed intake. As such, OPF-TMR pellets can deliver the high growth rates and high milk yields necessary for profitability in cattle farming systems.

OPF-based Feedmill

Sawit Kinabalu Group has set up a feedmill at Apas Balung (Tawau, Sabah) to manufacture TMR with 30% inclusion of dried oil palm fronds (OPF-30 TMR pellet). Fresh OPF are dried and milled, mixed with other ingredients, and pelletized to become

TMR pellet that contains, on a dry weight basis, 30% milled OPF, and 70% of a concentrate mix consisting of palm kernel cake, other feed ingredients and premixes. Samples of the OPF-30 TMR pellets were analysed by the Department of Veterinary Services Laboratory (Salak Tinggi, Selangor). The results were very uniform (n=9, av±SD: DM 92.86±0.63%, Crude Protein 14.36±0.57%, Crude Fibre 14.99+1.12%, Ether Extract 4.03+0.63%, Ash 6.43+0.36%), and mostly consistent with the expected values calculated from assumed ingredient values. Surprisingly, the crude fibre content was lower than the calculated 19%, considering the high fibre contents of palm fronds and palm kernel cake. The OPF-30 TMR dairy pellet, had the same ingredients, but was formulated to contain 17.4% crude protein and 15.7% crude fibre.

Feeding Trails:

Controlled feedlot trial I (Young bulls)

Two year old Brahman bulls (n=10 per group), with an average initial weight of 258kg, were used to compare growth rate on a complete diet of OPF-30 TMR pellets, against a control ration of Napier grass and PKC that represents a common feeding practice in Malaysia. Over a 12 day introductory period, pellets offered to the treatment group were stepped up in 2kg increments at 4 day intervals, while their starting ration of Napier grass was reduced relative to refusals the previous day. On day 12, grass feeding was stopped and thereafter fed only with OPF-30 pellets at an ***ad libitum*** quantity of approximately 7kg DM, increasing to 11kg by day 53 (as liveweight increased). The control group continued to have Napier grass and PKC for same period. The trial result produced final liveweights of 350kg (treatment) and 301kg (control, t-test, $P<0.005$), with an average daily gain of 1.88kg (treatment) and 0.68kg (control, t-test, $P<0.001$). During this time the groups ate on average 4.8kg DM/day of control ration, or 9.06kg DM/day of OPF-30 TMR pellets, being 1.69% of liveweight in controls and 3.02% of liveweight in the treatment group. These intakes and growth rates gave feed conversion ratios of 7.06 and 4.83 in control and treatment groups respectively (Table 1).

Feedlot trials II and III (cull cows and weaner bulls)

Twenty seven Brahman cull cows were fed OPF-30 TMR pellets alone for 57 days and grew at 1.75 kg/day over that time from average liveweight 285kg to 383kg (Table 1). During the period their ***ad libitum*** pellet consumption increased from 8.8 to 11.44 kg DM per head/day, averaging 10.04 kg DM (3.01% of liveweight), for a feed conversion efficiency of 5.7. In further trial, 23 weaner Brahman bulls (age at start 8-15 months) were fed OPF-30 TMR pellets alone for 82 days and grew at 1.70kg/day over that time from average liveweight 150kg to 289kg (Table 1). Their ***ad libitum*** consumption of pellets increased from 5.3 to 7.5 kg DM per head/day, averaging 6.55 kg DM (2.98% of liveweight), giving a feed conversion efficiency of 3.86. These 23 weaner bulls were later kept on a diet of only OPF-30 TMR pellets for as long as 415 days, during which time they exhibited good health, and normal growth and development.

Table 1. Combined results of three feedlot trials with OPF-30 TMR pellet.

	2 y.o bulls Napier+PKC	2 y.o bulls OPF-30 TMR	Cull cows	Weaner bulls
	n=10	n=10	n=27	n=23
Liveweight at start (kg)	265.4	250.6	285	150
Liveweight at end (kg)	301.39[a]	350.05[b]	383	289
DOF	53	53	56	82
ADG (kg/d)	0.68[a]	1.88[c]	1.75	1.70
Average Napier DM fed (kg/d)	2.65	-	-	-
Average PKC DM fed (kg/d)	2.62	-	-	-
Average Pellets DM fed (kg/d)	-	9.17	10.09	6.66
Average DMI (kg/d)	4.80	9.06	10.05	6.55
%DMI/LWT	1.69	3.02	3.01	2.98
Feed Conversion Ratio	7.06	4.83	5.74	3.86

a, b, c : values with different superscripts are significantly different by t-test : a,b ($p<0.005$); a,c ($p<0.001$)

Dairy Trial 1

Two groups of late lactation Friesian-Sahiwal dairy cows (n=20 per group, average liveweight 430kg, > 300 days-in-milk (DIM), average milk at start 7.5litres/d) were used as a control group and treatment group. The control group was fed Napier grass plus PKC (total DMI estimated 8kg/d), representing the common feeding practice in Malaysia, and the treatment group was fed fully on OPF-30 TMR dairy pellets, after an 8-day introductory period. Grass and PKC feeding was stopped on day 8, and fed only with the OPF pellet with increasing daily amount until ***ad libitum*** intake was achieved (average 15kg DM). Feeding of the "control" group was not always consistent over the trial period, depending on availability of grass and other ingredients (common feeding scenario in the farm). After 25 days a further 16 fresh cows (< 100 days in lactation) joined the trial, allocated to the treatment and control groups (n=8 per group). Milk yield was averaged over 5 day intervals (Figure 1) and over the trial the control group continued to produce on average 7.5 L/d (>300DIM), or 8.5 L/d (<100DIM). Meanwhile the late lactation treatment group (>300DIM) climbed steadily to 11.5 L/d over the trial, with a temporary drop over the new year holidays due to feeding disturbances (Figure 1a). The fresh treatment cows (<100DIM) climbed steadily from their starting yield of 8.5L to 14.5L/day, over the 7 weeks to the end of the trial (Figure 1b). The groups differences in milk yield were always highly significant (t-test, $p<0.005$).

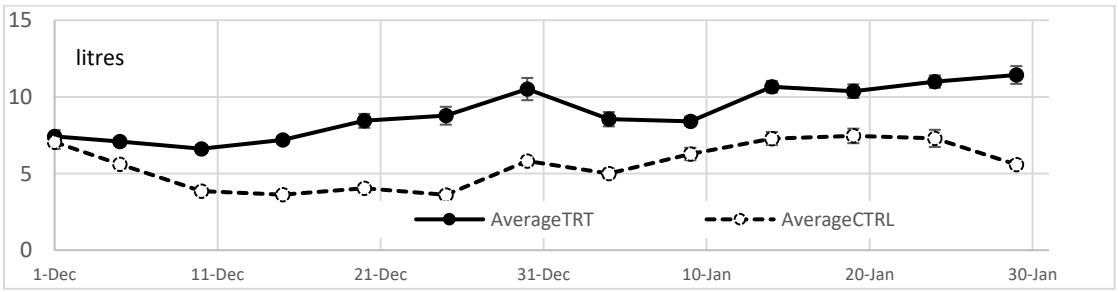


Figure 1a. Dairy Trial 1- Average daily milk production for cows >300 DIM

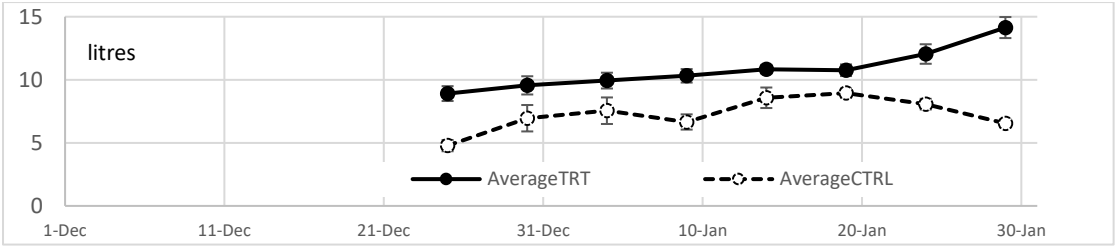


Figure 1b. Dairy Trial 1- Average daily milk production for cows <100 DIM

Dairy Trial 2

128 cows in the "mid-lactation" group on another large farm were divided into a control and treatment group. However some cows were dried off during the period, so complete data was collected from only 94 of these, and the sample sizes were unequal (control, n=43, treatment, n=51). Average liveweight was 470.2kg, and the starting average milk yield of the group was 12.5 litres/day. Average DIM was 250 (ctrl 227, trt 274). The control group was fed a combination of Napier grass and Guinea grass (cv Hamil), totalling 5.8kg DM, plus 8.25 kg DM of a commercial dairy pellet. The treatment group was fed 12.03kg DM of OPF-30 TMR dairy pellets, meant to represent an equivalent 8.25 kg concentrate ingredients plus the 30% OPF in the pellet, with an ***ad libitum*** allowance of grasses (Napier and Guinea). Surprisingly, the treatment cows consumed a similar amount of grass (5.6kgDM), despite the greater amount of pellets fed. The cows were milked three times per day i.e. at 8am, 4pm and midnight.

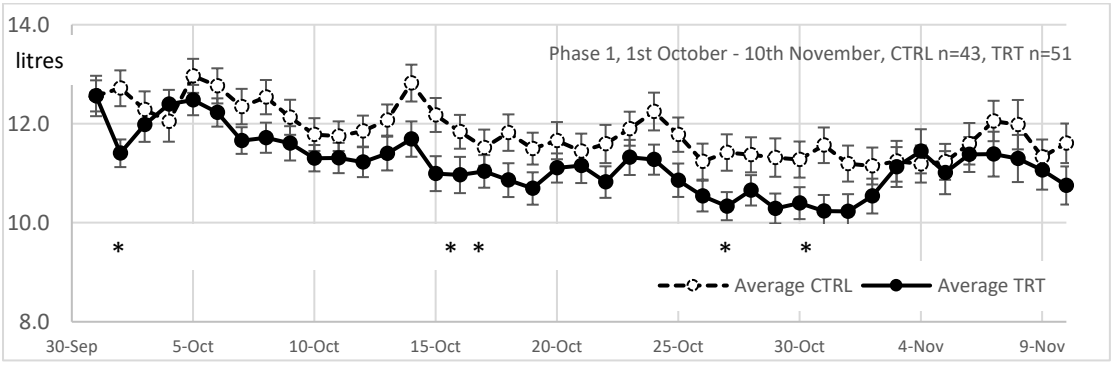


Figure 2. Dairy Trail 2 - Averages daily milk production for 94 cows.
*Days when the difference was significant (t-test, $p<0.05$).

Figure 2 represent the daily averages of milk production for the 94 cows present throughout a first phase of the trial. The average daily milk production for control group was 11.8 litres, and for treatment group 11.2 litres. While the average gap was 0.6 litres, the daily milk production tended to rise and fall in parallel between the groups. Tested with t-test (2 tail, homoscedastic) on each daily yield, the difference was significant ($p<0.05$) on only 7 out of the 41 days. In a further phase of the second trial described above, cows were fully fed on OPF 30 pellets, with no grass, but after three weeks milk yield suddenly and inexplicably declined and the trial was terminated.

DISCUSSION

In feedlot trials the feed conversion ratios of 5.74 in cows, 4.83 in 2 year old bulls, and 3.86 in 1 year old weaner bulls are as good as or better than most commercial feedlots expect to achieve. The combined impact of a formulation to maximise digestibility, and

a high dry matter intake, permit the animals to extract maximum nutrient value from the ingredients provided, including oil palm fronds, and to express their genetic potential for growth. The dry matter intakes of 3% liveweight are higher than the common feedlot intakes of 2.5-2.8% (Sutherland 2017, pers comm), and this may be in part due to the higher density of pellets compared to a loose mixed TMR. Throughout the first milking trial, where the control cows were to some degree underfed, variations in milk production, in both treatment and control groups, could be attributed to variation in dry matter intake. This means that it is not necessarily the complete feed pellet ***per se*** that gives the positive milk response, but simply that the pellet has "facilitated" this treatment group to get the nutrients required for the higher production, in a simple and convenient form. In the second trial, results might have been confounded by an overall difference in total dry matter intake, and also perhaps by a difference in average days in milk. Nevertheless, it was demonstrated that in a well fed and high producing herd, the OPF based ration could maintain the high milk output, albeit slightly less than the control group. The high lignin content of palm fronds apparently does not preclude it from being a suitable forage base in rations for high producing tropical cattle. Lignin are cross-linked phenolic polymers, which physically block microbial access to the digestible cellulose and other carbohydrates, and there can be modifying factors which influence the inhibitory effect of lignin on cell-wall digestion (Moore and Jung, 2001). It may relate to a difference between palms and grasses in the degree of cross-linking, and there may well be a positive physical effect of the grinding in the pelletizing process.

CONCLUSION

OPF is clearly suitable to use in feedlot rations for Brahman cattle, and can support a high milk production in Friesian-Sahiwal cows. Since the completion of these abovementioned-feeding trials, Sawit Kinabalu has continued to operate two feedlots with no grass; instead using OPF based TMR pellets only.

Acknowledgement
The authors would like to thank the Group Managing Director and management of Sawit Kinabalu Group for the permission to present this paper.

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APPLICATION OF PROBIOTIC ISOLATED FROM DADIH FOR ANIMAL HEALTH AND ENVIRONMENT

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ABSTRACT

Dadih is a fermented product from buffalo milk using bamboo tubes. It is one of the innovative product that provides positive effects for human and animal health with probiotics as requirements of functional food. Lactic Acid Bacteria (LAB) is a group of bacteria that can inhibit the growth of pathogenic microorganisms. It also has the another advantage such as: prevention of disease in livestock and the increasing of livestock reproduction, producing meat with low cholesterol, preserving food, and also utilisation as starter in producing feed, local microorganism, bio compos, biogas fermentation, food and cosmetics. LAB identified by molecular using a 16S rRNA technique. The aim of this research is to obtain the bacteria isolated from local microorganism which processed using a mixture of vegetable and fruit waste. It has been used as starter in the Bio compos manufacture and biogas fermentation in the small scale enterprise farming in South Solok District. The results showed that isolated from local microorganism are namely *Lactobacillus fermentum strain MGA40-6* and *Lactobacillus fermentum strain SNUV175*. It species can be used as a starter in the manufacture of fertilisers bio compos from cow manure, which contains Nitrogen (1:26%), Phosphor (0.33%) and potassium (0.98%) and it was an accordance to National Standardisation of Indonesia (SNI) and it has trademarks with namely BIOFUSS (Urine feces Organic Materials Innovation South Solok District) No.D002016062184. In conclusion, *Lactobacillus fermentum* can be used as a starter to fasten the biogas production and also to prevent animal from diseases and produce meat with lower level of cholesterol.

Key words: lactic acid bacteria, local microorganism, bio compos, biogas, probiotics

INTODUCTION

Dadih is a special food of West Sumatera region which is processed through natural fermentation process of buffalo milk in bamboo tube by Lactic Acid Bacteria (LAB) which is found naturally in buffalo milk (1). Microbes are thought to come from banana leaves as bamboo cover which used and from the milk its self and can also be from bamboo tubes which used (2). Areas that have the potential to produce Dadih in West Sumatra one of them is Solok District. Dadih contains some probiotic of lactic acid bacteria LAB (3), so it can be used as one of probiotic food and beneficial for health especially in live condition and available at high concentration (at least 10^6 CFU/g). Dadih is white in colour like milk, has dense and slick texture, with a distinctive aroma of acid (4). Dadih is a genuine food ingredient of the people of West Sumatra, rich in nutrients and beneficial to health, including as a source of probiotic (5, 6).

Probiotics provide physiological benefits to health, in prevention, such as anticholesterol, antihypertensive, intolerant, lactose, anticarcinogenic, gastrointestinal disorders and allergies. According to (2, 7) many well known probiotic bacteria belong

to the LAB group and include safe microorganisms known as food grade microorganisms. Widely, LAB is used as a starter for fermenting foods, beverages, meats, vegetables and milk that can convert carbohydrates (glucose) into lactic acid and it also can be isolated from various sources. However, not all sources of LAB were halal. Dadih can inhibit the growth of pathogenic microbes, neutralise bacteria digestive tract, absorb cancer and tumor and spur the immune system (6,7). The LAB can produce lactic acid by changing carbohydrate, hydrogen, peroxide and bacteriocin (9).

While conventional organic fertilisers using dried manure directly are not sufficient nutrients are good. In addition, the smell of environmental pollution by animal waste and fruit and vegetable waste is not utilised to be environmental problems for the community. The use of microorganisms for the fermentation process will help the production of organic fertilisers. LAB as a composer of organic material can be obtained from fermented fruit and vegetable waste. LAB will also assist in improving the nutrient quality of organic fertiliser naturally.

Agricultural waste can be processed to make organic fertiliser (Bio compos), by fermentation techniques of microorganism aid of agricultural waste can be used as fertiliser, this will make the use of fertiliser will be more efficient in cost and production, healthy and of course high selling value. Agricultural waste that has no selling value can be used as raw material for making organic fertiliser by fermentation method. Activity of organisms in this fermentation is expected to produce products containing local microorganisms (MOL) can be utilised as an environmentally friendly organic fertiliser. The ingredients of local microorganisms contain substances suspected of substances that can stimulate the growth of plants and substances that can encourage the development of plants such as zyberlin, sitoxinin, auxin, and inhibitors (8) In South Solok in the form of IPTEKDA LIPI activity titled "Technology of MOL Utilisation (Local Microorganism) and Bio Urine In Organic Fertiliser Making From Cow Manure to Increase Community Income in South Solok Regency of West Sumatera (10).

MATERIALS AND METHODS

The LAB colonies were selected and purified by repeated inoculating onto MRS agar and incubated an aerobically for 48 h at 37ºC and identified by observing macroscopic and microscopy. Macroscopic characteristic observed including morphological and color of isolates in MRS agar, and microscopy characteristic observed by Gram staining.

Extraction of Gram Bacteria Genomes Positively with Promega KIT (USA), amplification of Gene 16S rRNA (amplification reaction of DNA in to *thermocycler Mupid-Exu,* use PCR : Primer R [(16S-1492R, Tm 47ºC, 5'GTT TAC CTT GTT ACG ACTT-3) and F (16S- 27F, Tm 54.3ºC, 5'AGA GTT TGA TCC TGG CTC AG-3)] and analysis of sequen data using DNA star *software* program. *Sequen alignment* analysis do it compared of sequen result (*query*) and data in *Gene Bank* with *database searches* NCBI *internet site* (http//www.ncbi.nlm.nih.gov) used BLAST (*Basic Local Alignment Search Tool*) (11) were conducted.

Procedure fertiliser added LAB: Research procedure for stages of IMO (Indigenous Microorganism) manufacturing process by collecting unused and unsold tomato waste around the environment and allwed to ferment in an an aerobic (no oxygen) container for 20 days. Later, tomato waste material used at manure with ratio 1 liter of IMO (diluted with 10 liters of water for 100kg dried cage fertilise) and allowed to become biocompos or organic fertiliser is 14 days.

In silage making techonology involving, an addition of LAB in agriculture waste (coffee and cocoa with) has been used. The mixture of the ingredients were mixed and

become uniform before inserted into the plastic, as long as the insertion into the plastic the silage material is pressed and compacted. After all the solid silage material, the air contained in the plastic is removed with a vacuum device and allowed to ferment in anaerobic conditions for 3 weeks before its ready to be used as cow concentrated feed.

Preparing biogas substrate material which includes cow and water fumes homogenised in an inlet tub with a ratio of 1: 2 and then inserted into the digester through a pipe connecting the inlet tub and the inlet tub. The initial filling is carried out to the optimum limit of the digester wherein four tubes of digester are each filled with a substrate of 75% of the volume of digester and LAB. The fermentation process lasts for 21 days. The fermentation gas will go to H_2S filter tubes and CO_2 filter tubes are then assembled in a pure methane gas collection tube and ready for use. In order for biogas to be available at any time then for substrate filling is done every three days with the ratio of cow and water feces 1: 2 so that gas will be produced continuously.

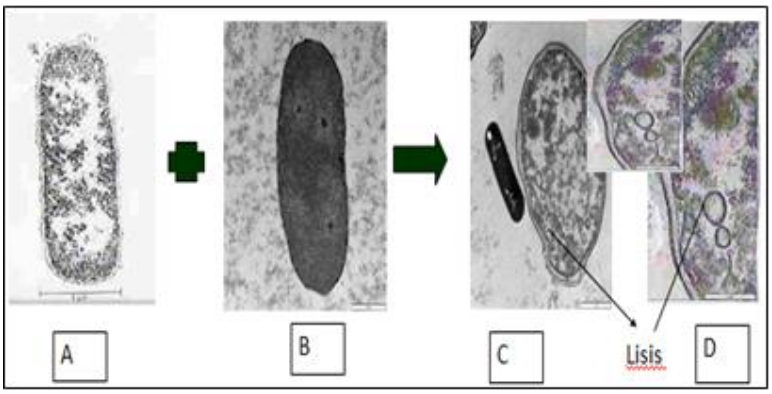
RESULTS AND DISCUSSION

The result of LAB isolation are purify for three times until found the really pure isolate. The total of this colony calculated (10^6 – 10^8 CFU/g) is an agreement with the result of FAO/ WHO (2001) in Dara (2009) about total colony LAB in dadih as probiotic food. Prevention of Disease using Halal Probiotics Isolation from the Curd Laboratory of Animal Product Technology Faculty of Animal Husbandry Andalas University of Padang with molecular conduct of 16S rRNA can be collected Lactic Acid Bacteria Halal in world that was : (1) Dadih : *Pediococcus pentosaceus*, *Weissella paramesenteroides*, *Lactobacillus plantarum*, *Enterococcus faecalis*, *Lactobacillus fermentum*; (2) buffalo milk : *Lactobacillus fermentum*, *Lactobacillus oris*; (3) blondo VCO (Virgin Coconut Oil) : *Lactococcus plantarum*; (4) fermented cocoa beans : *Pediococcus pentosaceus*; (5) biogas : *Lactobacillus fermentum*; (6) MOL : *Lactobacillus fermentum*. Probiotic bacteria means live microbial supplements that have a positive effect on humans and animals by improving intestinal microflora balance. *Lactococcus plantarum* (Probiotics) cause pathogens bacteria lysis (*E. coli/ Listeria monocytogenes*) (Figure 1).

The *in vitro* results research proved that probiotics isolated from the curd can kill pathogenic bacteria such as *Listeria monocytogens* cause abortion in both cattle and humans (Figure 2) as well as *E. coli* O157 which can cause diarrhea and is zoonotic.

The result of cattle feed silage was found that the best ration composition of fermented animal feed silage based on agricultural waste (coffee and cocoa) was on the mix treatment between cocoa and coffee skin with composition, 30% coffee skin, 30% cocoa leather, Bran 20%, 12.5% forage, palm sugar 7%, and urea 0.5%. The moisture, DM, CP, EE, CF, ash and BETN were 45.73%, 54.27%, 16.09%, 4.21%, 26.92%, 9.30, and 43.47%, respectively.

The result increased of protein but decreased of crude fiber and it has trademarks with namely SELASSE (Supplement Waste Agro Industry South Solok District) number ID : D002016062181 and also more low price Rp. 1,260/Kg compared to commercial supplements at a price Rp. 4,000/Kg. Which for dairy cow consumption per day 2 kg and beef cattle per day 1 gg, using silage result of this research profit can reduce production cost.



A). *E. coli* morphology before treatment (Control) (TEM 4000x);
B). Morphology *Lactococcus plantarum* (TEM 4000x)
C). *E. coli* after treatment with *Lactococcus plantarum*. (TEM 4000 x)
D). *E.coli* after treatment with *Lactococcus plantarum* (TEM 6300 x)

Figure 1. *Lactococcus plantarum* (Probiotic) lisis *E. coli* / *Listeria monocytogenes* seen with Transmition Electron Microscopy (TEM)

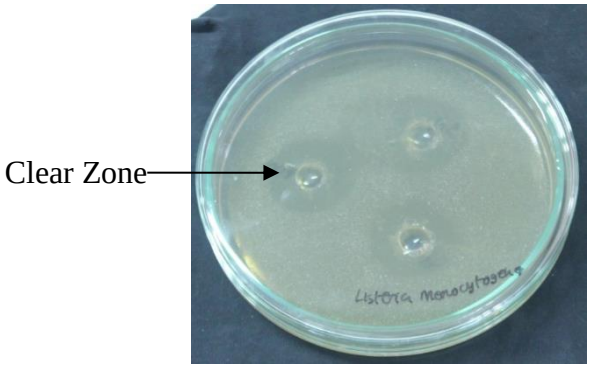


Figure 2. Antimicrobial Test of LAB with Bacteria Indicator of *Listeria monocytogenes*

The bio compos fertiliser using MOL with an addition of LAB produced in accordance with above SNI that resulted in an increased in Nitrogen (1.26%), Phospor (0.33%) and Potassium (0.98%). The bio compos that being produced will be sufficient for the cultivation of agricultural crops and better than artificial fertilisers. This result was accordance with National Standardisation of Indonesia (SNI) and it has trademarks with namely BIOFUSS (Urine feces Organic Materials Innovation South Solok District) No.D002016062184.

Reactor Biogas modification with the addition of LAB designed can be used as an alternative to produce bio-gas that is environment friendly and renewable with 14 days fermentation time. The resulting Bio gas can be applied in the packaging of LPG tubes with modification techniques accompanied by the addition of a bio gas binder (liquid H_2). Bio gas that has been applied in tube packaging can be connected directly to gas stoves such as LPG and has been able to meet the needs per individual per day for cooking 500 ml of raw water, 0.25 kilograms of rice and 3 eggs.

CONCLUSION

Isolation and identification of LAB from curd, buffalo milk will produce halal probiotics that can be used to assist fermentation of food and to livestock as preventive of livestock disease and decrease cholesterol in livestock meat so safe for human consumption in all circles. The use LAB from fruits and vegetables to produce organic fertilisers can reduce the risk of human consumption of crops to chemicals, thus making

more environmental friendly and the level of public health, healthy generation and increased with the economy increases by increasing the revenue area and regional income. It also will create a developed and insightful area and progress with making digester Biogas with LAC starter. The nutrient composition after fermentation of silage from LAB from curd to fermentation of silage based on agricultural waste (coffee and cocoa) is 45.73% water content, 54.27% dry ingredients, crude protein 16.09%, crude fat 4.21, crude fiber 26.92, ash 9.30, and BETN 43.47%.

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SCIENTIFIC PAPERS

Oral Presentation

THE EFFECTS OF SUPPLEMENTATION OF CALCIUM SALT OF FATTY ACID ON THE DIGESTIBILITY OF NUTRIENTS IN DAIRY GOATS

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Calcium salt of fatty acid (CaSFA) is commonly used as a source of energy for ruminants. In the form of calcium salts, fatty acids are not readily degraded by rumen microorganism and therefore they are digested and absorbed directly in the small intestine. Calcium salt of fatty acid is considered as a by-pass energy that can be fed at higher level without risks of acidosis. Calcium salt of fatty acid is known as protected energy and therefore very useful bypass energy for dairy animals (1, 2).
The aim of this study was to examine the effect of varying level of calcium salt of fatty acid supplementation on feed intake and digestibility of nutrient in Saanen goats.

Twelve Saanen female goats of approximately 12 months old with an initial body weight (BW) of 15 to 28 kg were used in this study. The goats were kept in the individual pens. A change over design experiment design was used and carried in two periods. Each period consisted of 7 days of adaptation period followed by 10 days of feeding trial. During the last 5 days, total dry matter intake (DMI) and faeces output were measured from each animal for each period. Four animals were randomly assigned to each 3 dietary treatments of T1 (0%), T2 (5%) and T3 (10%) of CaSFA per day. The feed comprised of 60% oil palm fronds (OPF) and 40% concentrates and given at 3% of body weight. Feed and faecal samples were analysed for DM, CP, Ash, NDF, ADF, EE, mineral (Ca and P), and gross energy. Data obtained were statistically analysed using the Analysis of Variance procedure of SAS (3). Duncan's New Multiple Range Test Analysis (3) was used to compare treatment means.

The digestibility of DM, CP, NDF, and ADF had similar patterns to that observed for DMI (Table 1). However, EE digestibility was significantly different ($p<0.05$) among treatment diets. Goats fed T3 showed the highest EE digestibility compared to T1 (control diet) and T2. These results indicated that fat given to goats at higher levels were well-digested. Although higher levels of fat in rations increase the digestibility of EE, it appeared to decrease the digestibility of other nutrient. Calculated energy digestibility were significantly different ($p<0.05$) among treatments, suggesting that CaSFA supplementation improved energy utilisation. The fat supplements were contributed in increasing the percentage of digestibility of energy, although at the level more than 5% appeared to be a slight decrease. Digestibility energy (kcal/kg) of goats were different ($p=0.06$) among treatment. Goats on diet T2 showed the highest DE as compared to T3 the intermediate and T1 the lowest. The digestibility of Ca and P were not affected by the dietary treatment. Similar to other nutrients, the digestibility had an increasing trend with increasing CaSFA supplementation.

In conclusion, there were no effects on digestibility of nutrients when the supplementation of Calcium Salts of Fatty Acid was given at different levels. Although statistically the means were not significantly different, there appeared to be a strong trend suggesting that supplementation with Calcium salt of fatty acid at above 5% improved digestibility of energy, ether extract, NDF and ADF.

Table 1. Dry matter intake (DMI), percentages of Dry matter (DMD), nutrients, energy and minerals (Ca, P) digestibility of goats in fed on different levels of calcium salts of fatty acids

Parameters	Dietary treatment			S.E.	P-value
	T1	T2	T3		
No. of goats	8	8	8		
DMI g/day	431.26	416.70	388.89	±1.02	ns
DMD (%)	41.67	52.73	51.80	±40.17	ns
CP (%)	30.86	40.99	40.59	±3.45	ns
EE (%)	62.69[b]	83.26[a]	98.20[a]	±3.40	0.03
NDF (%)	17.31	39.00	39.16	±2.91	ns
ADF (%)	34.46	47.53	46.35	±4.42	ns
Digestibility of E (%)	30.16[b]	48.28[a]	52.11[a]	±18.38	0.03
Calculated DE (kcal/kg)	1067.7[b]	1857.0[a]	1576.6[ab]	±141.04	0.06
Calculated ME (kcal/kg)	864.7[b]	1505.1[a]	1276.4[ab]	±114.3	0.06
Digestibility of calcium and phosphorus					
Ca (%)	25.68	32.60	34.86	±43.64	ns
P (%)	62.28	75.11	71.93	±28.22	ns

ns = means not significant ; T1= 0% of CaSFA; T2 = 5% of CaSFA; T3 = 10% of CaSFA

[ab] Values on the same row under each main effect with different superscripts different significantly ($p<0.05$)

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EFFECTS OF MEDICATED AND NON-MEDICATED UREA MOLASSES MULTI-NUTRIENT BLOCK SUPPLEMENTATION ON NUTRIENT DIGESTIBILITY OF SAANEN LACTATING DOES RAISED UNDER CONVENTIONAL DIETS.

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The slow growth and poor reproductive performances of goats reared by smallholder farmers in Malaysia are often attributed to inferior nutrition. Intake of daily dry matter is normally inadequate to meet the nutrient requirements, especially for protein and energy (1). Supplementation with urea-molasses mineral blocks (UMMB) had been reported to increase feed intake and rate of growth of these animals (2). Information on the effect of UMMB supplementation on lactating dairy goats is currently lacking. Hence, a trial was carried out to look into this issue, with emphasis on the effect of UMMB and medicated UMMB (MUMB) on the apparent digestibility of commonly used basal diets. Twenty four lactating Saanen does were assigned into four dietary treatments with six goats in each treatment group: (T1) Basal diet only (control group), (T2) Basal diet with UMMB, (T3) Basal diet with MUMB and (T4) Basal diet with commercial mineral block (CMB). The basal diet which consisted of commercial pellet (1 kg) and Napier grass (*Pennisetum purpureum)* (3 kg) was given at 9 am and 12 pm, respectively. A digestibility trial was conducted for 7 days after a feeding period of 90 days. The feed and faecal samples were analysed for dry matter (DM), ash, crude protein (CP), crude fibre (CF), ether extract (EE), acid detergent fibre (ADF) and neutral detergent fibre (NDF) based on the standard AOAC method. Apparent feed digestibility was determined by calculation.

Total dry matter intake (DMI) for T1, T2, T3 and T4 were 1.07±0.13, 1.26±0.05, 1.19±0.03, and 1.08±0.15 kg/d, respectively; while block intake in T2, T3 and T4 were 69.67±0.60, 62.62±4.84 and 30.52±1.95 g/d, respectively. Digestible DM, OM, CP, CF and ADF and NDF were significantly higher ($p<0.05$) in T2 and T3 than those in T1 and T4. UMMB and MUMB supplementation had enhanced fermentation process which directly increased intake of DM and other nutrients (3). Table 1 showed that DM, OM, CP, EE, CF, ADF and NDF digestibility were significantly higher ($p<0.05$) in T2 and T3 than those in T1 and T4. These improvements had resulted in increased fermentable nutrients supplied to rumen through UMMB and MUMB supplementation, leading to optimum growth of rumen microbes which effectively increased nutrient digestibility (3). Commercial mineral block supplementation did not result in marked improvement of nutrient digestibility as compared to other treatments as it is solely in the form of mineral elements and devoid of protein and energy sources. In conclusion, this study shows that locally produced UMMB and MUMB supplementations can effectively enhanced nutrient digestibility in the lactating dairy animals. Improvement of nutrient digestibility in the CMB supplemented group was small as compared to the control group.

Table 1: The digestibility of nutrient in goat fed on different dietary treatment (mean±SE)

Digestibility (%)	T1	T2	T3	T4
DM	62.75±3.59 [a]	79.35±0.75 [b]	77.16±1.50 [b]	68.35±1.35 [a]
OM	65.36±3.11 [a]	80.55±0.80 [b]	78.79±1.49 [b]	69.63±1.23 [a]
CP	60.77±2.74 [a]	80.15±0.30 [b]	75.16±2.30 [b]	66.52±2.28 [a]
EE	60.40±6.06 [a]	84.15±3.13 [a]	71.67±1.89 [a]	59.50±14.37 [a]
CF	64.67±4.47 [a]	79.05±1.68 [b]	77.51±1.78 [b]	68.53±1.78 [a]
ADF	64.17±3.42 [a]	79.00±1.35 [b]	77.98±1.62 [b]	68.56±1.20 [a]
NDF	52.17±4.89 [a]	79.29±1.23 [c]	78.31±1.77 [c]	69.17±1.06 [b]

T1-fed on basal diet only (control group); T2-basal diet with UMMB; T3-basal diet with MUMB; T4-basal diet with commercial mineral block

[ab] means in the same row with different superscript are significantly different ($p<0.05$).

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COW LEVEL PREVALENCE OF CLINICAL LAMENESS, CLAW LESIONS AND ASSOCIATED RISK FACTORS IN EIGHT DAIRY FARMS IN SELANGOR, MALAYSIA

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Lameness as a clinical presentation of impaired gait reduces productivity and welfare in the dairy cow. The economic losses accrued due to lameness in dairy cattle include the maintenance and treatment of affected animals as well as drop in milk yield and reproductive efficiency (1). Claw lesions remain the major cause of lameness in dairy cows (2). Recent development has seen the expansion of dairy production in Selangor and Malaysia generally. However, there is little information on the status of dairy cows in respect to claw health and lameness occurrence.

A cross-sectional study was then designed to investigate the prevalence of lameness, distribution of claw lesions and associated risk factors in dairy farms from the region. Eight purposely selected dairy herds were enrolled in the study based on certain criteria for participation which included large herd size, freestall housing, adequate records and location within the region. The number of cows sampled from each farm was proportional to the herd size. The study population was 251 lactating cows assessed for lameness and claw lesions by locomotion scoring (LS) and claw assessment respectively from September, 2016 to February, 2017. A four scale LS system developed by DairyCo (3) was employed for lameness detection where cows with LS $\geq$ 3 were considered lame. Cow level factors were assessed and scored in respect to hock condition (4), body condition (5) and leg hygiene (6).. In addition, the parity and days in milk were recorded for each cow. Claw examination was done with respect to the claw zone and the dorsal wall length was measured to examine presence of overgrown claw (7). Chi-square test and logistic regression were applied to compute the prevalence of lameness, claw lesions and association with cow level factors respectively.

The prevalence of lameness was 19.1% (95% Confidence interval, CI 10.0%, 33.3%) based on cows with locomotion scores > 3 while 31.1% of cows were affected with claw lesions (95% CI 16.3%, 40%). Statistical test revealed a significant difference ($p < 0.05$) between lameness prevalence in only one farm compared to others. Conversely, claw lesions prevalence was not significantly different ($p > 0.05$) amongst the studied farms. A total of 161 claw lesions were recorded in all the affected cows with the predominant being overgrown claw with deformities (24.8%; 40/161) and sole lesions (21.7%; 35/161) whereas the prevalence of white line disease, wall fissures and digital dermatitis were 13.0% (21/161), 10.6% (17/161) and 9.9% (16/161) respectively. Claw lesions were recorded in 87.5% (42/48) of the lame cows with highest being those having white line disease (61.2%; 13/21) and sole lesions (54.2%; 19/35). More than one claw lesion per cow was present in 71.8% (56/78) of the affected cows. Lameness was associated with early lactation (OR = 3.30; 95% CI 1.5, 7.3), injured hocks (OR = 4.8; 95% CI 1.4, 16.6) and dirty leg hygiene (OR= 2.6; 95% CI 1.04, 6.5) whereas presence

of claw lesions was associated with dirty leg hygiene (OR= 4.9; 95% CI 2.3, 10.5) and overgrown claw (OR= 2.68; 95% CI 1.3, 5.3).

Lameness and claw lesions remain a major health issue in the studied farms. Claw lesions occurred predominantly in combination and few cows had single lesions. Although a relatively fewer number of farms were enrolled in the study, certain hypothesized risk factors at cow level were associated with lameness and claw lesions prevalence. To address the claw health problems, farmers need to improve the management of cows at early lactation, with overgrown claw, injured hocks and cleanliness by establishing routine claw trimming and efficient stall design. Further studies are encouraged to investigate herd level factors associated with lameness and occurrence of specific claw lesions in the region.

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ASSOCIATION ANALYSIS OF TEAT MORPHOLOGY AND UDDER QUARTER MASTITIS STATUS IN FRESIAN AND JERSEY COWS

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Mastitis is an inflammatory reaction of the mammary gland and is considered as the most costly and widely occurring disease in the dairy industry (1). The bovine teat canal is unique in that it prevents milk leakages and bacteria entry into the udder, and therefore functions as part of the defense against mastitis (2). Udder and teat morphological conditions have been reported by many authors to be associated with udder health of dairy cattle (3,4). Rear udder quarters were reported to have shorter teats compared to the teats of the fore quarters (5). Nakov *et al*. (6) observed higher risk of clinical mastitis in the rear quarters with shorter teat. The aim of this study was to determine teats length and associate that with quarter mastitis score. A total of 590 udder quarters from 148 lactating Friesian and Jersey cows from a commercial dairy farm were used for this study. Subclinical mastitis was tested using California Mastitis Test (CMT). The test was performed using foremilk samples from each of the four quarters during morning and afternoon milking, according to the method described by Kasikci *et al*. (7). The results were scored according to Bhutto *et al.* (8) in a range of 0–4, with 0 for no reaction, 1 for a trace, 2 a weak positive, 3 a distinct positive and 4 a strong positive. Teat lengths were measured using a ruler according to Alic Ural (9). Data analysis was performed using proc MIXED procedure of the SAS software (Version 9.4).

The data showed a significant different ($p<0.05$) in teat length between the fore and rear quarters, with the rear teats being shorter (Table 1), as reported in previous study (5). The association of udder quarter CMT score with teat length is shown in Table 2. Udder quarters CMT score increased with decrease in teat length. Quarters with CMT score 3 and 4 had significantly ($p<0.05$) shorter teats compared to quarters with CMT score of 1 and 2. Nakov *et al.* (6) reported a higher risk of clinical mastitis in rear udder quarters which were found to have shorter teat. This suggest that the shorter the teat length, the higher the risk of intramammary infection. This may be attributed to machine induced oedema resulting from the liners' inability to massage the shorter teat end, due to their penetration level that is not up to the collapsing point as it is in the longer teats (10,11). However, in contrast to the present study Haghkhah *et al*. (1) reported no significant association between teat length and CMT reactions in cattle.

Table 1: Least square means (±SE) of teat length (cm) by quarters.

Udder Side	Fore Quarters	Rear Quarters	Fore vs. Rear
Right	4.60 ± 0.07	3.90 ± 0.07	P<0.05
Left	4.76 ± 0.08	3.91 ± 0.07	P<0.05

Table 2: Least square means (±SE) of teat length (cm) by quarter CMT score.

CMT Score	Teat Length
0	4.73 ± 0.08^{a}
1	4.42 ± 0.06^{b}
2	4.20 ± 0.07^{bc}
3	3.92 ± 0.11^{c}
4	4.19 ± 0.13^{bc}

Means that do not share common superscripts are significantly ($P<0.05$) different.

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EFFECT OF PROBIOTIC ADDITION IN DIFFERENT FEED FORMULATION ON RUMEN FERMENTATION *IN VITRO*

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The use of antibiotics as growth promoters has been banned in current animal production practice because of antibiotic resistance problem. One of the solutions is to use probiotics as alternatives to antibiotics in feed formulation. Probiotic supplemented diets have been observed to stabilizing the rumen pH of ruminants (1). Probiotic would have therefore a role on the balance of gut microflora by increasing the resistance against pathogenic agents, both through strengthening intestinal barrier and stimulating directly the immune system (2). The aim of this study was to observe the effect of probiotics addition on *in vitro* rumen fermentation characteristics.

The experiment consisted of six different formulations. i.e. R1 (100% consentrate), R2 (52% concentrate + 46% forage), R3 (56% concentrate + 44% forage), R4 (100% forage), R5 (26% concentrate + 74% forage), R6 (24% concentrate + 76% forage) and six treatments of probiotics. i.e. T0 (control), T1 (*Lactobacillus plantarum*), T2 (*Lactobacillus brevis*), T3 (*Lactobacillus plantarum* + *Lactobacillus brevis*), T4 (*yeast*), and T5 (*Lactobacillus plantarum* + *Lactobacillus brevis* + *yeast*). The dietary treatments were incubated *in vitro* at 39°C for 24 h. Parameters measured after the *in vitro* incubation were pH, gas production kinetics, dry matter digestibility (DMD), and organic matter digestibility (OMD). Gas production kinetics data were fitted using the following equation: $Gas = a + b (1 - e^{-ct})$, where a + b is potential gas production (ml) and c is gas production rate (ml/h). Experimental design used was a factorial randomised complete block with three blocks (replicates). Data were analyzed by analysis of variance and continued with a post-hoc test namely Duncan's multiple range test to compare among various treatment means.

There was no significant interaction ($p>0.05$) between different feed formulation and addition of probiotics. The results were presented according to the main effects. The pH of the R1 was significantly lower ($p<0.05$) compared to R3, R4, R5 and R6, but not different ($p>0.05$) between R2. The samples with an addition of *Lactobacillus plantarum* (T1) has the lowest ($p<0.05$) pH compared with the others (T0, T2, T3, T4, T5). The kinetics of gas production were significantly affected by feed formulation, addition of probiotics and block of rumen fluid ($p<0.05$). The dry matter digestibly was lower in R3 and R5 ($p<0.05$), but not significant between R2 and R6 ($p>0.05$), with an addition of probiotic, T1 was higher than T5 ($p<0.05$), but not different between T0, T2, T3, and T4 ($p>0.05$). The organic matter digestibility showed that R1 (100% concentrate) and T5 (combination of *Lactobacillus plantarum*, *Lactobacillus brevis*, and *yeas*t) was the highest compared to others within the same main effect.

In conclusion, different feed formulation and an addition of probiotics in the feed will altered the pH, gas production rate, dry matter digestibility and organic matter digestibility.

Table 1. The pH, gas production, constants of a+b and c, digestibly of dry matter and organic matter of formulated feed and with an addition of probiotics.

Parameters	Observed Variables					
	pH	Gas[a]	a+b (ml)	c (ml/h)	DMD (%)	OMD (%)
Formulated feed						
R1	6.53[a]	116[a]	244[a]	0.069[a]	72.8[a]	80.3[a]
R2	6.61[ab]	108[ab]	234[a]	0.052[b]	64.8[bc]	73[ab]
R3	6.67[b]	109[ab]	233[a]	0.054[b]	62.3[c]	70.5[ab]
R4	6.68[b]	86[d]	223[ab]	0.028[d]	70.9[ab]	66.7[b]
R5	6.69[b]	96[c]	207[b]	0.046[c]	62.2[c]	71[ab]
R6	6.79[c]	101[bc]	225[ab]	0.044[c]	66.4[abc]	67[b]
Probiotic treatments						
T0	6.72[a]	93[c]	221	0.04[b]	64.5[ab]	66.9[b]
T1	6.59[c]	108[a]	233	0.053[a]	71.4[a]	68.9[ab]
T2	6.64[ab]	107[a]	230	0.053[a]	66.7[ab]	70.5[ab]
T3	6.67[ab]	106[ab]	229	0.052[a]	68.7[ab]	73.8[ab]
T4	6.71[a]	97[bc]	222	0.044[b]	65.1[ab]	72.2[ab]
T5	6.65[ab]	105[ab]	230	0.053[a]	63[b]	76.1[a]
Block						
B1	6.80[b]	110[a]	259[a]	0.05[b]	66.2	74.3[a]
B2	7.10[c]	107[a]	221[b]	0.042[c]	67.7	63.8[b]
B3	6.09[a]	90[b]	203[c]	0.055[a]	65.8	76.1[a]

R1, 100% concentrate; R2, 52% concentrate + 46% forage; R3, 56% concentrate + 44% forage; R4, 100% forage; R5, 26% concentrate + 74% forage; R6, 24% concentrate + 76% forage. T0, control; T1, *Lactobacillus plantarum* only; T2: *Lactobacillus brevis* only; T3: combination - *Lactobacillus plantarum* + *Lactobacillus brevis*; T4: yeast only; T5: combination - *Lactobacillus plantarum* + *Lactobacillus brevis* + *yeast*; B1-B3, block; DMD: dry matter digestibility; OMD: organic matter digestibility.

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NUTRITIVE VALUE OF NAPIER (*Pennisetum purpureum* Schumach.) CULTIVARS AS FRESH AND ENSILED FODDER

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Forages are the cheapest and the best feed source for ruminants. The inclusion of forage to concentrate from 30 to 70% in dairy cattle diet could reduce up to 30% cost of production. The grass quality was measured based on nutritional composition and digestibility as it reflects the actual level of nutrients available for body utilization. Napier grass is a C_4 type tropical grass and commonly used as ruminant feedstuffs due to its promising yield. The preservation of Napier grass is to ensure continuous feed supply for the animals during shortage of forages as well as preserving the quality of the grasses. Thus, four Napier cultivars (Common, Silver, Red and Dwarf Napier) were established, harvested and ensiled at the age of 6th to 8th weeks for proximate and *in-vitro* digestibility analysis (1). Data were analyzed using PROC GLM of SAS with class variable including Napier cultivars and feed types. The Common, Silver and Red Napier were classified as tall types and Dwarf Napier as short cultivar. Generally, Dwarf Napier had the highest leaf to stem ratio (3.18) and nutritive value (10% crude protein (CP); 66% *in-vitro* dry matter digestibility; 56% *in-vitro* organic matter digestibility (IVOMD) than tall cultivars. There were interaction ($p<0.05$) between cultivars and feed types on CP content (Figure 1). The CP content of Common Napier increased significantly ($p<0.05$) from 8.13 to 9.26% after ensiling process. Increase of CP content ($p>0.05$) in Napier cultivars after ensiled could be accompanied by the populated anaerobic microorganism during ensiling process (2).

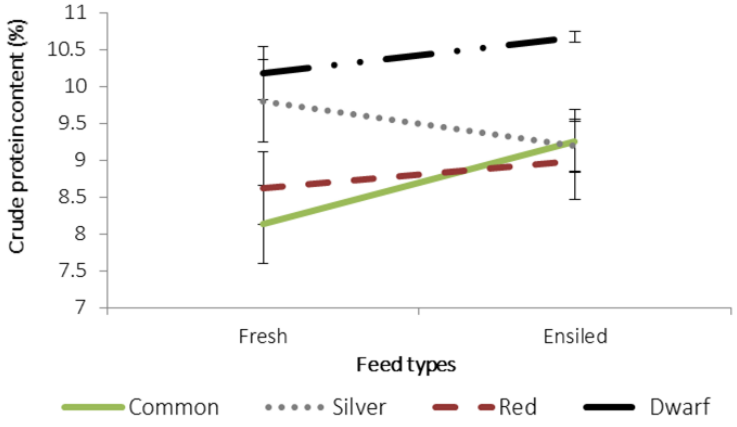


Figure 1. The interaction of crude protein content (±SE) between fresh and ensiled cultivars

In spite of that, a reduction ($p<0.05$) of CP content in Silver Napier after ensiling resulted by proteolysis occurring during wilting and ensiling by plant enzymatic activity and microbial fermentation (3). No changes of CP content ($p>0.05$) observed in both Red and Dwarf Napier due to ensiling process. The cell wall compositions (Table 1) except for

hemicellulose content and digestibility were significantly affected ($p<0.05$) by ensiling process. The NDF content of ensiled Napier grass was clearly affected ($p<0.05$) by the process of fermentation. The reduction of NDF content from 72 to 67% can be explained by the hydrolysis of NDF content during fermentation process (4). The IVDMD were markedly decreased ($p<0.05$) after ensiling process. This can be explained by the losses of digestible portion which reflected primarily by the losses of soluble in effluent as well as associated with the extensive fermentation. Interestingly, the IVOMD of Napier grass increased significantly ($p<0.05$) from 52 to 58% after ensiling. Thus, it seems that the improvement of IVOMD was contributed by microorganisms involved during fermentation of ensiled grass.

Table 1. Cell wall composition and digestibility of Napier cultivars as fresh and ensiled fodder

Napier cultivars	Cell wall composition (%)					Digestibility (%)	
	NDF	ADF	ADL	HC	CL	IVDMD	IVOMD
Common	71.59[a]	41.22	6.17[a]	30.37	35.05[a]	65.62	56.11
Silver	70.82[a]	42.15	5.26[b]	28.67	36.89[a]	63.11	53.01
Red	68.74[b]	40.29	4.80[b]	28.45	35.49[a]	63.74	53.67
Dwarf	66.11[c]	36.00	4.50[b]	30.16	31.50[b]	65.81	56.04
P-value	*	NS	*	NS	*	ns	ns
S.E.M	0.74	0.40	0.32	0.94	0.51	2.06	2.14
Feed types							
Fresh	71.68[a]	41.51[a]	5.92[a]	30.17	35.59[a]	68.75[a]	51.63[b]
Ensiled	66.95[b]	38.31[b]	4.44[b]	28.66	33.87[b]	60.38[b]	57.78[a]
P-value	*	*	*	NS	*	*	*
S.E.M	0.51	0.29	0.22	0.65	0.36	1.46	1.58

NDF, neutral detergent fibre; ADF, acid detergent fibre; ADL, acid detergent lignin; HC, hemicellulose; CL. Cellulose; IVDMD, *in-vitro* dry matter digestibility; IVOMD, *in-vitro* organic matter digestibility
* refer to significant difference at $P<0.05$; NS refer to non-significant difference ($P>0.05$)
[a, b] Within a column, means without a common superscript differ ($P<0.05$)

It is concluded that ensiling process reduced the digestibility (IVDMD and IVOMD) of the Napier grasses and Dwarf Napier had superior quality in both fresh and ensiled form among the cultivars.

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IN VITRO EVALUATION OF *Gliricidia sepium, Sapindus rarak* OR *Hibiscus* sp. SUPPLEMENTATION TO NAPIER GRASS

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Napier grass is a common tropical forage fed to ruminants and known to have high nutritive value. However, feeding napier grass only is not adequate to satisfy nutrient requirement of ruminants especially the protein requirement. Therefore supplementation of napier grass with other high protein diet such as *Gliricidia sepium* is necessary to close the gap between nutrients available in feeds and nutrient requirements of the animals. *Gliricidia sepium* contains high protein, easy to plant and still produce well despite the dry season. *Sapindus rarak* and *Hibiscus* sp. has been widely used as a feed additive in Indonesia to reduce methane mitigation and improve digestibility. Therefore, this study aimed to compare the gas production produce by napier and *Gliricidia sepium* together with *Sapindus rarak* or *Hibiscus* sp. as a partial replacement to napier grass by using an *in vitro* gas production technique.

Samples of napier grass, *Gliricidia sepium*, *Sapindus rarak* and *Hibiscus* sp. were subjected to *in vitro* incubation by using buffered rumen fluid according to Menke and Steingass method (1). The following experimental treatments were used: napier grass (Ng), *Gliricidia sepium (Gs) Sapindus rarak (Sr), Hibiscus* sp. (H), *Ng* 70% + Gs 30%, Ng 70% + Sr 30%, and Ng 70% + H 30%. An amount of 200 mg substrate was placed into each incubation bottle. Rumen fluid was taken from two fistulated Brahman-cross cattle before morning feeding, and then brought to the laboratory to be filtered and mixed with buffer solution (rumen fluid:buffer = 1:4 v/v). The incubation was performed in four replicates by employing a randomized complete block design. The pH of the samples were also recorded using pH meter.

Gliricidia sepium samples in this study contained 20-30% crude protein (dry matter basis) and 15% crude fiber. Crude protein content of napier grass was 9.06% DM. Gas production of *Gliricidia sepium, Sapindus rarak* or *Hibiscus* sp., either individually or in combination with napier grass was presented in Figure 1. Incubation of *Hibiscus* sp. produced higher gas production than that of napier grass ($p<0.05$). On the other hand, lower gas production of *Gliricidia sepium* or *Sapindus rarak* was observed in comparison to napier grass ($P<0.05$). Supplementation of *Gliricidia sepium*, *Sapindus rarak* or *Hibiscus* sp. to napier grass had resulted in similar amount of gas produced between the supplemented and unsupplemented napier grass.

Gas produced by rumen microbes during incubation is partly due to a product of microbial fermentation on the feed or substrate (2). Results revealed that total gas production *in vitro* increased tremendously within the first 10 hours of incubation and started to slow down due to reduction of fermentable substrates as the time of incubation increase. This is due to the decreasing quantity of fermentable substrates (3). Based on previous study reported by Istiqomah et al (2011) that the gas production decreased significantly by supplementing with napier grass and saponin from Hibiscus L. This is because the concentration of saponin supplementation is different and higher ie 5% to

10% of DM feed. Thus higher concentration of saponin reduce more protozoa population that lower the gas production (4).

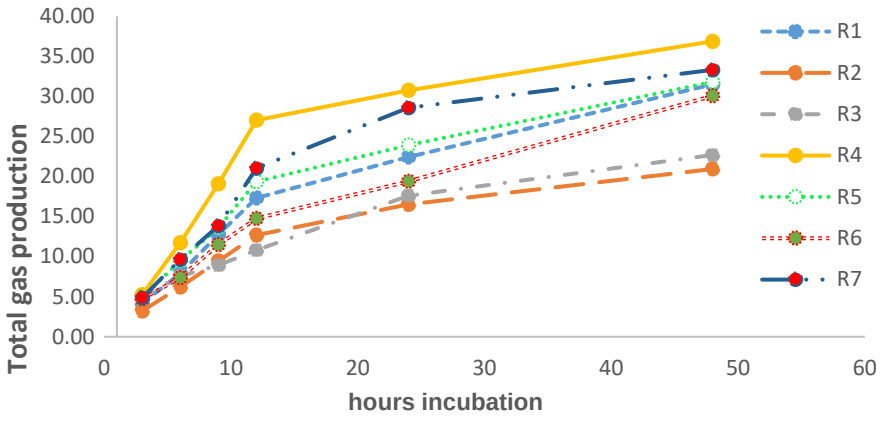


Figure 1. *In vitro* gas production of napier grass, *Gliricidia sepium*, *Sapindus rarak*, *Hibiscus* sp. or their combination.

R1 = Napier grass, R2 =*Gliricidia sepium, R3 = Sapindus rarak*, R4 = *Hibiscus* sp., R5 = *Ng* 70% + Gs 30%, R6 = Ng 70% + Sr 30%, and R7 = Ng 70% + H 30%.

The rumen pH values indicated a normal rumen condition, i.e. ranged from 6.8 to 6.9. Supplementation of *Gliricidia sepium*, *Sapindus rarak* or *Hibiscus* sp. did not significantly alter rumen pH of unsupplemented napier grass.

Leaves of *Hibiscus* sp. apparently has a potency to be used as a feed supplement in ruminant diet as shown by its gas production profile. Although gas production of *Gliricidia sepium* or *Sapindus rarak* was relatively low, they may be used as a supplement but for different nutritional strategies such as for protozoa defaunation since both plants contain substantial amounts of saponins.

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LIPOGENIC GENES EXPRESSION IN GOATS FED FATTENING DIET SUPPLEMENTED WITH LINSEED OIL

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The feeding of high concentrate fattening diet is a common practice in feedlot or intensive farming. However, this feeding practice also promotes fat accumulation and increases saturated fatty acids content which is detrimental towards health. Therefore, supplementation with health-beneficial polyunsaturated fatty acids (PUFA) (e.g. linseed oil) to the animals can helps in modifying the fatty acids profile, thus making the meat and meat products healthier for the consumers. Nutrigenomics is a term referring to the effect of diet on physiological processes by altering the gene expression (1), and the advancement in molecular technologies has made it possible to study and elucidate the nutritional effect on fatty acids related genes. Therefore, this study was conducted to elucidate the effect of linseed oil supplementation on lipogenic genes (acetyl-CoA carboxylase (ACACA) and fatty acid synthase (FASN) genes) expressions in goats. Twelve Boer-crosses male goats between three and four months old were used in this study. Animals were randomly allocated to either the control group or treatment (linseed oil-supplemented) group, with six replicates per group. The animals in the control group were fed diet consisted of 30% alfalfa hay and 70% concentrates while the treatment group was fed the same control diet, supplemented with linseed oil at 4% to the concentrate (w:w), and feed was offered at 4% (DM basis) of body weight (BW). Animals were raised for 100 days and liver samples were taken for gene expression study after slaughter. The RNA extraction and reverse transcription-polymerase chain reaction was performed prior to the quantitative real time PCR (qPCR). Results of study were analysed by using the student's t test and probability was considered at $P<0.05$. Linseed oil supplementation downregulated ($p< 0.05$) the relative expression of ACACA and FASN genes (Figure 1). The association of ACACA and FASN genes with saturated fatty acids content and fat accumulation in animals has been reported previously (2), where the upregulation of both genes indicates an increased capacity in fatty acid synthesis (3). The result thus suggest that goats (possibly other ruminants as well) supplemented with linseed oil in high concentrate diet may have a lower saturated fatty acids content compared to non-supplemented animals. In conclusion, supplementation of linseed oil downregulated the expression of lipogenic genes in goats fed high concentrate fattening diet. This potentially leads to the reduction of saturated fatty acids content and fat accumulation, thus promoting the production of healthier meat and meat products.

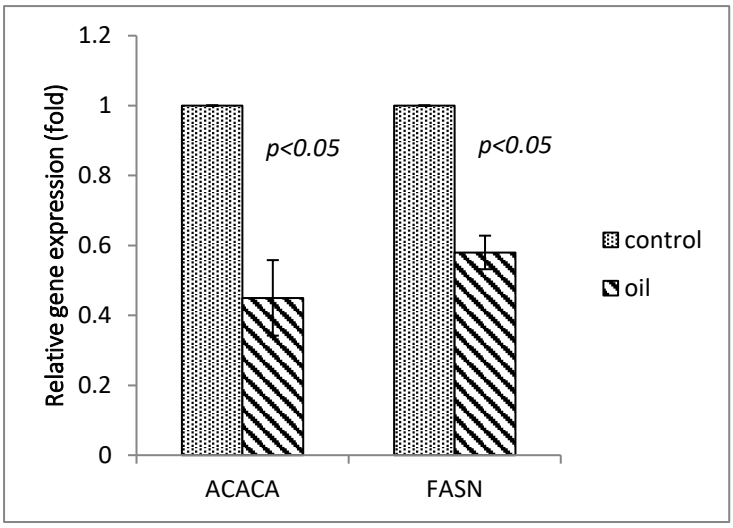


Figure 1. Lipogenic gene expression in goats fed diets unsupplemented and supplemented with linseed oil at 4% to the concentrate (w:w)

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PHYSICAL AND CHEMICAL CHARACTERISTICS OF EMPTY FRUIT BUNCH-BASED BEEF CATTLE FEED PELLET

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Currently, Malaysia is towards the development of practical and low-cost feed for various classes of ruminant species. Oil palm-based ruminant feed with good physical and chemical characteristics is one of the solutions in order to achieve the vision. The physical quality of feed pellet is crucial for a number of reasons such as to endure transportation and handling in order to ensure that the product retains its structure until eaten by the animals (1, 2). Physical properties of feed pellets largely depend upon the composition and mode of processing in the feed mill and are considered an important criterion for the acceptance of compound cattle feed by farmers. It is also very important to supply feed with balanced nutrient, hence feeds need to be formulated and manufactured in order to provide all the required nutrients including energy, protein and amino acids, minerals and vitamins in adequate levels and balanced proportions to promote optimum growth as well as preventing nutritional diseases. Therefore, a study had been carried out to investigate the physical analysis and chemical composition of empty fruit bunch (EFB)-based beef cattle feed pellet.

There were three different feed samples consisting of concentrate feed with inclusion of 20% EFB, concentrate feed with inclusion of 40% EFB and commercial feed (COMM) as a control. Samples were subjected to physical and chemical analyses for feed quality determination. The physical analyses comprise of fines percentage analysis, pellet durability index (PDI) and hardness test. For chemical analyses, the beef cattle feed pellet samples were analysed for proximate composition following (3) procedures. The analyses conducted were total moisture, total ash, crude fat, crude protein, crude fibre and gross energy content to determine the proximate composition.

Figure 1 shows the results of physical characteristics of beef cattle feed pellet samples for 20% EFB, 40% EFB and COMM. For fines percentage analysis, COMM feed showed the lowest level with 3.53% followed by 20% EFB with 4.43%. Meanwhile, 40% EFB showed the highest fines percentage and exceeded the permitted fines level (< 5%) with 5.47%. Both EFB-based feed pellets showed good PDI values of 95.17 and 94.43%, respectively, and meet the requirement (>90%) for animal feed pellet specification compared to COMM feed with 73.60%. The hardness values for all feeds ranged between 80.42 and 102.78 N. Both 20% and 40% EFB showed the same value of hardness with 102.78 N. The results obtained for proximate analyses of 20% EFB, 40% EFB and COMM beef cattle feed pellets are presented in Table 1. Moisture content values were between 6.37 and 9.20% for all samples. COMM had the highest value of total ash content with 17.16%, while the lowest value can be observed in 40% EFB with 10.48%. For crude fat, the nutrient specification for beef cattle was between 4 and 6% from feed intake. The highest value of crude fat can be observed in 20% EFB with 7.13%, followed by 40% EFB with crude fat content of 5.18% and the lowest was from COMM with 4.13%. Requirement for crude protein was in the range of between 12 and 15% for beef cattle. 20% EFB had the highest crude protein value of 13.80%, followed by 40% EFB and COMM with 11.10% and 10.53%, respectively. Crude fibre requirement for beef cattle ranged between 10 and 25%. COMM had the highest value of crude fibre with

29.69% and the lowest was from 20% EFB with 20.86%. The highest gross energy reported was from 40% EFB with 17.00 MJ/kg, followed by 20% EFB (16.99 MJ/kg) and COMM (16.09 MJ/kg). The requirement for gross energy in beef cattle ranged between 10 and 11 MJ/kg.

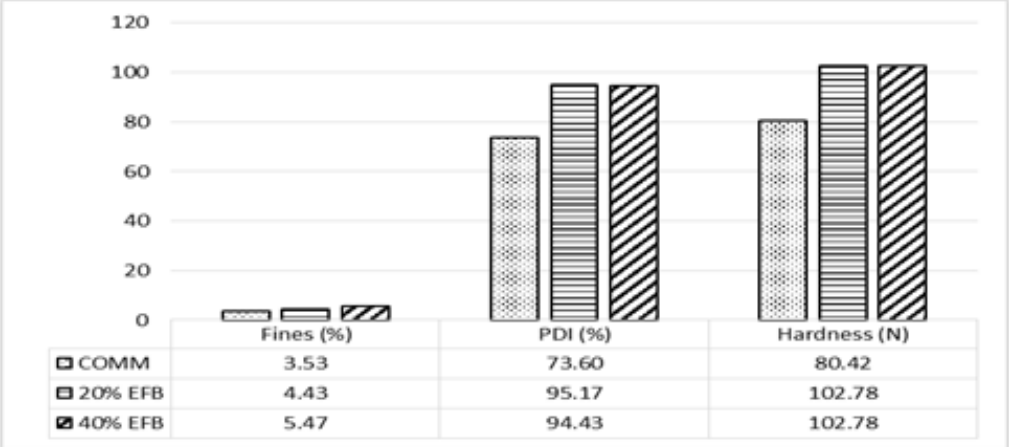


Figure 1: Physical characteristics of beef cattle pellet samples

Table 1: Mean percentage of nutrients content of beef cattle pellets

Parameters	20% EFB	40% EFB	COMM
Moisture Content (%)	8.98 ± 0.38	9.20 ± 0.12	6.37 ± 0.05
Total Ash (%)	10.96 ± 1.47	10.48 ± 0.52	17.16 ± 1.74
Crude Fat (%)	7.13 ± 0.02	5.18 ± 0.00	4.13 ± 0.00
Crude Protein (%)	13.80 ± 0.12	11.10 ± 0.09	10.53 ± 0.11
Crude Fibre (%)	20.86 ± 0.09	27.99 ± 0.75	29.69 ± 1.60
Gross Energy (MJ/kg)	16.99 ± 9.90	17.00 ± 12.02	16.09 ± 19.80

EFB: empty fruit bunch; COMM: commercial pellet

In conclusion, EFB inclusion of 20% and 40% in the beef cattle feed did not affect the physical quality in term of PDI (>90%) and hardness, although 40% EFB did not comply with fines percentage level. Both groups also meet all the nutrient requirements for beef cattle feed. Thus, there is a promising opportunity for EFB inclusion to produce good quality of beef cattle feed with acceptable parameters in physical and chemical characteristics as required by the industry.

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RESPONSE OF SUPEROVULATION BY USING FSH (FOLLICLE STIMULATING HORMONE) AND SEX DETERMINATION OF PESISIR CATTLE EMBRYOS USING PCR METHOD AS GERMPLASM FROM WEST SUMATRA

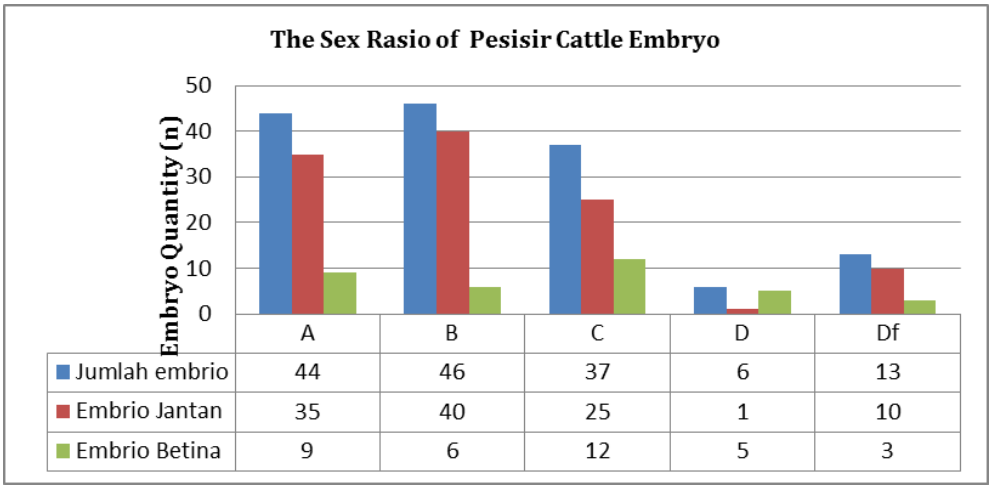
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Pesisir Cattle is one of Indonesian local cattle race which is breeded by most of the people in West Sumatera, especially South Pesisir Regency. They are spread over the coast areas such as Padang Pariaman Regency, South Pesisir Regency, and Agam Regency (1). Some superior characteristics of this local cattle is its ability to well adapt with low quality of ration and the traditional extensive breeding system, as well as the ability to resist toward the disease and parasite (2). Pesisir Cattle has given a lot of contribution to supply the meat for people in the West Sumatera province, since the need for meat supply in society has increased 2.0 ton/capita/year during the last 10 years (3). For the last couple of years, the population of Pesisir Cattle has continually decreased and may lead to the extinction of germplasm in West Sumatera. Artificial insemination (AI) and embryo transfer (ET) technology are the option to solve this problem. This research was conducted by using experimental method to study about the response of superovulation by giving 16 ml dosage level of FSH hormone to Pesisir cattle.

A total of 15 Pesisir cows were used. The oestrus schedule of Pesisir Cattle was set by inserting CIDR (Controlled Internal Drug Release) into the vagina for 12 days. Moreover, at day 10th, all cattle were injected with 16 ml dosage levels of FSH. The 16 ml FSH, then, is injected by decreasing the dose for 3 days. On the 3rd day, FSH injection is accompanied by $PGF_{2\alpha}$ injection and CIDR is removed. The estrus detection is performed at the day 13th. Natural mating was proceed after the oestrus signs visible. Collection of donor embryos was done on the 6th and 8th day after mating. The variables that measured are the response of superovulation, total of corpus luteum, embryos and sex ratio.

The result obtained was 100% of superovulation response of Pesisir cattle. The total average of corpus luteum and embryos of Pesisir Cattle was 5.93±3.17 and the total of transferable embryos were 90, with the average of 6.00 or 61.64%. The sex of embryos obtained in this study from 146 embryos are 76.03% (111 embryos) males and 23.97% (35 embryos) females. Based on total of transferable embryos, there were 51.37% male embryos and 11.28% of female embryos (Figure 1). The ratio of male is bigger than female for the *in vitro* embryo (4). The amount of male livestock from Artificial Insemination (AI) is higher than female livestock because principally the sperm carrying male gene is stronger than the sperm carrying female gene (5). It can be seen that the difference between X and Y chromosome is the size of the DNA (y is smaller and X is bigger), surface change (X sperm moves to cathode) and motility (Y sperm is faster, Y chromosome fluorescence). Male embryo (XY) will be appeared in two stripes with 141-bp-long meanwhile for female embryo (XX) will be appeared in one stripe with 216-bp-long as shows in Figure 2.



	A	B	C	D	Df
Jumlah embrio	44	46	37	6	13
Embrio Jantan	35	40	25	1	10
Embrio Betina	9	6	12	5	3

Figure 1. The diagram of the sex rasio of pesisir cattle embryo



Figure 2. The appearance of a marking system of sex determination. M is the standard size while XX, YY and XY are the identification control (XY=male heterozygous, YY= male homozygous and XX= female). Source Jamsari (2007)

The result of this study showed that the sex ration of male embryos is higher than female embryos.

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CAN THE COMBINATION BETWEEN *Panax ginseng* AND *Eurycoma longifolia* AQUEOUS EXTRACTS IMPROVE CRYOPRESERVED SPERM?

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Techniques in livestock reproduction, for instance artificial insemination (AI) in cattle, are regularly used to improve the value and magnitude of genetic and phenotypically superior calves. However, sperm cells show significant alterations with cryopreservation (1). Therefore, the efficiency of AI technique is dependent on the post-freezing semen quality, which able to provide adequate sperm progressive motility, high viability, and vigor (2). Hence, this study was conducted to investigate the effect of *Panax ginseng* (PGe) and *Eurycoma longifolia* (ELe) aqueous extracts supplementation as a single dose or as combination in tris based extender on the quality of cryopreserved bull sperm. The dosages of PGe were determined according to previous study (3). Therefore, two dosages of PGe (0.5 and 0.25 mg/mL) and ELe (5 and 2.5 mg/mL) as previously determined (4) were used in the present study. The total treatment groups of the present study were control group (0.00 mg/mL), G_1 (0.5 mg/mL of PGe), G_2 (5 mg/mL of ELe), G_3 (0.5 mg/mL of PGe + 5 mg/mL of ELe), G_4 (0.5 mg/mL of PGe + 2.5 mg/mL of ELe), G_5 (0.25 mg/mL of PGe + 5 mg/mL of ELe), and G_6 (0.25 mg/mL of PGe + 2.5 mg/mL of ELe). Six ejaculates were obtained from three Brangus–Simmental bulls using an electro-ejaculator. Tris-egg yolk extender was prepared as two fractions (2), either with or without glycerol. Ejaculate was firstly diluted with non-glycerol fraction of extender, and then chilled for 3 h at 5℃. At that point, the 2nd fraction of extender containing glycerol was added to make the final concentration of glycerol at 6.4%. Samples were packaged in 0.25 ml French straws containing at least 20 x 10^6 sperm/straw and frozen in liquid nitrogen. The cryopreserved straws were evaluated after 7 and 14 days (d) post-freezing. All straws were thawed for 30 s at 37℃ for evaluation. Figure 1, showed that the sperm motility peaked significantly at G_2 (5 mg/mL, ELe) but decreased significantly with PGe in single or combination groups after 7 and 14 d post-freezing. The percentages of cryopreserved sperm normality trend similarly but the differences were not significant. Since, G_1, G_2 and control recorded (93.80 ± 0.51%, 93.60 ± 0.60% and 93.60 ± 0.57%, 7 d post-freezing respectively) and (93.48 ± 0.86%, 93.70 ± 0.97% and 93.50 ± 0.55%,14 d post-freezing respectively). Sperm viability (Figure 2) also peaked at 5 mg/mL ELe and was only significant with G_4 that contain high dose of PGe and low dose of ELe after 7 and 14 d post-freezing.

In conclusion, the present study revealed that 5 mg/mL ELe supplemented in tris-based extender improved post-freezing bull sperm motility, normality and viability. This might be due to the bioactive components and the anti-oxidant effect of ELe into sperm cells. Present study also revealed that supplementation of PGe into tris-based extender as a single dose or combination with ELe reduced quality of cryopreserved bull sperm and all sperm functional parameters were decreased in relation to control.

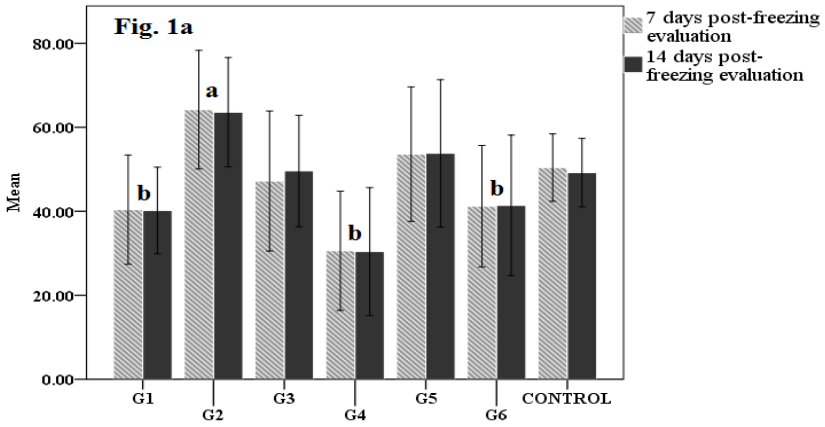


Figure 1. Synergistic effect of PGe and ELe on cryopreserved bull sperm on sperm motility

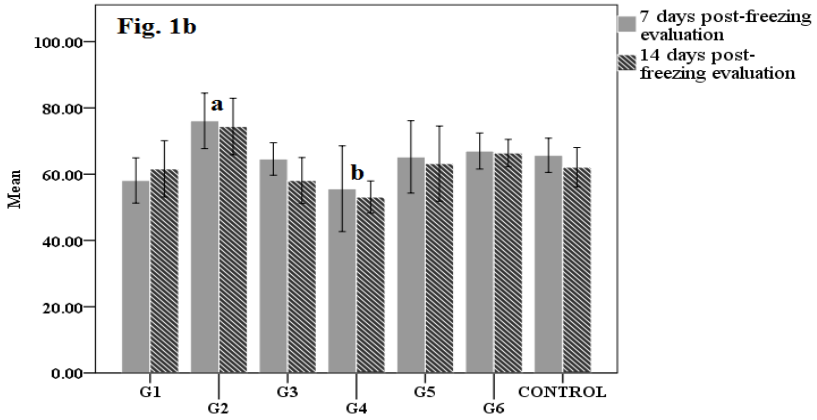


Figure 2. Synergistic effect of PGe and ELe on cryopreserved bull sperm on sperm viability.

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COMPARISON OF SAMPLE PREPARATION METHODS FOR DETERMINATION OF TITANIUM, PHOSPHORUS AND CALCIUM IN BROILER DIETS AND DIGESTA

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In understanding the effectiveness of phytase in improving nutrient digestibility, digesta samples from each segment of the gastrointestinal tract (GIT) need to be analysed for several different nutrients (1). Most of the analyses require separate sample preparation and large amount of sample dry matter which is the main constraint concerning the amount of digesta obtained from each segment of GIT. By having a common sample preparation for diets and digesta samples which later could be used in several analyses could minimize the amount of sample required. The objectives were to compare the content of titanium (Ti), phosphorus (P) and calcium (Ca) in diet and digesta samples after being separately prepared using different acid digestion. It was hypothesised that the content of P and Ca measured following either HCl or H_2SO_4 digestion would not differ from each other.

Two different acid digestions were done prior to the determination of Ti, P, and Ca in all diets and ileal digesta samples. The sample preparation methods were; (a) HCl digestion according to AOAC Official Method 965.17 (2) for determination of P in animal feed and pet food and (b) H_2SO_4 digestion as in method by (3) for determination of TiO_2 in chicken digesta, both with slight modification (2). The digesta samples were collected from terminal ileum of 3 weeks old Ross 308 male broilers fed on formulated to meet the specification for Ross 308 Broiler except with lower content of available P (0.35%) and Ca (0.86%) and contained 0.5% titanium dioxide (TiO_2) and stored at -20^{o}C prior further processing and analysis. All data were analysed using Minitab 17 Statistical Software (5). Diet and digesta content of Ti, P and Ca were first subjected to normality test and the non-normal data were transformed by the best estimate λ value prior to the analysis of variance (ANOVA) using general linear model (GLM). Significant differences between means were identified at $p<0.05$ by Multiple Comparison of Means Tukey's Method.

There were no significant differences observed between P content of the diets measured by ICP-OES assay following HCl or H_2SO_4 digestion (Table 1).

Table 1. Total phosphorus (P), calcium (Ca) and titanium (Ti) in diets and ileal digesta of broilers as prepared by different acid digestion methods.

Acid digestion	Diet			Ileal digesta		
	P (%)	Ca (%)	Ti (%)	P (%)	Ca (%)	Ti (%)
HCl	0.63±0.03	0.83±0.04[b]	0.03±0.04[b]	0.76±0.05[b]	1.43±0.12[b]	1.10±0.14[b]
H_2SO_4	0.68±0.01	0.94±0.04[a]	2.98±0.15[a]	0.98±0.02[a]	1.90±0.07[a]	10.78±0.38[a]
SEM	0.02	0.03	0.35	0.04	0.09	1.27
P-value	0.158	0.023	<0.001	<0.001	<0.001	<0.001

[a,b]Means ± SE with a different letter within a column were significantly different, $P< 0.05$

Different acid digestion significantly affected ($p<0.05$) ileal P content and the content of Ca and Ti in both diet and ileal digesta. This is probably due to different boiling times (6) and the high concentration of TiO_2 in digesta samples. Based on our observation, greyish white opaque solution was produced when acid was added to ash containing TiO_2 and H_2SO_4 solution became clear after 60 min of boiling, indicating TiO_2 was completely dissolved. For digesta sample with higher concentration of TiO_2, boiling time was about 90 min before the acid solution became clear, while HCl solution remained cloudy after boiling for 60 min. Very low Ti was detected in HCl digested samples which was unexpected and unexplainable since Ti is insoluble in HCl (7). In common practice, samples are prepared separately for different analyses, for example P content in a diet containing TiO_2 is analysed using the molybdovanadate method that involves HCl digestion but TiO_2 does not fully dissolve in HCl. Therefore, Ti content is determined separately by method of (3). On the other hand, it was reported that sequential analysis of several nutrients was able to minimize the unavoidable samples losses when the analyses were performed in a single container instead of using several containers (8). Based on the findings of the study, therefore, the sequential analysis is proposed for determining of DM, total ash, Ti and other minerals for diet and digesta. Briefly, a 20 ml borosilicate glass vial is used to determine DM and ash content of a sample and followed by acid digestion. Total content of the vial is filtered through a filter paper into a 100 ml volumetric flask and after diluted to 100 ml with ultra-pure water, the sample is ready for analysis of minerals using either colorimetric or ICP-OES methods. The filtered residue can be further ashed for AIA determination if required.

In conclusion, it is suggested that H_2SO_4 could be used in replacing HCl in sample digestion prior to P and Ca analysis. Digestion of diet and digesta using H_2SO_4enabled sequential analysis of Ti, P and other minerals.

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IMMUNOSENSOR FOR ELECTROCHEMICAL DETECTION OF CLENBUTEROL

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Antibiotic clenbuterol (CLB) is an approved medicine for therapeutic use in animals as a bronchodilator, but it is strictly regulated in the livestock industry (1). Above the therapeutic dose level, CLB acts as a growth promoter which is an illegal feed additive in various countries (2). CLB has a long half-life and slow metabolism in animal bodies (3), thus human who consume food products that contained CLB residue may experience increase in heart rate, glaucoma, muscular tremor and respiratory problem (4). Liquid chromatography-mass spectroscopy (LC-MS) is a known established method to qualify and quantify CLB residue in the meat products (5). However, this method involves complicated procedures, requiring a highly skilled person, large instrument and is very time-consuming. Thus, development of a compact instrument with a simple operating procedure that can be performed by the semi-skilled person is in demand. In this study, electrochemical immunosensor was developed by modifying screen printed carbon electrode (SPCE) with poly(3,4-ethylenedioxythiophene)/multiwalled carbon nanotube/anti-CLB antibody (PEDOT/MWCNT/Ab) composites for CLB detection.

Modification SPCE with PEDOT/MWCNT was performed by electropolymerization of EDOT and MWCNT suspension onto the working electrode (WE) by chronoamperometry (CA), using potentiostat (Autolab PGSTATM101, Metrohm) (6). Meanwhile, immobilization of Ab onto PEDOT/MWCNT/SPCE was performed through activation of the electrode surface with EDC/S-NHS crosslink method. Blocking was carried out with dry milk to avoid the formation of any undesirable signal. Direct competitive assay format was applied for detection whereby CLB solution and CLB-HRP were competing to form binding with Ab. The potential was applied at -0.1 V in the presence of tetramethylbenzidine (TMB), thus resulting recordable current signal from TMB-HRP redox reaction formation.

Linear graph of standard clenbuterol with R^2=0.9921 was reported (Figure.1). Electrochemical immunosensor developed from PEDOT/MWCNT/Ab/SPCE has shown a potential to be applied in detection of CLB. Analysis of 10 real samples from meat extractions were performed to detect possible CLB residue by using developed electrochemical immunosensor and LC-MS simultaneously. Since no trace of CLB was detected, the samples were spiked with 50 and 100 ppb CLB. More than 80% recoveries were obtained from both detection method (Figure 2). In conclusion, the developed electrochemical immunosensor has produced competitive results in comparison with LC-MS thus implying the reliability of this immunosensor for CLB detection in the real sample application.

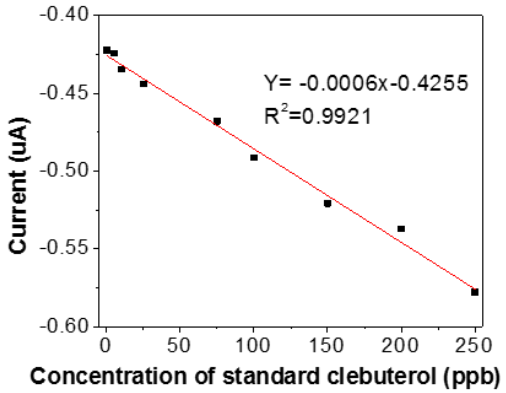


Figure 1 Calibration line of the current vs standard clenbuterol concentration.

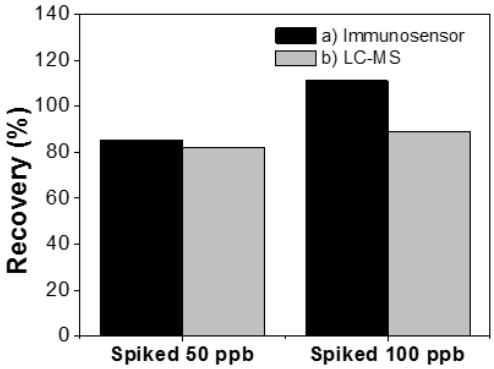


Figure 2 Percentage recovery of CLB a) Immunosensor; b) LC-MS.

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EFFECT OF PALM KERNEL EXPELLER AND PALM KERNEL EXTRACT (OLIGOPKE) ON INTESTINAL MONOSACCHARIDES TRANSPORTER GENE OF BROILER CHICKS

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Over the decades, many studies have been conducted using enzymes to improve the nutritive value of palm kernel expeller as feed ingredient for poultry, however, the results were not promising. It is suggested that the predominant sugar released by enzyme treatment was mainly mannose, which was reported to be poorly absorbed as compared to glucose and xylose (1). In the intestine, monosaccharides were absorbed into enterocytes by SGLT1 (glucose transporter), SGLT4 (mannose transporter) and GLUT5 (fructose transporter) and exist the enterocytes through GLUT2. To validate the above hypothesis, this study aimed to evaluate the effect of feeding PKE, enzyme-treated PKE and OligoPKE (oligosaccharides extract of PKE) on the jejunal expression of monosaccharides absorption transporters namely, SGLT1, SGLT4, GLUT2 and GLUT5.

Forty eight male day-old chicks (Cobb 500) were randomly allocated to four treatment groups (6 replicates per treatment and 2 birds per replicates) fed with different dietary treatments [0% PKE (Control), 5% PKE and 5% enzyme-treated PKE, and 1% OligoPKE]. On day 14, a segment of the jejunum from all chicks was sampled. Total RNA of each sample was extracted with RNeasyPlus Mini kit (Qiagen, Germany) and was then converted to cDNA using a Maxime RT PreMix kit (Intron Biotechnology, Korea). Quantitative real-time PCR was performed to quantify the amount of GAPDH, GLUT2, GLUT5, SGLT1, and SGLT4 genes. The expression of genes of interest was normalized using GAPDH as a reference gene. Data were analyzed using the $2^{-\Delta\Delta Ct}$ method (2). Results are presented in Figure 1.

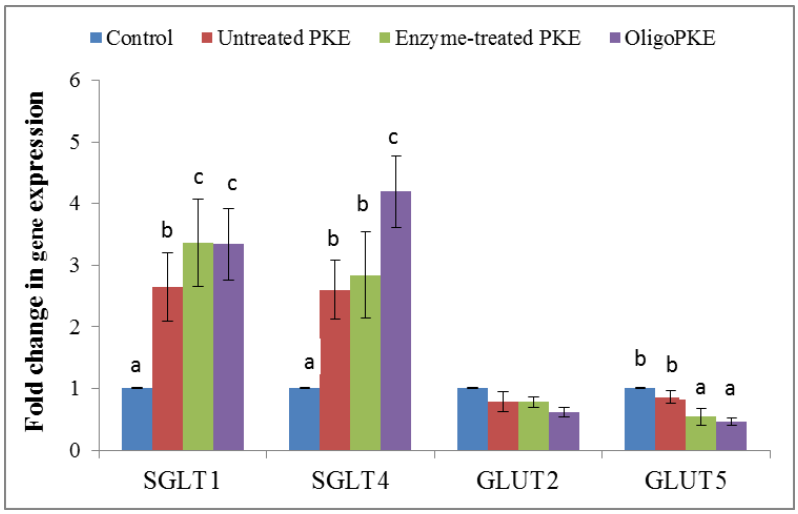


Figure 1. Effect of PKE based-diet on monosaccharides transportersgene expression of jejunum in14 days old broiler chicks.

Results indicated that expression of glucose and mannose transporters (SGLT4) was significantly increased ($p < 0.05$) in all of the PKE-based diets. While there were no changes in GLUT2 expression, GLUT5 expression were lower in chicks fed with enzyme treated PKE and OligoPKE. Even though only the relative changes in the mRNA levels were determined in the present study, it has been reported that majority of genes mRNA reflect protein abundance very well (3). The OligoPKE used in this study contained higher mannose leading to a marked increase in the expression of SGLT4 in the jejunum. Based on the expression of SGLT4, we speculate that high concentration of mannose may not be the limiting factor in mannose assimilation in the broilers.

Nevertheless, only a few transporters were evaluated in this study and much is needed to be learned on the effect of PKE-based diets on the expression of other nutrient transporters in the small intestine. However, the results of this study provide a framework to a better understanding of absorptive mechanism in chickens.

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EFFECT OF AGE ON EGG QUALITY PARAMETERS OF ISA BROWN LAYER STRAIN REARED UNDER CLOSED BATTERY CAGE HOUSING SYSTEM.

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Internal and external characteristics of egg changes significantly with age, while egg shell quality deteriorates, egg weight, yolk weight and albumen weight increase as the age increase in chickens. The use of Haugh units has been accepted as a measure of the quality of the albumen in various studies on egg quality (1). The Haugh unit value of fresh eggs and albumen height decreases with increasing age of the hen (2). The objective of this research was to evaluate the quality of eggs from Isa brown laying hens at different ages (35-week versus 85- week). The study was conducted in the Institute of Tropical Agriculture and Food Security, Animal Research Farm while the eggs were analysed at the chemical laboratory of the Department of Animal Science, Faculty of Agriculture, Universiti Putra Malaysia. The birds were raised in a closed battery cage housing system and fed with commercial feed according to the NRC (3) recommendations. A total of 960 eggs over collection period of 30 days were used from the two age groups of the laying hens (35-week versus 85- week) regarded as treatment with 8 replicates (n=60). All eggs were labelled according to the treatments and analysed individually using Egg Analyzer® (ORKA Technology, Wanchai, Hong Kong). The experiment was a CRD and data were statistically analyzed using GLM procedure of SAS version 9.2 software. Shell thickness, albumen height and Haugh unit differed significantly ($p<0.05$) among the two age groups of the laying hens. However, egg weight, shell weight and yolk colour were similar ($p>0.05$) among the treatment groups (Table 1).

Table 1: Mean values of egg quality parameters at different hen ages.

Parameter	Hen age (weeks)		SEM	P values
	35	85		
Egg weight (g)	64.88	68.25	1.19	0.167
Shell weight (g)	6.40	6.00	0.25	0.448
Shell thickness (mm)	0.33 [a]	0.26 [b]	0.01	0.0003
Albumen height (mm)	5.63 [a]	3.93 [b]	0.39	0.021
Yolk colour	4.50	4.33	0.45	0.864
Haugh unit	71.67 [a]	52.00 [b]	4.96	0.040

According to the findings of (4) egg size increases with increasing hen age. However, shell weight increases or stays the same. The shell thickness values reported in this study was low for 85-week hens and could be related to the age of the birds. Older birds tend to lay bigger eggs. Smaller eggs have stronger shells than larger ones (5). Albumen height in 35-week hens was higher than the value obtained in 85-week hens. This confirmed to the fact that albumen quality declines with increasing bird age (2). The colour of the yolk scores indicated very light (pale yellow) colouration. This could be attributed to the nature of management of the laying hens (6). The higher the value of the Haugh unit, the better the quality of eggs and in this study 35-week old had higher HU value. This is in agreement with the findings of (2).

In conclusion, the age of the birds can influence the egg quality.

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GROWTH PERFORMANCE AND MEAT QUALITY OF BROILER FED DIETS WITH DIFFERENT SOURCES OF OIL AND L-ARGININE

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Vegetable oils are usually included in broiler diets to increase the energy content as well as to increase the bird performance (1). Fat digestibility depends on dietary fatty acid profile and numerous studies reported that diet containing oil rich in unsaturated fats has higher metabolizable energy (ME) values due to better intestinal absorption compared to saturated fats which leads to better performance (2). Mixture of both saturated and unsaturated fats act synergistically in the absorption of fats (3). At present, interest has been shown on the manipulation of fatty acid composition in meat using polyunsaturated fatty acids (PUFAs) rich vegetable oils. Lower proportion of PUFAs compared to saturated fatty acid in meat has been considered to be a major concern of consumer's as higher intake such meat increased the incidence of diseases especially cardiovascular diseases (4). For this reason, numerous research works have been carried out to increase PUFAs in meat by supplementation of PUFAs rich oil in animal diets. Moreover, amino acid L-arginine (L-Arg) is important for chicken because there are unable to synthesis this amino acid due to lack of enzymes that are involved in urea cycle. Dietary L-arg stimulates protein synthesis, decrease fat mass in animals (5). Although some information are available on the effect of fat types and L-arginine individually on the performance, fatty acid profile and lipid oxidation, the information on combination of dietary fats source and L-Arg on performance and meat quality are limited. Thus, the study was conducted to evaluate the effect of different sources of oils and L-Arg on growth performance and meat quality of broiler chicken.

A total of 180, day-old (Cobb 500) chicks were purchased from a commercial hatchery Malaysia. The chicks were weighed, wing-banded individually and randomly allocated into five dietary treatments. The basal diet composed of corn and soybean meal with four levels of oil combinations: Palm oil (PO) and Sunflower oil (SO) of which were supplemented with (L-Arg).The dietary treatments groups were as follow: T1, 6% PO (control); T2, 6% PO + 0.25% L-Arg; T3, 4% PO + 2% SO + 0.25% L-Arg; T4, 2% PO + 4% SO + 0.25% L-Arg; and T5, 6% SO + 0.25% L-Arg. The starter and finisher diets were supplied to the birds from 0 to 21 days old and 22 to 42 days old, respectively. Feed and water were provided *ad-libitum* throughout the experimental period. At 42 days of age, six birds per treatment were slaughtered and breast muscles were collected for evaluation of meat quality. Meat quality (pH, drip loss, cook loss and shear force) were assessed according to the procedure described by Kareem et al. (6).

Dietary supplementation of L-Arg increased the body weight gain of broiler chicken (P=0.001). Higher body weight and lower FCR (P=0.003) were observed in broilers fed L-Arg and combination of PO and SO (T3&T4) and SO alone (T5). However, the broilers fed dietary treatments T3, T4 and T5 had similar body weight gain and FCR. The higher body weight gain observed in birds fed L-Arg and increased level of SO. This finding supported with those Emadi et al. (7) who reported L-Arg

supplementation enhanced body weight gain of broiler compared to those group fed control diet. Better feed efficiency was observed in broilers fed dietary treatments T3, T4 and T5. This might be due to the combination effect of L-Arg and increasing level of unsaturated sources of oils. This finding corroborates with Velasco et al. (8) who reported that broiler fed unsaturated fats had higher body weight gain and better feed efficiency compared to those fed saturated fat. Dietary treatments did not influence the meat quality parameters such as pH, drip loss, cooking loss and shear force value. From this study, it can be concluded that L-Arg supplementation with combination of PO and SO had positive effect on growth performance without any deleterious effect on meat quality.

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BIOMASS PRODUCTION OF *Spirulina sp.* STRAINS ON DIFFERENT MEDIA AS SUPPLEMENT FOR BROILER

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For centuries, the blue-green cyanobacteria *Spirulina* has been known as one of the most effective natural sources to be used as a dietary supplement for human health, synthetic colour in food and cosmetic, antibiotics and other chemicals including as a complementary dietary ingredient in animal feeding. Due to the unusually high amount of protein (55 to 70%), lipids, vitamins, minerals, carbohydrates, antioxidants, iron, phosphorus and pigments.

In this study, five different strains of *Spirulina* sp.; *Spirulina platensis TBSH1-5*, *Spirulina platensis TBSHX-1*, *Spirulina platensis M1*, *Spirulina maxima*, *Spirulina platensis* (seawater) was previously maintained in UTEX media and stored at 4ºC. The strains were cultured into three different media; Zarrouk's media, OFERR media and Revised medium 6 carried by Pandey et al (1). The culture pH was adjusted to 8.8-9.0 using 6 M NaOH (2) since Spirulina grows in high alkaline condition that favours good production of Spirulina. The culture will be provided with aeration to allow agitation and left under 24 hours of light in a tropical condition. Fluorescent lamp (18W) will be used as light source during the night to provide continuous light intensity.

After 30 days, the growths were evaluated based on the culture condition and dried biomass production of *Spirulina* sp. at different media were determined. The Spirulina were harvested, centrifuged at 4000rpm for 10 min, washed to remove any excess media, and dried in a freeze dryer for 24 hours before the weight was recorded. The temperature, humidity and irradiance Lux was recorded at three different times (9 a.m., 12 p.m. and 3 p.m.) during the day using environmental meter.

Based on observation, the appearance of the culture shifted from light green on the 1st day to dark green as indicator to the increasing in cell mass. All strains cultured in Zarrouk's media were more healthy (dark green colour) compared with that grown in other media, which start to lose their consistency through the 30 days. The dried biomass production obtained had higher strains *Spirulina platensis M1* grown in ZM, 0.917g (Table 1).

In this study, Zarrouk's media was the most favourable media for cultivation of Spirulina sp. However, based on the overall cultivation on three media, *Spirulina platensis* (seawater) showed a constant high dried biomass production on all three media. The addition of the Spirulina may be one of the potential natural supplements to improve the performance and growth of broiler.

Table 1. Dried biomass production of *Spirulina* sp. in different media.

Culture media	*Spirulina* sp. strains	Dry weight (g/L)
Zarrouk's media	*Spirulina platensis TBSH1-5*	0.878
	Spirulina platensis TBSHX-1	0.318
	Spirulina platensis M1	0.917
	Spirulina maxima	0.879
	Spirulina platensis (seawater)	0.777
OFERR media	*Spirulina platensis TBSH1-5*	0.120
	Spirulina platensis TBSHX-1	0.147
	Spirulina platensis M1	0.559
	Spirulina maxima	0.637
	Spirulina platensis (seawater)	0.954
Revised medium 6	*Spirulina platensis TBSH1-5*	0.456
	Spirulina platensis TBSHX-1	0.635
	Spirulina platensis M1	0.206
	Spirulina maxima	0.730
	Spirulina platensis (seawater)	0.752

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SEMEN CHARACTERISTICS, ANTLER STAGE AND SCROTAL CIRCUMFERENCE OF *RUSA TIMORENSIS* DURING BREEDING AND NON-BREEDING SEASONS

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The progress of assisted reproductive technology (ART) in deer has been dampen due to various factors but much to the lack of understanding in species-specific reproductive biology (1). There is still a dearth of literature in the reproductive topic of male *Rusa timorensis* especially in breeding seasonality. However there had been studies in the reproductive biology of *R. timorensis* in Malaysia recently (2, 3). Following to that, further classification in characteristics in male *R. timorensis* between non-breeding (NBS) and breeding seasons (BS) were investigated. The objective of this study was to observe semen characteristics, antler stage and scrotal circumference of *R. timorensis* between NBS and BS.

Seven apparently healthy adult *R. timorensis* stags were selected for this experiment. The experiment was carried out in Unit Ruminan Kecil, Taman Pertanian Universiti, Universiti Putra Malaysia. The stags were observed, semen samples together with antler stage and scrotal circumference were recorded between August 2016 and March 2017 during NBS and BS. Sample collections were made up of 19 collections in each NBS and BS respectively.

The semen volume, general motility, semen concentration, semen collection success, antler stage and scrotal circumference during the breeding season were 0.72 ± 0.25 ml, 56.1 ± 7.05 %, 1601.37 ± 429.45 x 10^6/ml, 89%, 2.7 ± 0.11 and 19.2 ± 0.46 cm respectively. The results were tabulated in Table 1.

Table 1. The semen characteristics, antler stage and scrotal circumference of *R. timorensis* during breeding and non-breeding season expressed in (mean ± SEM).

Parameters	Season	
	Non-Breeding Season	Breeding Season
Semen volume (ml)	0.65 ± 0.26^a	0.72 ± 0.25^a
General motility (%)	16.50 ± 5.22^a	56.1 ± 7.05^b
Semen concentration (x10^6/ml)	1785.99 ± 1226.758^a	1601.37 ± 429.45^a
Semen collection success (%)	47	89
Antler stage*	1.75 ± 0.12^a	2.7 ± 0.11^b
Scrotal circumference (cm)	15.54 ± 0.31^a	19.2 ± 0.46^b

[ab] Mean value with different superscript between columns indicate significance difference ($p<0.05$) between NBS and BS.*Antler stage was scored between 1-cast, 2-velvet and 3-harden antler.

General motility, antler stage and scrotal circumference were significantly different ($p<0.05$) between seasons while there is no significant difference for the rest of the parameter. Breeding seasonality of *R. timorensis* can be determined by various practical reproductive parameters. The results from this study will be useful in applied farm settings to determine the breeding season of *R. timorensis*. Breeding season of *R. timorensis* was between December and March during the year of 2016 and 2017. The knowledge in identifying breeding seasonality in *R. timorensis* will contribute to the development of ART in the future.

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EDIBLE BIRD'S NEST (EBN) SUPPLEMENT IN RATS MODULATES UTERINE FUNCTION AND EMBRYO IMPLANTATION

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Edible bird's nest (EBN) has been an important item in Chinese cuisine and pharmacy, consumed as a delicious tonic food known as "bird's nest soup", which is regarded as a luxury food item (1). This study was conducted to determine the effect of EBN supplement on uterine function and embryo-implantation rate. A total 24 female adult rats, divided into four equal groups (labelled as G1, G2, G3, G4), were treated with different dosages of EBN (0, 30, 60 and 120mg/kg of body weight) respectively for 8 weeks. In the last week of treatment, intact fertile male rats were introduced into each group (three per group) with pro-estrous stage overnight for mating. On day 6 and 7 post-mating (expected days of implantation; peri- and post-implantation), animals were sacrificed for assessment of implantation rate, tissue sampling for histological and electron-microscopic examination of the uterus. Results showed that as the concentration of EBN supplemented increased, pregnancy and embryonic implantation rates also increased in the treated groups, significantly observed in G3 and G4. Although histological section did not show much difference among the groups, scanning electron microscopic examination showed enhanced development of elongated microvilli and pinopods in G4 with the highest EBN supplement.

EBN is known to possess hormones and high amount of sialic acids (2) that plays a critical role in both follicular development and reserve. These components of EBN as well as its great nutritional value may have contributed to the observed increase in pregnancy rates. On the other hand, enhanced development of pinopodes and change in microvilli of uterine epithelium to long projections in the treated groups may have contributed to the increased embryonic implantation rate. A previous study on testing endometrial receptivity *via* scanning electron microscopy of endometrial samples revealed that pinopodes are very good marker of endometrial receptivity in rats (3). The closure of the lumen promoted by elongation of microvilli and abundant pinopods assisted the contact of the embryo with the epithelium and positioning of pinopodes, which has better adhesion competence to the embryo than the microvilli, thereby promoting embryo implantation (4, 5, 6). Antioxidant property of EBN confirmed in the present study could have also contributed in enhancing fertility as oxidative stress is known to hamper reproduction through poor fertilization rate, impaired embryo development and higher rates of pregnancy loss (7). In conclusion, the present findings provided evidence to the potential role of EBN in enhancing fertility in rats that might be extrapolated to the traditional claims for its reproductive role which is one of the reasons of consumption among humans.

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SCIENTIFIC PAPERS

Poster Presentation

LEVEL OF THE TECHNOLOGY USAGE IN SMALL-RUMINANT FARM MANAGEMENT IN MALAYSIA

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During the 10th Malaysia Plan (10MP), agricultural sector achieved a better performance in production, value added and self-sufficiency level (SSL) (1). Though, the SSL of mutton was quite low, it recorded a positive increment from 12.2% (in 2010) to 17.3% (in 2015) (1). The increase in SSL was mainly contributed by increasing the productivity with the use of quality breeds, wider adoption of technologies among farmers, establishment of new large-scale food production areas and improved extension services. Generally, agricultural sector still relies on unskilled and semi-skilled workers who perform daily production tasks that are not dependent on their technical abilities nor technological skills. As technology plays an important role in empowering the country's livestock industry, the modernization of the agricultural sector was one of the key thrusts in the 11th Malaysia Plan (2). Therefore, this study aims to identify the level of technology utilization among small-ruminant's breeders and agropreneurs (small-ruminant's farmers) in Malaysia.

To identify the level of technology use, primary data were collected at the farm level from 443 small-ruminant farmers' using stratified sampling method. Personal interviews and farm visits were conducted using structured questionnaires to gather information on their profiles, application of farm inputs, farm management and utilization of technology. The Fuzzy Logic Model was applied to benchmark the technology status in small-ruminant production and provide the appropriate conclusions regarding the assessment of the level of technology utilization among small-ruminant farmers in Malaysia. Seven parameters were selected to develop benchmarking parameters such as accreditation, housing and infrastructure, rearing and breeding practices, animal feed, health management, pest and pollution control and farm waste management. Each parameter was evaluated based on the quality traits which were classified as low (≤ 0.29), moderate (0.3 - 0.49) and best (≥ 0.5). The overall result showed that 2% of small ruminant farms were categorized as best, 26% were moderate while others, 72% at a low level of technology practices. This means that most farmers are still using the traditional way of practicing their livestock.

Technology such as health management technology, animal feed, farm waste, rearing and breeding practices as well as accreditation approaches were likely to achieve the best technology (maximum) as its value are approaching the scale of 1.0. However, the numbers of farmers who practice it are very small. Others such as the use of housing and infrastructure technology, also pest and pollution control technology was still low because most of the farmers use only the basic technology. For example, farmers were still using regular cages without stack of cages for their livestock. In fact, many farmers do not implement the pollution control programs for flies and smells. The lowest score for these parameters indicated that those technology practices were at the minimum level. The technology came with financial consequences. Due to that, it was hard for small and medium scale small-ruminant farmers to fully practice the technology. As a conclusion, most of our farmers still need to improve the use of technology as to increase their productivity.

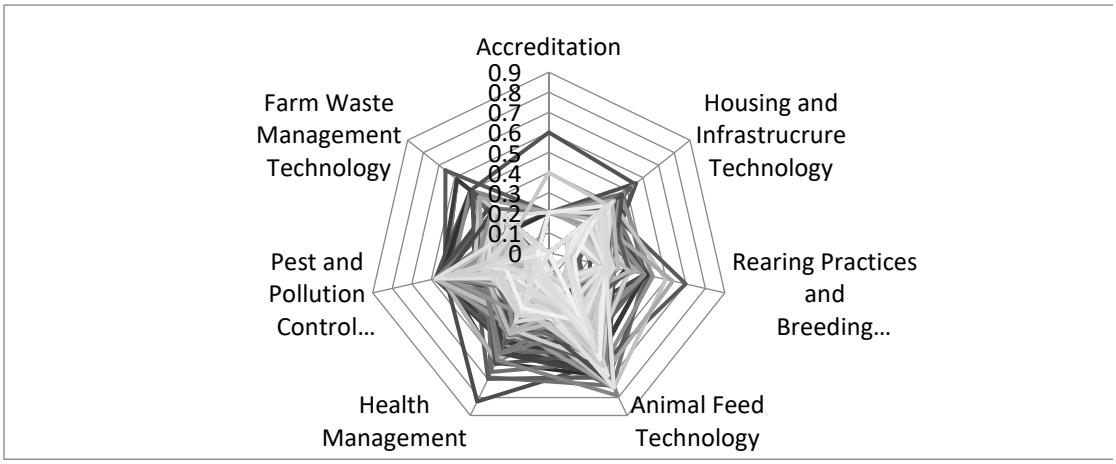


Figure 1. Small-ruminant technology practices based on Fuzzy Logic Model analysis

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SCREENING FOR MICROBIOLOGICAL SAFETY AND QUALITY OF GOAT MILK FROM JOHOR

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In Malaysia, fresh milk for human consumption must be pasteurised as the raw milk may contain pathogenic or spoilage microorganisms that may harm the consumer. In 2015, a large outbreak of human brucellosis occurred in Penang, Malaysia involving 79 patients who had consumed milk originating from the one farm. The owner of the farm was also diagnosed with the disease in which he claimed to have consumed unpasteurised goat's milk that he had also sold to the public (1). As not much data on the microbiological safety and quality of fresh goat milk in local market was available, a study with the objectives to screen for Brucella and *Coxiella burnetti* (zoonotic pathogens) as well as other microbiological quality of fresh goat milk, produced and sold by local farmers in Johor was carried out. Results from the study could be used to check the safety and pasteurisation status of the fresh goat milk sold for public consumption, as well as for the local governing agency to evaluate the appropriate food safety measures need to be implemented.

Thirty-two fresh goat milk sold in the market were purchased from 16 different locations around Johor in end 2016 (duplicate samples). From the total of 16 sampled localities, six samples were not labelled while the remaining 10 had printed labels and brand name on the milk bottles. Five of the brands indicated that the milk had been pasteurised, six were unpasteurised and another five were classified as unknown. Another 17 fresh raw goat milk from local farmers were also collected through the milk collection centres (MCC) in the state. All samples were analysed for total plate count (TPC), coliforms and *Escherichia coli* (2, 3). Direct isolation of *Brucella melitensis* and *Brucella abortus* was conducted according to the methods described by OIE (The World Organisation for Animal Health), whereas analysis of *Coxiella bur*netti was carried out by enzyme-linked immunosorbent assay (ELISA) method and staining procedure for positive samples were as described by the OIE.

The mean counts per ml for TPC were 4.90×10^5, 6.50×10^5, 1.60×10^5 and 1.48×10^6 for pasteurised, unpasteurised and unknown milk sold in the market as well as the raw milk from MCC, respectively. The mean counts per ml for *E. coli* were $<1.00 \times 10^2$ for pasteurised and unknown milk whereas 1.67×10^1 for not pasteurised and 1.18×10^2 for raw milk. The mean counts per ml for coliform were 9.53×10^3, 9.76×10^3, 1.20×10^2 and 1.16×10^4 for pasteurised, unpasteurised, unknown milk and raw milk, respectively. Overall, there was no significant difference in the microbiological counts for these bacteria in both the pasteurised and unpasteurised milk. Despite fresh milk were pasteurised, temperature abuse during storing and selling could be the reason for the high bacterial count. Another possible reason is that the pasteurisation had not been carried out properly. All milk in the current study were negative for *Brucella melitensis* and *Brucella abortus*, but one unpasteurised sample and two raw milk from MCC were positive for *Coxiella burnetti* through the ELISA test. These three positive samples were further analysed through staining and the unpasteurised sample showed the presence of the *Coxiella burnetti*, a bacteria that causes Q-fever disease in both animals and humans.

Human with Q-fever may develop pneumonia, hepatitis, risk for miscarriage during pregnancy and even can be fatal (4). The sale of unpasteurised fresh goat milk for consumption in the local market could risk the consumers to the harmful disease, especially when the unpasteurised goat milk is given to infants for treatment of jaundice.

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COMPARISON ON PERFORMANCE OF JAMNAPARI GOAT FED WITH GUINEA GRASS (*Megathrysus maximus*) AND NAPIER GRASS (*Pennisetum purpureum*)

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In Malaysia, Guinea (*Megathrysus maximus*) grasses and Napier (*Pennisetum perpureum*) are considered as good palatable fodder for goat along with other grasses (humidicola grass, centrosema, and glyricidia). Guinea grass and napier grass have been used widely as fodder grasses (4). Guinea grass is an ideal forage plant as it grows well on in wide variety of soils and even under light shade of trees and bushes and can survive long dry spells and quick-moving fires which does not harm the underground roots. Guinea grass yields an average of 30t DM/ha/year (1) but depend on the cultivar and fertilizer application. While napier grass is a native grasses species in the tropical grasslands of Africa (2), and spread rapidly in many parts of the world. As for Napier grass, it has been promising and known as a high yield grass, giving dry matter yield that surpasses most other tropical grasses, like guinea grass (*Megathrysus maximus*) and Rhodes grass (*Chloris gayana*) (3). The aim of this study was evaluated a potential grasses for goat to get an optimum growth performance.

Fourteen (14) males Jamnapari goats average five months of age were used in this experiment. All animals were individually weighed and divided equally (7 goats) into 2 treatment groups for the entire duration of the trial (120 days). Group 1 were fed with cut and carry guinea grass while group 2 were fed cut and carry napier grass. Both groups were given the same quality and quantity of PKC and molasses. Fodder was offered *ad libitum* while water and mineral licks were freely available. The goats were weighed at twice a month interval, before feeding. Feed intake was recorded daily and feed consumption was determined weekly to meet the daily requirement. The data was analyzed using the Statistical Analysis System (SAS). Statistical significance of differences between group means was tested by one-way ANOVA followed by Duncan post-hoc test. A 'p' value of less than 0.05 ($p<0.05$) are considered statistically significant.

Performances of Jamnapari goat fed with guinea grass (Group 1) and napier grass (Group 2) are shown in Table 1. The results showed that there was no difference in the AIW, AFW, AWG and ADG among the two dietary treatments group. However, DMI and FCR showed a significant different. The goat fed with Guinea grass resulted in higher ADMI and FCR. These results were supported by Duncan post-hoc test for mean comparison. As for economic evaluation which calculated based on the current animal feed prices (Table 2), showed that the costs for giving napier grass as an animal feed was slightly cheaper 4.72% than guinea grass with the cost of RM2.97/goat/day against RM3.10/goat/day. Group 1 was given 41.88kg Guinea grass and Group 2 was given 43.56kg Napier grass. Group 1 and 2 were given 4.8kg PKC and 4.8 kg molasses respectively.

In conclusion, feeding goats with napier grass showed a significant improvement of the growth performance of goats which produce optimum weight with low DMI and FCR than those fed with guinea grass. Moreover, napier grass also provided the farmers with an alternative low cost animal feed for their daily operational ranch. Therefore,

napier grass alone could suffice as a low cost good performance animal feed for goat which later aid the farmers to gain optimum productivity and high income.

Table 1: The growth performance of Jamnapari goats fed with Guinea grass and Napier grass.

Parameter	Group 1 (Fed Guinea Grass)	Group 2 (Fed Napier Grass)
Avg. Initial Weight (kg)	20.42[a]	20.25[a]
Avg. Final Weight (kg)	35.92[a]	34.67[a]
Avg. Weight Gain (kg)	15.50[a]	14.42[ab]
Avg. Daily Gain (kg/day)	0.130[a]	0.121[ab]
Avg. Dry Matter Intake (kg/day)	0.97[a]	0.80[b]
Feed Conversion Ratio (FCR)	7.46[a]	6.61[b]

Note: Means with same superscript letter in same row are not significantly different ($p>0.05$)

Table 2: Feed cost of Guinea grass and Napier grass

Group Treatment	Types of Feed	Feed Cost (RM/kg)	Total Feed Cost (RM)	Feed Cost (RM)/goat /day
Group 1	Guinea Grass	0.23	9.63	3.10
	PKC	0.94	4.51	
	Molasses	1.58	7.58	
Group 2	Napier Grass	0.20	8.71	2.97
	PKC	0.94	4.51	
	Molasses	1.58	7.58	

Notes: PKC: Palm Kernel Cake

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PRE-AND POST-WEANING GROWTH PERFORMANCE OF KATJANG X BOER GOATS

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The Malaysian goat population in 2014 was 429,398 heads and slightly increased to 439,227 heads in 2015 (1) but it is still low compared to other livestock populations in the country. In 2015, the self-sufficiency rate for meat products from small ruminants was only 13.58% (2). The government intends to achieve 35% self-sufficiency rate by 2020. One of the initiatives is through the importation of new breeds to increase the goat population. Boer goats have been imported to Malaysia since 2000 and MARDI was the first government organization to embark in research on Boer goats under Malaysian environment (3). The imported Boer goats from Australia and South Africa are usually reared for meat production. Unfortunately, many imported goat breeds have had a problem expressing their best reproductive characteristics and growth in Malaysian. Many goat farmers experienced high mortality rates and poor growth performance. The local goat which is known as Katjang, Kachang, Kambing Kampung or Kambing Licin can be found in small populations mainly in Negeri Sembilan, Pahang, Kedah and Kelantan (4). Katjang goats are small in size but are known for their prolificacy and hardiness (5, 6). As the native breed, Katjang goats possessed the natural characteristics of heat tolerance under the local environment (4). There is very limited emphasis given to improve the productivity of Katjang goat breed because of lower body weight at maturity. There is therefore justification to investigate alternative means of increasing productivity to complement useful traits already present in this breed using crossbreeding. The crossbreeding of native breeds with exotic breeds was to fully utilize the indigenous breed for increased economic gains and local meat production. The objective of the present study was to evaluate the pre-weaning and post-weaning growth performances of F1 Katjang x Boer goats under the semi-intensive system. The data were collected from a breeding programme at the Small Ruminant Unit, MARDI Kluang. The goats were allowed to graze on purple guinea grass (*Panicum maximum*) for five to six hours/day. Supplementary concentrate feeds were provided in the sheds at a rate of 300g/head/day. The goats were weighed at birth, 3 months, 6 months and 12 months of age. The data were analysed using Generalized Linear Model (GLM) Program in the SAS Package (2004).

The mean pre-weaning and post-weaning trait of the kids are presented in Table 1. The mean birth weights of male and female kids were 2.75 kg and 2.34 kg, respectively. This study indicated that males were 0.41 kg or 14.9% heavier than the female kids. However, there were no significant differences in weaning weight at 3 months between male and female kids (15.16 kg vs. 13.17 kg). The pre-weaning daily gain of male kids was significantly higher ($P<0.05$) compared to female kids. The average pre-weaning average daily gain (ADG) of male and female kids was 138.5 and 120.6 g, respectively. There were significant differences in post-weaning weights (6 and 12 months) between male and female goats (22.2 vs. 19.47 kg and 34.3 vs. 27.1 kg, respectively) and also post-weaning ADG (69.52 vs. 75.61 g). There is an urgent need for further research on

breeding of Katjang x Boer goats to establish it as the future superior goat breed for Malaysian.

Table 1. Means (± SD) for pre- and post-weaning growth performance of Katjang X Boer goats

Trait	Sex	Growth performance
Birth weight (kg)	Female (n=50)	2.34±0.52 [a]
	Male (n=50)	2.75±0.99 [a]
Weaning weight, kg (3 months)	Female (n=45)	13.17±2.94 [a]
	Male (n=45)	15.16±2.35 [a]
Pre-weaning ADG (g)	Female	120.6±0.33 [a]
	Male	138.5±0.30[b]
Post-weaning weight, kg (6 months)	Female (n=33)	19.47±3.56[a]
	Male (n=25)	22.20±3.72[b]
Post-weaning ADG (g)	Female	75.61±0.48[b]
	Male	69.52±0.26 [a]
12 months weight (kg)	Female (n=28)	27.1±3.00[a]
	Male (n=20)	34.3±2.11[b]

[a,b] Means with different superscripts for a particular trait differ significantly ($p<0.05$)

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COMPARISON OF GROWTH CURVE PARAMETERS OF BRAKMAS AND BALI COWS

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Growth plays a significant role to ensure the sustainability of a beef cattle operation alongside reproductive efficiency; thus it is an important criterion to emphasize in animal selection. Growth is defined as the incremental change in size and cell number and the accumulation of extracellular substances (1). It is important to understand the animals' growth in order to decide the optimum age and body weight to breed and slaughter. Furthermore, strategic feeding management can then be implemented to achieve the desired body weight at minimal cost. However, the study of growth often takes a long period; therefore, non-linear algebraic models are used widely in order to describe the growth events of the animals. Non-linear algebraic models are an effective method of describing individual growth patterns in a small number of biologically interpretable parameters. Sigmoidal growth curve is often characterized by an increasing slope, named the self-accelerating phase, and a segment of decreasing slopes of the self-inhibiting phase (2). The meeting point between these two phases is known as the point of inflection where the peak accelerated growth tends to decline towards a growth plateau. The objective of this study was to compare growth parameters of Brakmas and Bali cattle for body weight by using the non-linear regression model. Data of body weight collected from 74 and 279 heads of Bali and Brakmas cows, respectively, were fitted to the Gompertz model to estimate the growth curve parameters, namely mature weight (A), constant of integration (b), and rate of maturing (k). Data was analyzed by using PROC NLIN (SAS v9.3) and unpaired sample t-test procedure.

The analysis showed that the Gompertz model accounted for 97.2% of the data for both breeds; therefore it was a suitable model to describe the growth pattern for both breeds. It estimated the mature weight of Bali and Brakmas cows at 277.6±5.54 kg and 339.3±6.075 kg, respectively. The result also showed that Brakmas cattle body weight was significantly higher at maturity ($p<0.05$). Rate of maturing of Brakmas and Bali cows were 0.056±0.007 and 0.06±0.004, respectively. The maturing rate of Brakmas cattle was significantly lower than Bali cattle ($p<0.05$); therefore, it will attain its mature weight later but will be heavier than the Bali cattle. Later maturing-heavier mature weight relationship is explained by negative correlation between mature weight and rate of maturing (3), where the correlation magnitudes for Brakmas and Bali cattle were -0.704 and -0.61, respectively. In conclusion, Brakmas cattle showed significantly higher mature weight and were slower growing animals compared to Bali cattle. Both breeds showed an estimated mature age of approximately 8-9 years, and one of the traits that will be affected by late mature age is age at first breeding. Study on feeding manipulation is one of the aspects that may improve the maturity rate so that the animals can be used as breeding stock earlier.

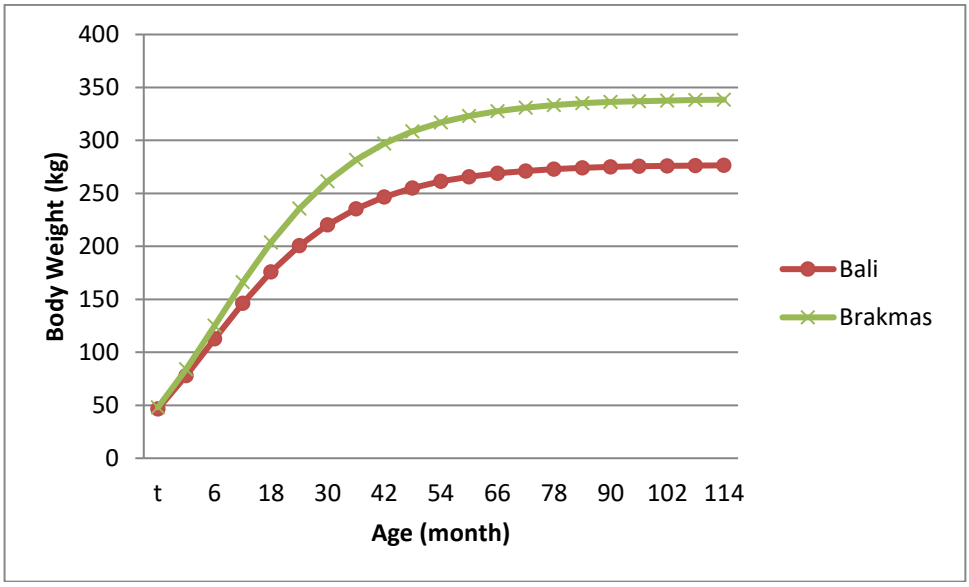


Figure 1. Comparison of Growth Patterns for Bali and Brakmas Cows Estimated by Gompertz Model

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EFFECT OF BREED, LACTATION STAGE AND BODY CONDITION SCORE ON MILK COMPOSITION

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Dairy products are very important providing energy, high-quality protein, minerals and vitamins to human. The demand for dairy products has increased and expected to rise continuously with the increase in population and per capital. Milk production has increased in Malaysia as well as the demand for milk increased but the production is not sufficient, therefore imported milk contributed to reducing the gap between the production level and local demand (1). The quality and nutritive values of milk is determined by milk composition, which varies according to the genetic, lactation stage, feeding, health status of the cows (2,3). This study was conducted to evaluate the milk composition of two breed of dairy cows at different lactation stages and body condition score.

Eighty dairy cows consist of Jersey (n=16) and Friesian (n=64) breeds were used in this study. Lactation stages and body condition score (BCS) of selected cows were determined and divided according to day in milk (DIM); 0 to70 DIM (early lactation), 70 to140 DIM (mid), 140 to 300 DIM (late) and more than 300 DIM (over) and according to BCS (4). All cows in the farm were fed on total mixed ration (TMR). Morning milk sample (50ml) from individual cow was collected and analysed form milk composition at MARDI using an infrared spectrophotometer (Milko-Scan FT1, Foss Electric, Denmark).

Table 1: Effect of breed, lactation stage and body condition score on milk composition

Parameters	n	Fat	Protein	Lactose	casein	MUN
Breed						
Jersey	16	3.61[a]	3.96[a]	4.01[a]	3.01[a]	5.53[a]
Friesian	64	2.98[a]	4.00[a]	4.15[a]	3.03[a]	5.78[a]
Stage of Lactation						
Early	13	3.64[a]	3.97[a]	3.93[a]	2.98[a]	4.72[a]
Mid	31	2.97[a]	3. 93[a]	4.14[a]	3.00[a]	5.17[a]
Late	19	2.97[a]	4.07[a]	4.17[a]	3.07[a]	6.16[a]
Over	17	3.22[a]	4.02[a]	4.17[a]	3.08[a]	6.88[a]
Body condition score						
2.25-2.5	22	13.34[a]	3.232[a]	3.95[a]	4.16[a]	2.99[a]
2.75-3	40	14.01[a]	3.317[a]	3.95[a]	4.18[a]	2.99[a]
3.25-3	14	11.53[a]	2.644[a]	4.14[a]	4.08[a]	3.20[a]
3.75	4	13.30[a]	3.143[a]	4.12[a]	3.15[a]	3.03[a]

[ab] Different superscripts in the same column indicate significant difference at $p<0.05$.

Results indicate that there was no significant breed effect ($p>0.05$) on milk composition in this farm. The stage of lactation stage also did not significantly affect ($p>0.05$) the milk composition, this could probably due to the method of sampling, where all the milk samples from individual cows were collected directly from the teat from each quarter, and not from a pooled samples after milking of individual cow. No significant effect of body condition score was observed on milk composition, this may be due to the the unbalance metabolism process and also milk yield (5, 6, 7).

In conclusion, the breed, stage of lactation and body condition score did not altered the milk composition in this dairy cattle farm.

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PRELIMINARY STUDY ON NUTRIENT CONTENT OF LOCAL GRASS IN INTEGRATED FARMING IN JOHOR

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Integrating livestock in rubber or oil palm plantations has optimized the productivity of each land unit used in Malaysia. Malaysia has vast fields such as oil palm plantations, rubber and coconut. Under the trees and inter-row spaces promote the growth of at least 60 species of grass which is commonly considered as weeds (1). These are potential forages can be a good source of feed or fiber for ruminant. However, lack of study was conducted to determine the nutritive values of local forages that grew under oil palm trees. The objective of this study is to document the nutrient contents of some of the local grasses found in the integrated farm.

The study was conducted at cattle-oil palm integrated farming in Paloh, Johor. This farm was started from year 2006 with 150 hectares and can accommodate five herds (60 to 70 heads / herd). Brahman and Kedah Kelantan breeds of cattle were placed under oil palm plantation for three days and transferred to the other oil palm plantations to prevent over grazing. Four grass samples and a water sample were collected from this farm. The samples were analysed for the dry matter (DM), crude ash (Ash), crude protein (CP), ether extracts (EE), crude fiber (CF) and nitrogen free extract (NFE) at Feed Analysis Laboratory, Institute Veterinary Malaysia. The CP content (*N x 6.25*) was determined by the Kjeldahl method, CF was measured using Fibertec methods (FOSS) and EE was measured using Soxtec methods (FOSS). Other parameters were determined according to AOAC (2) and TDN was calculated using Menke equation. Water sample was tested with pH meter to get a pH reading.

The results (Table 1) showed that TDN value for mix grass (containing three types of grasses, buffalo grass, asystasia grass and carpet grass**)** is 64.8%; TDN value for carpet and buffalo grass approximately 63% and asystasia grass has 45.4% TDN value. Metabolism Energy value for both carpet grass and buffalo grass is approximately 9MJ/Kg and asystasia 6.5MJ/Kg. However, mix grass has 9.78MJ/Kg ME value. Asystasia grass contains 30.7% CP, while two other grasses contain approximately 13%. A mix grass contains 17.6 % CP. These values are higher than a mature cow's CP requirement which is 7% (3). The herd is drinking river water with pH 7.07; according to Curran (4) drinking water should be in the range 6.5 to 8.5. If the pH is highly acidic which is less than 5.5 can cause acidosis and reduced feed intake may occur. However, if highly alkaline water which is over 9 may cause digestive upsets and diarrhea, lower feed conversion efficiency and reduce intake of water and feed. Undergrowth grazing was the only source of feed for cattle in this integrated farm; no concentrate feed or other grasses are planted to give to livestock. The purchase of livestock feeds requires a high cost, in this way the owner can save on farm production costs. The nutrient contents also show that these three local grasses can fulfill the livestock nutritional requirement if availability is abundance. Further studies should be conducted to obtain the amount of grass produced by the farm to ensure sufficient or not to be eaten by livestock. Analysis of nutrient contents on other grasses found in the integration farm should also be carried out.

Table 1. Nutritional content of grasses found and eaten by the cattle in Paloh integrated farm.

Parameter (%)	Grass samples			
	Paspalum conjugatum/ Buffalo grass	*Asystasia gangetica*/ Asystasia grass	*Axonopus compressus*/ Carpet grass	Mix grasses
Dry matter	29.7	11.2	31.6	20.3
Crude Protein	13.4	30.7	13.0	17.6
Ether Extracts	1.2	3.3	2.0	2.2
Crude Fiber	25.9	19.8	27.4	25.9
Total Ash	8.8	17.6	7.5	8.6
Nitrogen Free Extract	50.8	28.7	50.1	45.6
Total Digestible Nutrient	62.7	45.4	63.2	64.8
Metabolism Energy (MJ/Kg)	9.42	6.59	9.52	9.78

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THE EFFECTS OF ADDING POME (PALM OIL MILL EFFLUENT) IN THE SOIL ON YIELD AND NUTRITIVE VALUES OF NAPIER GRASS (*Pennisetum purpureum cv. Taiwan*)

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Agricultural residues contribute to the largest amount of biomass resources in Malaysia and one of the major contributors is the palm oil industry. The residues of the palm oil industry include palm oil mill effluent (POME), empty fruit bunch, palm kernel shells and mesocarp fibres. The accumulation of oil palm biomass from palm oil industry, which is approximately 40 million tonnes per year, has been constantly growing with increasing global demand for crude palm oil. The amount of wastewater sludge or better known as POME sludge generated during the production of crude palm oil is abundant and available for use in agricultural. In general, utilization of sludge in agriculture is considered as one of the best waste management options as it improves the soil's aggregate stability, porosity and water infiltration rate, and supplies organic matter and major nutrients, such as N and P to the soil (1). POME contains substantial amounts of N, P, K, Mg and Ca, which are the vital nutrient elements for plant growth. Due to the non-toxic nature and fertilizing properties, POME can be used as fertilizer or animal feed substitute in terms of providing sufficient mineral requirements (2). Studies have been carried out to utilize POME sludge for plant growing and as amendment for agricultural soils due to its high content of nutrients and organic matter. Another study has indicated that the application of fermented POME to soil increased the growth and yield of maize (*Zea mays*. L) (3). Hence, the objectives of this study were to enhance the yield of Taiwan Napier grass and to improve the quality of Napier grass especially for crude protein and metabolized energy values by using POME in the soil. Six forage plots (three forage plots on POME treatment and three forage plots on control treatment) were established. All forage plots were 8m by 3m and were separated by a 1.0 m alley. The planting materials of Taiwan Napier Grass were planted in rows with spacing 0.6 m x 0.6 m. Ground magnesium limestone was used at the rate of 2.5 tonnes/hectare to assure proper soil pH and adequate magnesium level. A soil pH of 6.0 is adequate for Napier production. The standard rate of basal fertilizer used were 60 kg of N, 30 kg of P and 30 kg of K /hectare. Applications of 5 metric tonnes POME (55-60% DM)/hectare were used as treatment for the three forage plots. The POME is collected from Coronation Palm Oil Mill, Kluang, Johor. The grasses were cut close to the ground level to get a uniform stand on day 70 after planting and then the cutting treatments at the interval of 60 days were carried out three times. After each harvest, the rates of maintenance fertilizer used were 150 kg of N, 60 kg of P and 100 kg of K /hectare. The Napier plants were cut about 10 cm from the ground and cut plants were weight. Random samples of Napier, representative of each plot were sent for proximate analysis (CP: crude protein, ME: metabolized energy, DM: dry matter and CF: crude fibre). The data were analyzed using Statistical Analysis System (SAS) followed by t-Test post-hoc test. AP value of less than 0.05 ($p<0.05$) are considered statistically significant. Results of fresh, DM yield and nutritive values of Napier grass by POME treatment are presented in Table 1. The result for fresh yield of Napier grass treated with POME indicates that there is significantly higher ($p<0.05$) yield than control (52.94 tonnes /ha/harvest). As for nutritive value, the CP (14.92 and 12.82%) and ME (8.94 and 8.51 MJ/kg) were

significant differences ($p<0.05$) for Napier grass treated with POME and control, respectively. However, no significant difference ($p>0.05$) was observed in DM and CF for both treatments, it is proven that application of POME can produces higher yields (4).

Table 1. Fresh, Dry Matter Yield and Nutritive values of Napier grass by POME treatment.

Parameters	Control	POME
Fresh Yield Production (tonnes/ha/harvest)	52.94[b]	66.16[a]
DM Yield Production (tonnes/ha/harvest)	7.73[b]	9.59[a]
Nutritive values		
Dry Matter (%)	14.60[a]	14.49[a]
Crude Protein (%)	12.82[b]	14.92[a]
Crude Fibre (%)	33.88[a]	33.94[a]
Energy/ME (MJ/kg)	8.51[b]	8.94[a]

Note: Means with same superscript letter in same row are not significantly different ($p>0.05$)

As a conclusion, application of POME in Napier cultivation increased the yield (reach up to 57.6 tonnes dry matter/ ha/year) and gave a better nutritive values in livestock feeding. This study proved that the use of POME can improve soil productivity and significantly increased the yield of Napier grass.

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AGRONOMIC PROPERTIES AND YIELD OF FIVE VARIETIES OF NAPIER GRASS

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Napier grass (*Pennisetum purpureum*) is a productive persistence and high quality forages grass widely grown in tropics and subtropics. Over the last two decades several Napier grass varieties have been introduced, and their nutritive quality parameters were differences among the varieties. Therefore this study was to generate new information on the agronomic properties and nutritional quality of the five varieties of Napier grass and identify superior cultivars based on those criteria.

The study was conducted at Field 2, Faculty of Agriculture, Universiti Putra Malaysia, Serdang, Selangor. The treatments consisted of five treatments of Napier grass varieties. Common Napier, Dwarf Napier, India Napier, Red Napier, Zanzibar Napier, in a Randomized Complete Block Design with three replicate. Fifteen plots of Napier grass in field area to evaluate the agronomic properties. The establishment of the plot was done with initial ploughing by heavy disc plough at the depth of 10-15 cm, followed by harrow and rotavation to break up the trash and incorporate in the soil. A period of 8 to 10 weeks was allowed from initial ploughing to planting to ensure good seedbed preparation. The plots were 4 x 3 meters each and separated by 1 meter alley with the planting distance in the plots was 0.5 m x 0.75 m using stem cutting with two nodes for each points. The total of 30 planting point in each plots. Plant height refer to the longest distance between the plant base and the tip of the highest leaf, measured with measuring tape. Tiller number refer to the all shoots that growth after first parent shoot grow from seeds or stem. The three tiller was randomly selected from each plot of experimental and the leaf number was recorded on weekly basis.

Dwarf Napier shows the shorter plant height compared to other varieties for all three harvest of grass (Figure 1) and the different varieties shows different respond on vegetative growth (1). Leaf to stem ratio is associated with high nutritive value of the forage because leaf is generally of higher nutritive value (2). There was significance difference ($p<0.05$) in leaf to stem ratio between all varieties of Napier grass. Throughout three harvests, DN showed higher leaf to stem ratio with an average (2.22 ± 0.06). Zanzibar Napier, India Napier, Red Napier and Common Napier were no significant different ($p>0.05$) in leaf to stem ratio. The highest leaf to stem ratio is obtained from the short varieties (2), and other workers found that the highest leaf-stem ratio (LSR) was from the shortest varieties of Napier, with shorter Napier varieties (height of 78 cm) recorded LSR as high as 8.7 (3). The number of tillers per plant, number of leaves per tiller and per plant, leaf length per plant and basal circumference per plant of Napier grass increased as the defoliation frequency decreased (4). The study showed that Dwarf Napier had highest tiller number with an average of three harvest (47.44 ± 1.06). While the other varieties were slightly difference in number of tiller. The taller tillers also associated with greater number of leaves per tiller and per plant, but less leaf: stem ratio (5). For leaves number per tiller, the result shows Zanzibar Napier have slightly higher leaves number per tiller compared to other varieties throughout the three harvest with average (12.83 ± 0.16). In evaluating the quality of pasture grass with higher proportion of leaf indicates better nutritive value.

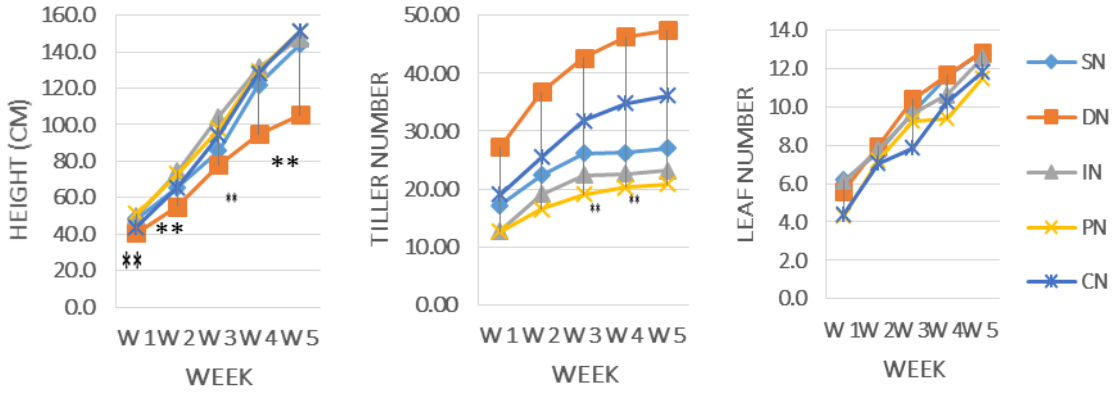


Figure 1. Plant height, tiller and leaf number of five varieties of Napier grass
CN= Common Napier, DN= Dwarf Napier, IN= India Napier, PN= Red Napier, SN= Zanzibar Napier

Dry matter production is an important indicator of forage production because the plant yield is considered as a manifestation of all the processes and the events that occur in plant growth. There was significance difference ($p<0.05$) in dry matter production between all varieties of Napier grass. The average of three harvest showed that Common Napier with the highest dry matter yields (9.67 ton/ha). Dry matter yield shows increasing pattern from first to third harvest. This was in agreement with the results that the taller varieties showed higher dry matter yields, and the dry matter yields of the most promising cultivars are within the range (15 to 22 t ha-1) reported for Napier grass in eastern Africa (6). All Napier shows similarity in dry matter production, while, Dwarf Napier shows higher in nutritive quality in term of crude protein, tiller number and leaf to stem ratio compared to others varieties.

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OPTIMUM ENSILAGING PERIOD OF SIXTH WEEKS OLD NAPIER GRASS HYBRID

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Fodder fermentation or ensilaging technology is one of the most economical and suitable methods to sustain a quality fodder supply for livestock. In Malaysia, the common fodder used is Napier grass (*Pennisetum purpureum*) which was first introduced in 1920's. In recent years, a hybrid of Napier grass (*Pennisetum purpureum* x *Pennisetum americanum)* became popular as it has faster growth rate and higher dry matter (DM) yield compared to the common Napier grass. Six weeks old Napier grass with 14.9% DM and 66.5% water soluble carbohydrate (WSC) was suggested to yield good quality silage (1). The objective of this study was to determine the optimum ensilaging period for 6 weeks old Napier grass.

Hybrid Napier grass was harvested at 6th weeks of age from Venture Ace Napier Farm, Rembau, Negeri Sembilan and was transported to MARDI Headquarters in Serdang. The grass was wilted in a shaded area until DM reached 24% for 24 hours and cut into 0.9 cm lengths (2). It was then mixed with 3% of diluted sugar cane molasses with water at a ratio of 3:1, before packing into 10 kg plastic bags. The plastic bags were vacuumed, sealed and stored in a dark room at ambient temperature. Optimum ensilaging period was evaluated mathematically using Fleigh number (FN) equation (4). Sampling was taken from 3 layers of the silage pack every 2 days until day-30. Value of pH and DM were collected from each sample in three replicates. The pH of silage was determined by electronic pH meter on the aqueous extract of silage. The DM of silage was determined by drying the silage samples in the oven at 100°C over night before converted into toluene dry matter by equation suggested by (3). Silage with FN less than 20 is poor, 25-40 is quite good, 55-60 is moderate, 60-80 is good, while more than 85 is considered of very good quality (4).

The results showed 16 days of fermentation was the optimum ensilaging period for quality silage production using 6 weeks old Napier grass (Table 1).

Table 1: Fleigh number (FN) from 3 layer of 6th weeks Hybrid Napier silage sample.

Day / Layer	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Upper	-11.8	-9.1	13.5	26.9	50.9	69.5	81.5	94.9	96.2	104.2	100.2	97.5	96.2	97.5	97.5
Centre	8.2	8.2	20.2	52.2	60.2	84.2	92.2	96.2	96.2	108.2	104.2	96.2	96.2	100.2	100.2
Bottom	8.2	16.2	36.2	48.2	72.2	88.2	92.2	96.2	96.2	108.2	104.2	96.2	96.2	100.2	100.2

At 14.8% DM, 30% of packaged silage (the bottom layer) has reached pH 3.7 (FN: 88.2), pH 3.6 (FN: 92.2) and pH3.5 (FN: 96.2) for day 12, 14 and 16, respectively. An average of all three layers at day 16 reached pH 3.5 and FN at 95.8, which indicates a good quality of silage. The pH value and moisture content decreased continuously until day 30, which indicates stable fermentation process (5). The optimum DM content for silage production was 25% (6) and exceeding 6-7 % WSC of DM was recommended to achieve well-preserved fermentation (7). Secondary fermentation due to high moisture content was

not detected in sixth week old Napier grass hybrid. In the present study, the reduction in crude protein and crude fibre were observed during the ensilaging period (Table 2).

Table 2: Nutritional composition of 6 weeks old of Napier grass and Napier silage

Type of Feed	Dry matter (%)	Percentage of DM			
		Crude protein	Crude fiber	Ether Extract	Ash
Fresh Napier	15.5	11.7	27.6	2.1	13.8
100% Napier	14.8	10.8	24.2	2.9	15.3

However, silage's ether extract and ash were increased when compared to fresh Napier. The decreasing of crude fiber could be related with degradation of hemicelluloses, cellulose and NDF content by the LAB during fermentation as compared with fresh Napier. The increase in the fat content of the silage was influenced by LAB which play crucial role in biosynthesis of fatty acid (8). The increasing of ash content during ensilaging process in the present study could be due to the reduction of hemicelluloses and cellulose content and consequently to higher proportion of inorganic matter in the silages compared to the fresh Napier (8).

In conclusion, 16 days of fermentation of 6 weeks old Napier grass hybrid was the optimum ensilaging period for the production of good quality silage.

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EFFECTS OF FEEDING OIL PALM TRUNK CORE BASED DIET ON PERFORMANCE OF COLORED SASSO CROSSBRED BROILER ("VILLAGE") CHICKENS

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Feed constitutes a large proportion of the cost of production in broiler production. Intensive broiler production is highly dependent on imported feedstuffs. The imported feed ingredients range from cereal grains, vegetable and animal proteins such as soybean meal, corn gluten meal, fish meal, mineral sources and various micro-ingredients - vitamins, minerals and other additives used to support highly efficient growth rate of the commercialized broiler breed. As such it will be a logical and viable option if we were able to explore and utilize locally available feed ingredients such as the core of oil palm trunk (OPT) for broiler production. The incorporation of OPT Core into poultry diet has been made possible with the fermentative application of effective microbes (EM). The fibrous content of OPT Core is broken down through fermentative actions of the EM thus, enabling the released of energy for production. The purpose of this study is to observe the effects of feeding OPT Core based diet on the performance of coloured Sasso crossbred broiler ("village") chickens.

The study was carried at a private coloured broiler farm in Alor Gajah, Melaka. The experiment consist of two treatments (OPT core based diet vs Commercial diet) with fifty day old chicks (50) coloured Sasso crossbred broiler birds randomly assigned to each treatment and 25 birds from each treatment were randomly selected and weighed. All birds were housed and group fed. A random sampling of the birds from each treatment were individually weighed every two weeks. Body weight gain and mortality percentage were recorded to evaluate the difference between the treatment rations. Daily mortality was recorded. Both treatment diets were sampled at week 1 and 8 for proximate analysis to determine their quality. Three (3) birds from each dietary group were slaughtered and analyse for carcass characteristics at end of the feeding trial period. A sensorial test of the meat was performed by non-trained testers. All data were statistically analysed based on p-value of 2-tail t-Test using Microsoft Excel Statistical software.

Proximate analysis results showed that the crude protein, crude fibre, metabolisable energy (ME) were 11.9%, 17.7%; 30.1%, 26.6%; 19.0 MJ, 15.3 MJ for OPT Core and commercial feed, respectively. The body weight and average daily weight gain are summarized in Table 1. Body weight and average daily weight gain were significantly affected by the dietary treatment ($p<0.01$). At end of the trial period (10-week), the mean body weight of birds fed with OPT core based feed was 1084.0 g/bird whereas the control group recorded a mean of 1830.5 g/bird. Inadequate CP and ME content in the OPT core based feed resulted in poor growth performance attained of the coloured Sasso crossbred broiler birds (1, 2, 3). The form of diets maybe one of the limiting factor that contribute to the poor performance (4), since the OPT core based diet is fed in the form of mash whereas the commercial feed in the form of crumble.

Table 1. Mean body weight gain of coloured Sasso crossbred broiler birds over 10 weeks feeding trial.

Parameters	Feed	Initial	Weeks				
			2	4	6	8	10
Mean Body Weight (g)	CF	37.6	155.4	393.3	706.0	1149.2	1830.5
	OPT	37.9	70.1	151.4	231.0	552.3	1084.0
Number of Observation (No of birds)	CF	25	25	25	25	12	10
	OPT	25	25	25	24	15	10
Average Daily Weight Gain (g/day)	CF	0	9.1	14.2	17.1	21.0	25.6
	OPT	0	2.5	4.5	5.0	9.7	14.9
STD (g)	CF	1.6	25.1	53.6	123.9	127.4	276.5
	OPT	1.4	10.4	47.3	63.6	125.7	172.0
P-value t-test	Between 2 means	0.509	1.49 E-20	7.23 E-22	1.81 E-21	5.18 E-12	9.67 E-07

Mortality rate was 0% in control group but 22% in OPT Core group, mainly due to emaciation and malnutrition. The carcass analysis carried out on 6 slaughtered birds (3 birds from each treatment) showed no significant difference in smell, texture and colour of the meat. However, the meat and bone yields, dressing percentage, skin with fats and visceral fats were significant differences ($p<0.05$) in OPT Core group.

It has to be concluded that the poor performance of Sasso crossbred broiler chicken compared with control diets is probably due to inadequate crude protein and metabolisable energy in the diets.

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EFFECT OF DIFFERENT DIETARY OILS ON GROWTH PERFORMANCE OF BROILER CHICKEN

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Different types of fats and oils are frequently included in broiler diets as energy sources, source of dietary essential fatty acids (linoleic and linolenic acids) that cannot be synthesized by the animal, aid in absorption of fat soluble vitamins, and provide specific bio-active fatty acids (1). Considering diets with similar nutritive values, the use of fats in broiler feed have been reported to show better birds performance than those without oil inclusion (2, 3). Palm oil currently accounts for 28.6% of the total world production of oils and fats, overtaking soybean oil (25.3%) as the most traded vegetable oil in the world (4). Palm oil and its derivatives are suitable to be used as animal feed ingredients and the ever expanding oil palm cultivation in Malaysia offers a sustainable supply of oil palm-based lipid to replace imported energy sources in broiler feed formulation. Therefore, this study was conducted to evaluate the broilers' performance with addition of different oils at 3.5% and 4% for starter and grower feed, respectively.

A total of 180 day-old Cobb500 chicks were kept in a Climatic Control House (CCH) equipped with three rows and three tier cages. Broilers were allotted to three treatment diets with 4 replications and 15 birds per cage. The three treatment diets were formulated to be isonitrogenic and isocaloric (5) with the following treatments diet I, had no added fat (**CON**), diet II and III contained 3.5% in starter ration and 4% in grower ration of added crude palm oil (**CPO**) and soybean oil (**SBO**), respectively. Feed was given manually to the broiler and water was supplied *ad libitum* through nipple drinker. Starter rations (0-20 days) was provided as crumbles while grower rations (21-40 days) as whole pellets. Feed offered and feed refusal were recorded daily to determine the feed intake. Initial live body weight was recorded and then at a weekly intervals thereafter. At the end of each period (starter and grower), feed conversion ratio (FCR) was calculated from the feed intake and body weight gain. Broiler Performance Index (BPI) was determined from the final live body weight and liveability divided by the FCR and days of rearing which reflect the assessment of maintenance performance of the broiler chicken.

There were no significant differences ($P>0.05$) in average weight gain (AWG) and FCR among all treatments during the starter period (Table 1). Broilers fed with CPO diet showed the highest average feed intake (AFI) at day 18 ($P<0.05$) compared to broilers fed with CON and SBO diets. During the grower period, there was no significant differences ($P>0.05$) in the AFI among the treatments. AWG of broilers fed with CPO diet showed the highest weight gain with average weight of 2.57 kg ($P<0.05$) compared to broilers fed with CON and SBO diets with 2.39 and 2.40 kg, respectively. The best FCR was from CPO and SBO diets ($P<0.05$).CPO diet showed the highest BPI with 412.92 followed with CON and SBO with 362.67 and 358.96, respectively. However, all treatment diets showed higher BPI than the minimum level, which was 270.

Similar results were found with a study on the use of different fatty acid compositions of oils (soybean and palm oils) at 3% inclusion on the growth rate (6). They indicated that during the growing phase, the growth rate of broiler fed with palm oil group showed significantly higher ($P<0.05$) as compared to soybean oil group. In terms of feed intake, soybean oil fed broiler group consumed less than palm oil fed broiler

group which indicate that diet containing soybean oil depress feed intake, as also stated by (6). It is concluded that the inclusion of crude palm oil could be an alternative energy source ingredient in broiler feed ration with no adverse effects on body weight and broilers' performance.

Table 1. Broilers' Performance fed with different dietary oil for starter and grower periods (mean ± SD)

PARAMETER	CON	CPO	SBO
Weight at arrival (kg)	0.041	0.041	0.041
AFI at day 18 (kg)	$0.76^{ab} \pm 0.02$	$0.77^{a} \pm 0.01$	$0.74^{b} \pm 0.02$
AWG at day 18 (kg)	0.56 ± 0.03	0.57 ± 0.01	0.54 ± 0.02
FCR Starter Period	1.35 ± 0.03	1.34 ± 0.02	1.36 ± 0.04
AFI at day 40 (kg)	3.87 ± 0.11	3.94 ± 0.08	3.76 ± 0.23
AWG at day 40 (kg)	$2.39^{b} \pm 0.05$	$2.57^{a} \pm 0.06$	$2.40^{b} \pm 0.12$
FCR Grower Period	$1.62^{a} \pm 0.03$	$1.53^{b} \pm 0.01$	$1.57^{b} \pm 0.03$
*BPI	362.67	412.92	358.96

CON: Control; CPO: Crude Palm Oil; SBO: Soybean Oil
AFI: Average feed intake; AWG: Average weight gain; FCR: Feed conversion ratio
BPI: Broiler Performance Index
[ab] Means in the same row with different superscripts are significantly different (P<0.05)
*No statistical analysis for this parameter. BPI was calculated using this formula:

$$BPI = \frac{final\ live \text{ weight x liveability}}{FCR\ x\ days\ of\ rearing} \text{ x } 100$$

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EFFECT OF FEEDING PALM FATTY ACID DISTILLATE AS LIPID SOURCE ON GROWTH PERFORMANCE OF RED HYBRID TILAPIA

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Marine fish oil, a by-product from capture fisheries is one of the important conventional oil source widely used in the formulation of aquaculture feed (1). Due to the high consumption of marine fish oil in aquafeed processing which is about 60% of global fish oil production (2), other alternatives should be explored and identified to replace this source of lipid. Most of fish oils are produced in temperate countries, and is expensive and difficult to be obtained by users especially in tropical countries (3). Lipid from plant-based source such as vegetable oils (soybean oil, linseed oil, sunflower oil, etc.) and also palm oil products have good potential as substitutes for marine fish oils. The lower requirement of n-3 fatty acids by freshwater fish seems to provide greater potential in the use of palm oil in fish diets (3). The use of palm oil products such as crude palm oil (CPO), refined, bleached, deodorized (RBD) palm olein, palm fatty acid distillate (PFAD) and residual oil present in spent bleaching clay (SBC) have been studied in several fish species and showed no adverse effects on their growth performances (4, 5).

Malaysia is among the top producers of palm oil, second after Indonesia. In 2017, Malaysia produced 12 million MT of palm oil products consisting of CPO, palm kernel, crude palm kernel oil and palm kernel cake (MPOB, 2016). PFAD is a residue of physical refining of CPO from palm oil refinery and is rich with free fatty acids (2) with production of 649,459 metric tonnes in 2016, or 3.25% of PFAD produced from one tonne of processed CPO (6). The price of PFAD is RM 2462.50 per tonne in 2016 which is lower compared to the price of CPO which was used in formulating animal feed. The present study was conducted to determine the growth performances of red hybrid tilapia (*Oreochromis* sp.) fed with diets using PFAD to replace CPO.

A 12 week feeding trial was conducted using 900 juveniles of red hybrid tilapia (± 3 inches size). The fishes were randomly assigned to 3 treatments with 6 replications per treatment. The treatments used in this study were; T1: control diet with CPO at 2.5% inclusion; T2: control diet with PFAD inclusion at 2.5%, T3: control diet with PFAD inclusion at 5%. The fishes were fed with isonitrogenous (32% CP) and isocaloric (13 MJ/kg) diets. The fishes were fed twice a day at feeding rate of 5% body weight. Water quality (dissolved oxygen, temperature, pH, ammonia level) was measured throughout the feeding trial to ensure that it is within the range for cultivated fish. All data presented were analysed using analysis of variance (ANOVA) with significant differences between means separated by Tukey test using the SAS Version 9.3.

The weight gain, feed intake and FCR of fish fed with 3 dietary treatments are shown in Table 1. Over the 12 weeks feeding trial, fish fed with the control diet consisting of CPO as oil source showed the highest weight gain (138.40±16.82g), feed intake (157.77±26.41) and the best feed conversion ratio (1.14±0.08). Treatment 3 was observed to have the lowest weight gain and feed intake, and poorest FCR. However, for all treatments, there was no significant differences found ($p>0.05$) for all the parameters observed. Ng et al. (5) found that inclusion of 1.5% PFAD in diet of African catfish, showed a significantly ($p<0.05$) better growth performance compared to the control diet

using fish oil as sole oil source and higher weight gain than fish fed with 3% PFAD inclusion. This study however showed an indication of decreased growth performance of red tilapia when PFAD exceeded 2.5%.

Table 1. Initial weight, final weight, weight gain, feed intake and FCR for red hybrid tilapia fed with 2 levels of PFAD inclusion

Parameters	Treatment		
	T1	T2	T3
Initial weight (g)	28.93±5.73[a]	28.53±5.41[a]	28.47±5.83[a]
Final weight (g)	167.33±22.26[a]	158.54±16.67[a]	149.52±20.53[a]
Weight gain (g)	138.40±16.82[a]	130.01±11.62[a]	121.05±15.15[a]
Feed intake (g)	157.77±26.41[a]	151.82±21.52[a]	147.25±23.83[a]
FCR	1.14±0.08[a]	1.16±0.09[a]	1.21±0.07[a]

FCR- Feed conversion ratio
Treatments: T1- 2.5% CPO inclusion, T2- 2.5% PFAD inclusion, T3 -5% PFAD inclusion

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APPARENT DIGESTIBILITY COEFFICIENTS OF POULTRY OFFAL MEAL, PALM KERNEL CAKE AND RICE BRAN IN JELAWAT (*Leptobarbus hoevenii*)

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In Malaysia, there are very few native species of freshwater fish which are considered high value fish. Among the most popular in this category is *Leptobarbus hoevenii* or commonly known as the Sultan fish or Jelawat (1). This fish belongs to the carp family and is native to Malaysia. It is categorized as high value freshwater fish as its price can range from RM90-120/kg depending on the origin of the fish. The culturing of this fish has increased tremendously about 92% from 480 metric tonnes in 2005 to 923 metric tonnes in 2015 (2). It is well known that not all of the feed protein is successfully digested and utilised by the fish. In many cultured fish, fishmeal is the main feedstuff used due to its excellent source of indispensable amino acids, fatty acids and other nutrients essential for fish growth (3). However, due to the dwindling and depleting source of fishmeal, and the competitive demand from other livestock, other alternatives should be explored to substitute fishmeal in aquafeed. Very limited research and studies have been done on Jelawat and this study was conducted to evaluate the digestibility of three local feed ingredients in Jelawat.

An experiment was conducted to evaluate the apparent digestibility coefficient (ADC) of protein and energy of poultry offal meal (POM), palm kernel expeller (PKE) and rice bran (RB) in Jelawat. Juvenile fish (mean weight of ±17g, 3 inch length) were purchased from a local fish farmer in Selangor. The fish (total 180) were stocked in 100L aquarium and was divided into 4 treatments: reference diet and 3 test diets. Each treatment had 3 replicates consisting of 15 Jelawat juveniles each. The reference diet consists of fishmeal as the sole protein source, whereas for the test diet, it was formulated to contain 70% reference diet and 30% of the test ingredient (POM, PKC and RB). Fish were fed to satiation once a day at 0900 and uneaten feed were collected an hour after feeding time to measure feed intake. The faeces were collected 4 hours after feeding and every morning before feeding on the following day by the siphoning method. Faeces samples were pooled, dried in the oven at temperature of 60˚C, ground and kept in the freezer until further analysis. Feed and faeces samples were ground and analyzed for dry matter (DM), crude protein (CP) and energy (GE) to determine its digestibility coefficient. The apparent digestibility coefficients were calculated (4, 5).

The ADC of protein and energy for the three locally available sources (poultry offal meal, palm kernel cake, rice bran) in Jelawat are shown in Table 1. POM showed the best digestibility with 100% digestibility for both protein and energy. No reports so far have been documented for Jelawat fed on poultry by-product meal. However in another carp family, the common carp, 20% of poultry by-product meal can be included in the diet (6). This could be an indication that this carp family is capable of utilizing nutrients from poultry by-product meal. In a study by Law (1984), he found that the protein and energy digestibility in fingerlings Jelawat was 30.81% and 43.56%, much lower compared to what was found in this study. In this study, rice bran showed a better digestibility with 78% for protein and 84% for energy (Table 2) which is double the previous reported. Palm kernel expeller has the poorest digestibility with energy digestibility of 60%. The protein digestibility in PKE is higher (74%) than the energy

digestibility (60%), suggesting that it could be a better protein source rather than energy source for Jelawat.

Table 1. Ingredient of reference and test diet used in digestibility study (g kg^{-1})

Ingredient	Reference Diet	Test Diet
Test Ingredient*	0.00	300.00
Fish Meal	790.00	553.00
Corn Starch	100.00	70.00
Palm Oil	70.00	49.00
Mineral Premix	20.00	14.00
Vitamin Premix	20.00	14.00
Total (g)	1000.00	1000.00

*Test ingredients: poultry offal meal, palm kernel cake, rice bran

Table 2. Apparent digestibility coefficient and digestible values of protein and energy of poultry offal meal (POM), palm kernel cake (PKC) and rice bran (RB) in Jelawat

Protein Digestibility (%)			
Ingredient	Digestible coefficient	Total value	Digestible value
Poultry offal meal	1.00±0.00	63.80	63.80
Palm kernel cake	0.74±0.09	17.30	12.80
Rice bran	0.78±0.06	13.00	10.14
Energy Digestibility (MJ/kg)			
Poultry offal meal	1.00±0.00	18.77	18.77
Palm kernel cake	0.60±0.06	17.25	10.35
Rice bran	0.84±0.04	17.29	14.52

Digestible coefficient values are presented in means±SD

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CARCASS CHARACTERISTICS OF MALE DORPER SHEEP WEANED AT DIFFERENT AGES

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Local mutton consumption increased by almost 30% from 19,309 tonne in 2009 to 43,703 tonnes in 2014. However, this was not reflected in the local population of sheep which only increased by about 3% from 136,285 heads in 2009 to 139,670 heads in 2014 (1). The increase in meat demand was partially supplemented by the importation of live sheep, whereby 34,554 heads of live sheep were imported in 2014 compared to 20,187 in 2009. Dorper is a sheep breed suitable for the Malaysian environment due to its hardiness and adaptability (2) as well as its fast-growth for meat production. The aim of this study was to assess the carcass characteristic of male Dorper sheep weaned at three different ages.

A total of 27 newborn Dorper lambs (average body weight, 3.06±0.74kg) were randomly divided into three equal (n=9) experimental groups namely, Group 1, Group 2 and Group 3, weaned at day 30, 60 and 90, respectively. The creep and grower feeds were calculated and offered based on 3.5% of their mean body weight before and after weaning. Three animals from each group were slaughtered at 9 months of age for carcass characteristics.

The live weight before slaughtered, carcass characteristics and the meat to bone ratio were not significantly different ($p>0.05$) between the treatment groups (Table 1).

Table 1: The mean (±se) live weight before slaughtered, carcass characteristics and the meat to bone ratio of Dorper at 9 months of age.

Parameters	Treatments		
	Group 1	Group 2	Group 3
Live weight, kg	42.17±8.01	43.83±3.33	45.00±6.25
Carcass weight, kg	19.17±4.65	20.63±4.37	19.83±2.84
Carcass length, cm	82.83±6.05	84.00±1.00	83.33±10.87
Dressing, %	45.14±3.61	46.79±6.98	44.16±3.23
Meat, kg	7.18±1.52	7.94±1.39	7.65±1.27
Bone, kg	1.82±0.37	1.86±0.23	1.64±0.33
Meat to bone ratio	1:0.25±0.01	1:0.24±0.06	1:0.21±0.01

Group 1: weaned at 30 days), Group 2: weaned at 60 days, Group 3: control - weaned at 90 days.

The mean weight of lambs weaned at 90 days (Group 3) were 2.8 kg heavier than those weaned at 30 days (Group 1). In the current study, the dressing percentage was ranges from 44.16% to 46.78%, and with an agreement with previous report (3), except

for the meat to bone ratio, which was higher. The overall carcass parameters were not different between the three treatment groups.

It was concluded from the present study that the age of weaning does not influence the carcass characteristics of male Dorper sheep.

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SENSORY EVALUATION OF MEAT FROM GOATS FED WITH OIL PALM BY-PRODUCTS: A PRELIMINARY STUDY

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Malaysia's oil palm industry has produced around 90 million dry tonnes of solid biomass annually and it is expected to increase up to 85 to110 million dry tonnes by 2020 (1). Production of by-products in oil palm industry are contributed not only from the plantation level, but also from the processing mill (2). These include oil palm trunk (OPT), oil palm fronds (OPF), empty fruit bunches (EFB), palm press fibre (PPF), palm fatty acid distillates (PFAD), palm kernel cake (PKC) and palm oil mill effluent (POME). Most of these by-products have a great potential to be utilized as components in compound feeds. Animal diet is among several factors that has impact on meat quality such as colour and tenderness, which subsequently influences customers' acceptability and satisfactory. Thus, an experiment was conducted to examine the effects of oil palm by-products based pellet in comparison with commercial pellet on sensory evaluation of meat from two breeds of goat. Four Boer and four Katjang goats were randomly allocated to four groups of two goats per breed and kept in individual pen. The experimental design was using 2 × 2 factorial, with treatment diet and breed as the main effects. Each group received either commercial pellet or oil palm by-products based pellet which contained OPF, PKM, EFB, PFAD, corn, soybean meal, rice bran and other feed additives. The study was conducted for 104 days with 14 days of adjustment period followed by 90 days of experimental period. The goats were fed at 4% body weight with the respective diets, based on 60% pellet and 40% Napier grass, once daily at 9.00 a.m. At the end of the trial, the goats were fasted for 24 h with free access to water before slaughtering by referring to Halal method as outlined in MS 1500:2009 (3). Sensory evaluation was carried out on long muscles (*longissimus dorsi)* by twenty trained panellists. Samples for the sensory analysis were taken from both sides of the carcass, divided into approximately 2 × 2 × 2 cm subsamples and cooked in a pressure cooker for 30 min (4). The samples were given three-digit codes and randomised serving sequence. Each sample was evaluated using a 5-point hedonic scale (5 = extremely desirable, 1 = extremely undesirable). Of the sensory characteristics, colour, taste, juiciness, tenderness and overall liking were evaluated. Data obtained for all parameters was analysed using two way ANOVA (5). The Duncan multiple range test was used to further compare means at $p<0.05$ for significant differences. The effect of oil palm by-product based pellet on sensory evaluation is presented in Table 1. Experimental diets did not show any significant difference ($p>0.05$) for all sensory attributes. Similar results were also reported by (6) and (7) which demonstrated that meat from goats fed with two different diets had no significant influence on the sensory evaluation. However, different breeds showed significant differences ($p<0.05$) in colour perception and juiciness of the goat meat. Boer goat was found to be more preferred in term of colour perception, although it was undesirable in term of juiciness when compared to Katjang goat. There were no significant diet × breed interaction was found for sensory evaluation. Therefore, these results suggest that oil palm by-products based pellet did not affect overall sensory evaluation and showed encouraging results in terms of meat colour and juiciness. For

future study, bigger sample size need to be used and other parameters such as growth performance, carcass composition and cost comparison can be included to have better interpretation on the effects of feeding oil palm by-products based pellet in comparison with commercial pellet.

Table 1. Consumer sensory evaluation of meat (mean) from Boer and Katjang goat fed with commercial pellet and oil palm by-product based pellet.

Attibutes[#]	Experimental Diets		Breed		SEM
	COM	OPB	Boer	Katjang	
Colour	2.95	3.20	3.45[a]	2.70[b]	0.12
Taste	2.83	2.85	2.68	3.00	0.11
Juiciness	2.58	2.68	2.38[b]	2.88[a]	0.11
Tenderness	2.98	3.20	3.03	3.15	0.10
Overall Liking	3.03	3.38	3.10	3.30	0.11

COM = Commercial pellet, OPB= Oil palm by-product pellet
Main effect means followed by the different letter are significantly different at P<0.05 by Duncan multiple range test; a and b for species
[#] : Sensory panel scales: range from 5 = extremely desirable to 1 = extremely undesirable.

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EFFECTS OF RAW *Aleurites moluccana* (L.) Willd. KERNEL MEAL ON FATTY ACID PROFILE OF *PECTORALIS* AND *ILIOTIBIALIS* MUSCLES OF QUAIL

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The imbalance of omega-6 and omega-3 ratio in human diet will contribute to chronic diseases such as cardiovascular disease (1). Modification of poultry diet by including sources high in polyunsaturated fatty acid (PUFA) such as *Aleurites moluccana* (Candlenut) kernel in the diet would enhance the fatty acid profile of meat (2). Therefore, the objective of the study was to determine the effects of *A. moluccana* kernels on fatty acid profile of quail meat.

One hundred *Coturnix coturnix japonica* male broiler quails, 22 days of age, with body weight 152.88±1.01 g, were randomly allocated into four treatment groups, each replicated five times, consisting of 5 birds per replicate. From 22 to 42 days of age, the birds were fed a basal diet supplemented with either 0 (Control), 0.25, 0.50 and 1% raw *A. moluccana* kernel meal (AMK). All birds were fed ad libitum. Drinking water was made available at all times. At 42 days of age, two birds of each replicate were slaughtered randomly and approximately 20 g of *pectoralis* muscle of breast and *iliotibialis* muscle of thigh were collected from the left side of carcass. All samples for fatty acid profile were analysed based on the methods described by (3). The data were subjected to one way ANOVA using the GLM procedure of SAS 9.4.

Table 1. Fatty acid profile (% of total fatty acids) of breast muscle (Mean±SE)

	Dietary treatments			
Numeric Name	T1 (Control)	T2 (0.25%)	T3 (0.5%)	T4 (1%)
n-6	14.93±0.56^{c}	16.59±0.17^{b}	17.70±0.19^{ab}	18.84±0.07^{a}
n-3	1.55±0.24^{c}	2.23±0.50^{bc}	4.43±1.28^{ab}	6.20±0.42^{d}
n-6/n-3	4.49±1.49	7.10±5.64	4.14±1.44	5.19±1.92

^{a,b,c,d} Means within a row with different superscripts differ significantly ($p<0.05$)
T1=basal diet, T2=basal diet+0.25% AMK, T3=basal diet+0.50% AMK, T4=basal diet+1% AMK

Table 2. Fatty acid profile (% of total fatty acids) of thigh muscle (Mean±SE)

	Dietary treatments			
Numeric Name	T1 (Control)	T2 (0.25%)	T3 (0.5%)	T4 (1%)
n-6	11.04±0.43^{c}	12.57±0.57^{c}	21.27±1.08^{a}	17.57±0.59^{b}
n-3	0.98±0.10^{c}	1.27±0.14^{bc}	2.59±0.39^{ab}	2.66±0.35^{a}
n-6/n-3	11.40±1.62^{a}	10.01±0.69^{ab}	9.83±0.29^{ab}	6.28±0.67^{a}

^{a,b,c} Means within a row with different superscripts differ significantly ($p<0.05$)
T1=basal diet, T2=basal diet+0.25% AMK, T3=basal diet+0.50% AMK, T4=basal diet+1% AMK

However, the omega6/omega3 ratio of breast muscle was not influenced by the supplementation (Table 1). Adding of 2% either treated or untreated *A. moluccana* kernel meal has also been proven to be effective in increasing the meat fatty acid profile especially omega-3 fatty acid in broiler chickens (2).

Supplementing of raw *A. moluccana* kernel meal as low as 0.25 to 1% in the diet would enhance the fatty acid profile in the both types of meat especially in omega-3 fatty acid.

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OESTRUS RESPONSE OF DORPER CROSS EWES SYNCRONISED USING INTRAVAGINAL SPONGE FGA WITH DIFFERENT BACKFAT THICKNESS AND OESTRADIOL BENZOATE DOSES

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Popularity of Dorper breed was known as hardy mutton sheep with a top quality carcass at early age (1). Due to this reason, Malaysian government had imported this breed under East Coast Economic Region's (ECER) livestock industry program. It was initiated to meet the rising demand for mutton in Malaysia. In addition Oestrus Synchronization (OS) has been implemented in order to manipulate Dorper cross ewe's reproduction aspect thus able to increase its production. The most frequently use of OS in Dorper cross breed was progestagen based protocol with administration of eCG and PG. The application of fluorogestone acetate (FGA) sponge with frequent use of eCG may cause the development of anti-eCG antibodies in ewes. It has been reported that oestradiol benzoate (OB) are able to induce LH and subsequently ovulation (2). Furthermore, backfat thickness (BFT) has become an alternative way of quantifying the Body Condition Score (BCS) of ewes which will offer a reliable answer using ultrasound. Therefore, this study was conducted to evaluate oestrus response of Dorper crosses using FGA sponge with different BFT and OB doses.

Seventy one non-pregnant ewes, ages between 2 to 4 years with body weight range between 20 to 40 kg, were used. This study was conducted at RPS Runchang Farm, Runchang, Pahang. Backfat screening at 12th and 13th ribs region of ewe's dorsal part using linear probe (7.5MHz) connected to an ultrasound machine DP-6600Vet® (Mindray Medical International Limited, China) was done a day before synchronisation started. Then, ewes were randomly allocated to two groups of BFT (Tn: ≤3mm; Tk: >3mm). Each BFT groups received intravaginal FGA sponge for seven days, and prostaglandins (PG: 1 ml of 250 µg/ml cloprostenol) on day 6 post pessary insertion. On day of pessary withdrawal, the ewes were randomly assigned to receive one of the following treatments (i.m.): Control (CO) - 1 ml Corn Oil, low dose of OB (LOB) - 1 ml of 0.05 mg/ml OB, and high dose of OB (HOB) - 1 ml of 0.25 mg/ml OB. At 24 h post pessary withdrawal, nine fertile rams were alternately released into each group of ewes for 30 min at 4 h intervals until 72 h post OB administration to detect oestrus and allow them to mate.

There was no interaction ($p>0.05$) between BFT and OB doses for oestrus responses. Therefore, the results were presented according to the main effect (Table 1). The BFT indicate that there is no significant difference ($p>0.05$) on the percentage of ewes expressed oestrus signs. However, synchronised ewes with Tn group has 3.4% higher than Tk group synchronised ewes. This indicates that ewes in Tn group response better to synchronisation protocol used in this study. Other than that, time interval from OB injection to onset of oestrus and time interval from OB injection to standing oestrus showed no significant difference ($p>0.05$) between both groups. The time interval from OB injection to onset of oestrus and time interval from OB injection to standing oestrus in synchronised Tk ewes was observed earlier than Tn ewes group. As expected, ewes in groups synchronised with LOB and HOB had earlier time interval from OB injection to onset of oestrus and time interval from OB administration to standing oestrus compared

to ewes group synchronised with CO, which in agreement with Takada *et al*. (3). However, the recruitments of new follicular wave is depend on the dose and interval of OB injection to ewes during oestrus synchronisation program which later may affect on the oestrus response (4).

Table 1: Oestrus responses of synchronised Dorper crosses ewes with different BFT and OB doses

Parameter	Treatments				
	BFT		OB Doses		
	Tn (n=37)	Tk (n=34)	CO (n=25)	LOB (n=24)	HOB (n=22)
No. of ewes expressed oestrus signs	35	31	21	24	21
Percentage of ewes expressed oestrus signs	94.6[a]	91.2[a]	84[a]	100[a]	95.5[a]
Time interval from OB injection to onset of oestrus (h±SE)	30.1±2.0[a]	29.4±1.7[a]	39.4±2.6[a]	24.5±0.2[b]	26.1±2.1[b]
Time interval from OB injection to standing oestrus (h±SE)	34.1±2.1[a]	33.7±2.1[a]	44.6±2.3[a]	26.8±1.2[b]	31.2±2.6[b]

[ab] Means with different superscripts between the columns are significantly different ($p<0.05$);
Tn: ≤3 mm of BFT; Tk: >3 mm of BFT; CO:Control- 0mg of OB, corn oil only; LOB: 0.05 mg of OB diluted in corn oil; HOB: 0.25mg of OB diluted in corn oil.

In conclusion, the synchronisation protocols of Dorper ewes using FGA with oestradiol benzoate with either low or high dose showed better oestrus response. Classification of BFT group in this study has less variation due to availability of ewes in farm.

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ASSESSMENT OF SEMEN QUALITY OF KATJANG X BOER F1 BUCK IN MARDI KLUANG

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The goat population in Malaysia has decreased from 479,444 in 2013 to 439,667 heads in 2015 (1). The increasing demand for goat meat led to massive importation of the Boer goat breed. Unfortunately the imported Boer breed had poor reproductive performance under the Malaysian climate (2). In contrast, the Katjang goat, an indigenous breed in Malaysia, is highly adapted to the local environment but has a relatively low meat production (3). Therefore, Katjang x Boer goats is being developed in MARDI Kluang to fully utilize genetic adaptation of the indigenous breed while improving meat production. This study was done to evaluate the semen quality of Katjang x Boer F1 buck.

Seven Katjang x Boer F1 buck between 18-21 months of age were trained and reared in an individual pen. The animals were fed with a commercial pellet and grass (*Brachiaria Humidicola*). Semen was collected and assessed for wave motion and percentage motility using a phase-contrast microscope. Concentration of semen was determined by using haemocytometer. The Eosin-nigrosin stain method was used to determine percentage of viable spermatozoa.

Table 1.Semen quality of Katjang x Boer (F1) buck in MARDI Kluang

Parameter	Katjang x Boer (±SEM)	Katjang x Feral[1]	Katjang x German[2]	Boer[3]
Semen volume (ml)	0.56±0.15	1.07	0.90	1.07
Wave Motion (score 0-5)	4.43±0.34	3.88	-	2.35
Sperm motility (%)	75.71±7.19	85.60	75.00	75.97
Concentration of semen(x 10^9/ml)	1.51±0.56	2.38	6.33	3.12
Sperm viability (%)	74.00±4.54	78.00	77.81	80.05

[1]Source (4); [2]Source (5); [3]Source (6)

The results in Table 1 showed that semen volume, semen concentration and viability of sperm obtained were lower compared to findings on Katjang x Feral (4), Katjang x German (5) and Boer (6). Sperm motility was lower than Katjang x Feral (4) but similar to Katjang x German (5) and Boer (6) findings. Meanwhile, wave motion was high compared to the other breeds (Table 1). Although this study suggests that sperm quality of Katjang x Boer (F1) was within the normal range, further study is required to evaluate the influence of local feed and management system to produce optimal semen quality.

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MULTIPLE OVULATION EMBRYO TRANSFER (MOET) IN DAIRY CATTLE: A CASE REPORT

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Multiple ovulation embryo transfer is one of the reproductive technologies which is important to increase animal production. There are a number of advantages of MOET in cattle; including improved and increased number of progeny, either male or female, from genetically superior donors (1, 2, 3). In addition, this kind of technique would allow the superior cow to produce a number of offspring more than normal productions. Besides, the MOET application also can leads to increasing the reproductive capability and ability of precious or valuable animals, as well as at same time increasing the percentage of genetic improvements of the herd. The aim of this report success of the MOET programme conducted.

In this case report, four cows were selected as donors while eleven cows were selected as recipients. Both donors and recipients had undergone the same procedures and steps for multiple ovulation and embryo transfer (MOET), such as cow preparation, synchronisation and only donor cows follows the superovulation protocol. Cows were artificially inseminated and the embryos were flushed and graded (3).

Table 1, shows the superovulation response, recovery rate and the embryo quality of the donor cows. Out of four selected cows for donor, one of them was pregnant and only two cows actually produced the embryos. The recovery rate for the embryo collection was 70.1%, and from 13 embryos (include unfertilised ova), 84.6% of the embryos was classified as good quality and suitable for embryo transfer. The overall results showed that out of eight recipients, five cows were detected pregnant which was 62.5 % pregnancy rate.

Table 1: Superovulation response, recovery rate and the embryo quality

Items	Parameters	Remarks
No. of Donor response	3 (due to 1 cow pregnant)	
Mean time of oestrus after CIDR out (hrs)	34	12, 36, 54
No of Donor with CL	2	-
Mean No. of CL	8.5	11, 6
Total No. of embryos & UFO recovered	13	10, 3
Mean Recovery rate %	70.1	90.1, 50.0
Quality of embryos %		
Good	84.6	11
Poor	7.7	1
Unfertised ova	7.7	1

The success rate after transferring of embryo from donor cows to recipient cows was 62.5% (Table 2), which was lower than reported previously (1). The results indicated that the overall program was a success although pregnancy rates is less than 70%.

Table 2. The number and pregnancy rate of recipient cows.

Items	Parameters
No. of recipients	8
No of cow pregnant	5
No of cow not pregnant	3
Pregnancy rate (%)	62.5

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MATERNITY DNA TESTING IN CATTLE USING MICROSATELLITE MARKERS

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Recently, National Institute of Veterinary Biodiversity, Pahang received a case of cattle ownership dispute in Pahang. Since the samples with unknown sires, the maternity test was conducted instead of a paternity test. Genetic information from parent are inherited to offspring, half of sire and dam, which is the principle of parentage or paternity test (1). However, maternity DNA testing in cattle determines whether a cow could be the biological dam of an offspring or not. It is much like a DNA paternity test; it compares an offspring's DNA pattern with that of the alleged dam to determine the probability of likelihood that the offspring has inherited the DNA from the alleged dam. Any inequality in the DNA pattern, the dam will be excluded from the list of possible dams of the offspring. In human, maternity testing is commonly applied in cases such as adoption, immigration and *in-vitro* fertilization with 99% accuracy (2). In the case above, it involved an offspring (Disputed Individual) and two possible dams (Dam 1 and Dam 2) without sire.

A total of thirteen microsatellite markers as recommended by International Society of Animal Genetics (ISAG)/ Food and Agriculture Organization (FAO) were used. The samples underwent DNA extraction process and conventional PCR. The amplified regions are carefully examined for DNA patterns and sizes using 4% Metaphor agarose gel under Alpha Innotech (Alpha Manager) Gel Documentation and Analysis system.

From the analyzed data in Table 1, the information can be divided into three categories as below:

1) Inconclusive data, when the alleles size for microsatellite markers involved, which were MB009, CSSM66, ETH152, TGLA227, TGLA53, TGLA122, ILST006, TGLA126, HEL13 and BM1818, were found to be not informative to include or exclude the both dams as the biological dam when compared to the alleles size of offspring (Disputed Individual).
2) Inclusive data, when one allele of the offspring (Disputed Individual) was matched to the dam's allele. The microsatellite markers involved were CSRM60, INRA177 and INRA035. In this case, Dam 1 qualified as a dam of the offspring (Disputed Individual).
3) Exclusive data, when both size of allele of dam were not matched to either one of alleles of the offspring (Disputed Individual). It showed that the offspring had not inherited any gene from the dam. The microsatellite markers involved were CSRM60, INRA177 and INRA035. Thus, one of the dam which is Dam 2 was excluded as the biological dam of the offspring (Disputed Individual).

Table 1. Allele size for an offspring and two possible dams using thirteen microsatellite markers.

Locus	Dam 1		Disputed Individual		Dam 2	
	Allele	Allele	Allele	Allele	Allele	Allele
MB009	158	158	158	158	158	158
CSRM60	87	87	87	87	79	67
CSSM66	178	178	178	178	178	178
ETH152	210	210	210	210	210	210
TGLA227	84	84	84	84	84	106
TGLA53	172	172	172	172	172	172
TGLA122	166	148	166	158	166	166
INRA177	73	73	73	73	89	75
ILST006	309	309	309	309	309	309
TGLA126	133	133	133	133	133	133
HEL13	218	206	206	206	206	200
INRA035	121	103	103	103	119	101
BM1818	272	272	272	272	272	272

Based on the data analysis above, it was concluded that Dam 1 was the biological dam of the offspring (Disputed Individual). This showed that microsatellite markers can be used as tool for maternity testing in Malaysian cattle industry.

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DETECTION OF *CAMPYLOBACTER* USING LATERAL FLOW IMMUNOASSAY KIT

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Campylobacter spp. are a major cause of gastroenteritis in humans and have led to economic losses in terms of decreased productivity and medical costs in developed and developing countries. *Campylobacter* spp. are gram-negative, non-sporadic and most *Campylobacter* species are strictly microaerophilic which require a microaerobic atmosphere (1). Symptoms of *Campylobacter* infection or also known as campylobacteriosis include cramping and abdominal pain often associated with headaches, fever and vomiting and usually occur after 24 to 72 hrs of incubation period. Poultry-based foods form the largest pool of *C. jejuni* (2). Development of rapid and reliable diagnostic methods for routine food monitoring, screening and identification of the bacteria has a major improvement in order to reduce the impact of these pathogenic bacteria to human and animal's health. The search for rapid detection for *Campylobacter* has resulted in the development of lateral flow immunoassay (LFIA) kit based on the polyclonal antibody-antigen detection system.

In this work, a polyclonal antibody preparation against *Campylobacter* that has been produced previously was utilized as the main bioreceptor in the development of LFIA kit for the detection of *Campylobacter*. The sensitivity and specificity of the LFIA kit were evaluated in this work. The LFIA kit consists of a sample well, conjugate and adsorbent pad, control (C) and test (T) line which have been immobilised with goat-anti-rabbit antibody and polyclonal antibody against *Campylobacter*, respectively. Positive contaminated samples with *Campylobacter* will react with the coloured colloidal gold-conjugated antibody forming a complex that migrates along the membrane. Red lines will form at the control line region (C) and the test line region (T) on the cassette window. If the sample is negative for *Campylobacter*, a red line will form only at the control line region (C).



Figure 1. Lateral flow kit for the detection of *Campylobacter.*

The sensitivity test for the LFIA kit was carried out by testing different concentrations of *Campylobacter* ranging from 1×10 to 1×10^9 CFU mL^{-1}. Results in Figure 2 shows that the sensitivity of the developed LFIA kit was at 1×10^4 CFU mL^{-1}. Based on the results obtained, the developed LFIA kit is more sensitive compared to several other commercial kits in the market such as ProSpecT™ and PREMIER™

CAMPY with reported LOD values of between 10^5 and 10^6 CFU mL^{-1}, and between 10^6 and 10^7 CFU mL^{-1}, respectively (3).



Figure 2. Sensitivity test of the LFIA kit.

The specificity test of the developed LFIA kit was tested with other pathogens such as *Listeria monocytogenes, Salmonella typhimurium, Escherichia coli* and with related species such as *C. coli* and *C. lari*. The results in Figure 3 shows that the developed LFIA overwhelmingly detected *C. jejuni* and other closely related species such as *C. lari* and *C. coli* while there was no cross reactivity to *L. monocytogenes*, *S.* Typhimurium, *E. coli* and negative control indicating that the developed LFIA was specific to *Campylobacter* spp. Both of the results indicate that the LFIA kit possesses sufficient sensitivity and specificity as a detection method of *Campylobacter* spp.

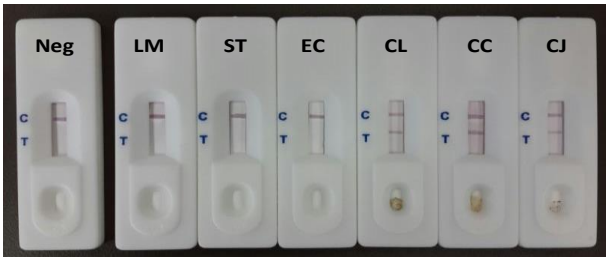


Figure 3. Cross-reaction of LFIA kit against different species of *Campylobacter* and other pathogens (LM=*L. monocytogenes*, ST=*S.* Typhimurium, EC=*E. coli*, CL=*C. lari*, CC=*C. coli*, CJ=*C. jejuni*).

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SURFACE MODIFICATION STUDIES FOR ANTI-T2 TOXIN ANTIBODY IMMOBILIZATION ON GOLD MACROELECTRODE FOR THE DETECTION OF T-2/HT-2 MYCOTOXIN

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Mycotoxins are highly toxic secondary metabolites produced by molds, affecting agricultural industry in particular cereal grains and cereal-based foods. Due to its acute toxicity and carcinogecity, the EU and in fact, many countries, have established a stringent regulation in order to control the contamination. T-2 and its metabolite, HT-2, is a trichothecene type A mycotoxin. Trichothecenes are classified in groups of A, B, C and D, depending on their basic structure (1). The clinical signs of trichothecene infection in animals include feed refusal and vomiting, growth retardation, reproductive disorders, blood disorders, dermatitis, oral lesions and depression of the immune response. Another major concern associated with T-2 toxin is the possible misuse of the chemical component as a biological warfare agent since mold-toxins are cheap and easy to obtain (2).

Detection of T-2 toxin could be either based on analytical instrumentation (e.g. GC-MS and LC-MC) or screening (TLC, ELISA, lateral flow strips) methods. The biosensor techniques reported for this toxin detection only dedicated on optical approach, namely SPR and QCM; with very little report on electrochemical biosensor. Concerning the toxicity posed by T-2 toxin, it is therefore important to develop a direct and straight forward method for its detection. With this regard, labelless detection of antibody-antigen interaction is required and such can be achieved by electrochemical impedance spectroscopy (EIS) (3). Here, we reported immobilization strategies for anti-T2 toxin antibody on gold electrode substrate for the detection of T-2/HT-2 toxin using EIS system and later the selected procedure was assessed optically.

Gold macroelectrode with a 20 x 70 mm area used in this study was fabricated in-house at Tyndall National Institute's Central Fabrication Facilities. Anti-T-2 toxin antibody and all chemicals were obtained from Sigma-Aldrich, Ireland while Veratox® T-2/HT-2 Toxin Quantitative Test Kit was obtained from Neogen. Three surface modifications strategies were chosen at initial stage to immobilize anti-T2 toxin antibody on gold surface, namely carboxymethyl dextran; and silanizations using 3-glycidyloxypropyl) trimethoxysilane (GOPTS) with poly-(ethelene glycol diamine (PEG linker) and (3-aminopropyl) triethoxysilane (APTES) with 1,4-Phenylene diisothiocyanate (PDITC) linker. Each surface modifications were carried out with four different electrodes to investigate the reproducibility of electrochemical impedance signal spectra generated from the immobilized antibody. It was found that although CM-Dextran with immobilized 0.1 mg mL^{-1} anti-T2 toxin antibody exhibited the largest signal after surface modification (Figure 1a), this technique had large electrochemical signal discrepancy between the four electrodes hence, hindered the reproducibility aspect in biosensor. GOPTS-PEG modified electrodes on the other hand, exhibited the most stable and uniform current changes. However this modification produced the smallest R_{ct} changes with no significant difference when antibody concentration was increased one-fold on the surface (result not shown). Taking into account the electrodes' stability and

fair amount of current signal generated from APTES-PDITC modified electrodes, this method (Fig. 1b) was therefore selected for further study.

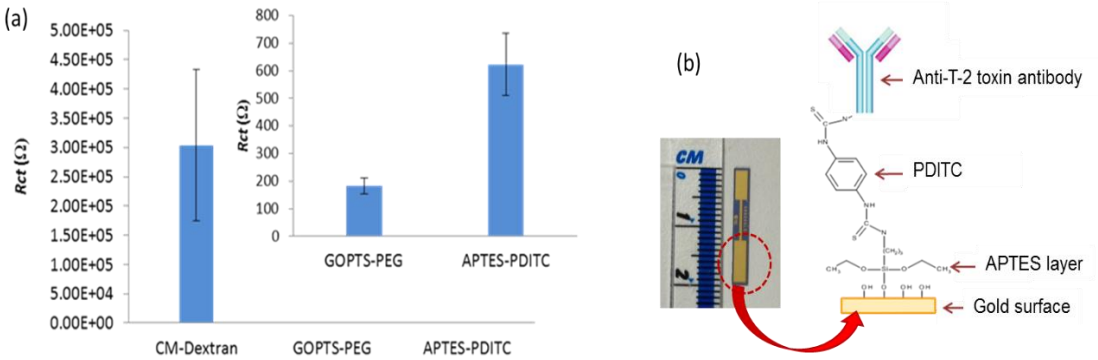


Figure 1. (a) Charge transfer resistance (R_{ct}) signal generated from electrodes with different surface modifications with immobilized 0.1 mg mL^{-1} anti-T2 toxin antibody concentration; (b) Schematic diagram of APTES-activated gold surface with antibody binding via PDITC linker (*inset*: picture of gold macroelectrode with 20 mm x 70 mm surface).

The immobilised anti-T2 toxin antibody on the APTES-PDITC modified surface was further tested by optical inhibition study. T-2 toxin conjugated horseradish peroxidase (HRP) enzyme was used to monitor the antibody immobilization. The experiments were conducted using the competitive direct enzyme-linked immunosorbent assay (ELISA) model employing two standard concentrations of 0 and 250 ppb T-2/HT-2 toxin. The absorbance of the toxin caused by enzyme-substrate interaction was inversely proportional to the concentration of T-2 toxin; typical inhibition signal associated with the ELISA method. Using the APTES-PDITC technique for antibody immobilisation, 78% inhibition was observed for 250 ppb T-2/HT-2 toxin as compared to control (0 ppb) indicating the viability of this modification protocol on the gold surface macroelectrode.

As the conclusion, the APTES-PDITC method by far has proven to be viable and compatible on the gold macroelectrode, as proven by both electrochemical impedance characterisation and optical inhibition study with ELISA approach. This technique thus, has been selected for further studies in microelectrode dimensions.

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OVICIDAL EFFECT OF *Sesbania grandiflora* LEAF EXTRACT ON NEMATODES' EGGS FROM NATURALLY INFECTED GOATS

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The resistance towards anthelmintic drugs has limited the effectiveness of conventional method for controlling gastrointestinal nematode in goats (1). Therefore, the interest to explore for natural anthelmintic from local plants is expanding (2). The present research was conducted to evaluate the antiparasitic effect of *Sesbania grandiflora* leaf extract on the egg stage of nematodes from infected goats using egg hatch assay (EHA) (3). Mixed sample of nematode eggs was tested using two types of extraction of *S. grandiflora* leaves; aqueous and ethanolic, in a separate set at six increasing 2-fold concentration from 0.075 to 2.4 mg/ml for 24hrs and 48hrs. Mean of egg hatching inhibition after both periods was presented in Table 1. *S. grandiflora* leaf aqueous and ethanolic extracts showed a significant inhibition effect for both incubation periods. Significantly higher inhibition rate ($P<0.05$) was observed for aqueous extract compared to ethanolic extract.

Table 1. Mean percentage of egg hatching inhibition (**± S.D)** after incubation with *Sesbania grandiflora* leaves aqueous and ethanolic extract at 24 hrs and 48 hrs

Incubation time/ Control	24hrs	48hrs	Incubation time/ Control	24hrs	48hrs
Negative	1.7 ± 0.42^{a}	1.73 ± 0.52^{a}	Negative	1.7 ± 0.42^{a}	1.7 ± 0.52^{a}
Positive	96.3 ± 2.31^{b}	96.7 ± 2.08^{b}	Positive	96.3 ± 2.31^{b}	96.7 ± 2.08^{b}
AE (mg/ml)			**EE (mg/ml)**		
0.075	26.3 ± 2.08^{c}	30.3 ± 1.15^{c}	0.075	22.3 ± 1.53^{c}	25.7 ± 1.15^{c}
0.15	$29.7 \pm 1.53^{c,d}$	32.3 ± 2.08^{d}	0.15	23.3 ± 2.08^{c}	31.7 ± 0.58^{d}
0.3	34.7 ± 0.58^{d}	41.7 ± 2.08^{e}	0.3	28.7 ± 0.58^{d}	35.7 ± 0.58^{e}
0.6	40.3 ± 1.53^{e}	49.7 ± 4.51^{f}	0.6	$33.3 \pm 1.15^{d,e}$	45.3 ± 1.53^{f}
1.2	44.3 ± 2.08^{e}	64.3 ± 2.08^{g}	1.2	37.3 ± 2.52^{e}	54.3 ± 3.06^{g}
2.4	55.3 ± 2.52^{f}	85.3 ± 2.52^{h}	2.4	42.3 ± 1.53^{f}	65.3 ± 1.15^{h}

Positive control: Oxfendazole; AE: Aqueous Extract; EE: Ethanolic Extract
*One-way analysis of variance (ANOVA) with Tukey post hoc test
[a,b] Means with different superscripts within a column for each group differ significantly at $P<0.05$

The increasing trend of egg hatching inhibition rate was proportionate to the increasing concentration of plant extracts used, as well as incubation period (Figure 1). These results can be related to previous study that anthelmintic potential of different plant extracts; aqueous, ethereal and alcoholic have shown anthelmintic effects in decreasing order, respectively (4).

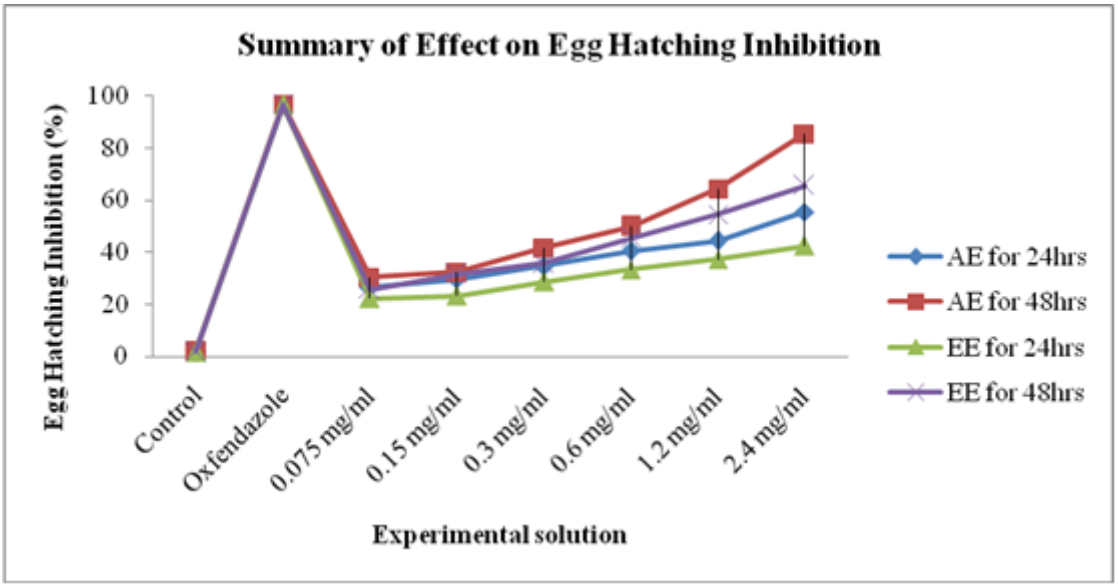


Figure 1. Means of egg hatching inhibition (EHI) rates (%) for aqueous (AE) and ethanolic extract (EE) of *Sesbania grandiflora* for two incubation periods

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ESTABLISHMENT OF MULTIPLEX PCR FOR IDENTIFIYING *Salmonella* SPP., *Salmonella* Typhimurium & *Salmonella* Enteritidis

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Polymerase Chain Reaction (PCR) have been proven to provide rapid and sensitive tools for detection of foodborne pathogens and also help in microbial forensic investigation. Therefore, the aim of this study was to establish a multiplex PCR (mPCR) with the designed primer sequences for simultaneous identification of *Salmonella* spp., *S.* Typhimurium and S. Enteritidis. Specificity of the designed primers was evaluated against selected *Salmonella* and non-*Salmonella* strains. Table 2 lists the primers used in the mPCR. The primers were designed based on the target genes adapted from previous study (2, 3, 4). Specificity of the designed primers was analysed using Basic Local Alignment Search Tool (BLAST) to find regions of similarity between biological molecules and later tested in actual experiment.

Table 2. List of designed primer sets used in singleplex and multiplex PCR assay for the detection of *Salmonella* spp., *S.* Typhimurium and *S.* Enteritidis.

Primer Name	Target Gene	Target Organism	Amplicon Size (bp)
STM_1	STM4495	*Salmonella* Typhimurium	650
STM_650	STM4495		
invA_3	*invA*	*Salmonella* spp.	500
invA_502	*invA*		
ENT_66	*sdfI*	*Salmonella* Enteritidis	103
ENT_168	*sdfI*		

Initially, mPCR was set-up as follows. A 25 µl. PCR mixture containing 1X PCR buffer, 2 mM $MgCl_2$, 1 U Taq DNA polymerase, 0.2 mM of each dNTP, 0.4 µM of each primers, 5 µl each of *S.* Typhimurium, *S.* Typhi and *S.* Enteritidis DNA. The thermocycler was programmed by 2 min at 94ºC; 35 cycles of 1 min at 94ºC, 1 min of 54ºC/56ºC, 1 min at 72ºC, 10 min at 72ºC and final hold at 4ºC. Optimisation started with optimizing Ta (54ºC and 56ºC), $MgCl_2$ concentration (2.0, 2.5 and 3.0 mM). Subsequently, primers concentration (0.2 to 1.0 µM) was optimized to obtain optimal bands visibility. PCR product was electrophoresed on agarose gel, stained with ethidium bromide and visualize under UV light. There was no obvious difference in amplicons yield when $MgCl_2$ was adjusted in the mPCR optimization (Figure 1). However, the yield of 103 bp of *sdfI* fragment was slightly increased at 2.5mM and 3.0 mM compared to 2.0 $MgCl_2$, while the yield of *invA* and STM4495 amplicons sized 650 bp and 500 bp was increased at Ta 54ºC with 2.5 mM $MgCl_2$. It was concluded that the optimum Ta and $MgCl_2$ for the mPCR was at 54ºC and 2.5 mM. Figure 2 demonstrated *sdfI* fragment yield is increased with 0.8 µM ENT_66/ENT_168 primers. Conversely, no reduction in amplicons yield when the STM_1/STM_650 and invA_3/invA_502 primers

concentration was reduced. Thus, 0.1 µM of STM_1/STM_650 and invA_3/invA_502 primers were selected as the optimum primer concentration that was able to yield amplicons without compromising the bands' intensities.

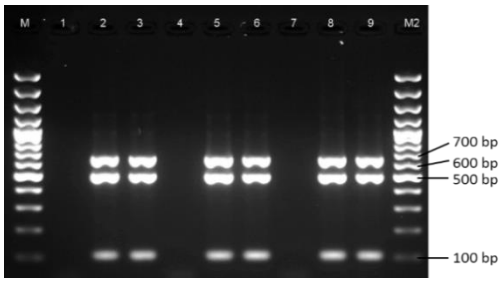


Figure 1. Optimisation of mPCR with different MgCl2 concentration with selected Ta of 54 and 56ºC with *S.* Typhimurium, *S.* Typhi *and S.* Enteritidis DNA. Note: Lane M and M2 are 100 bp DNA ladder, lane 1, 4 and 7 are negative controls for 2.0, 2.5 and 2.5 mM MgCl2 respectively, lane 1 to 3 with 2.0 mM MgCl2, 4 to 6 with 2.5 mM MgCl2, and lane 7 to 9 with 3.0 mM MgCl2.

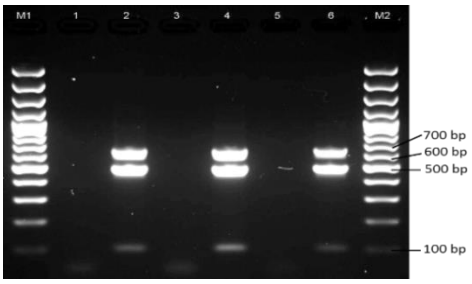


Figure 2. Optimisation of mPCR with 0.6, 0.8 and 1.0 µM ENT_66/ENT168 primer concentration, Ta at 54ºC and 2.5 mM MgCl2 with mixture of DNA template S. Typhimurium, S. Typhi and S. Enteritidis. Note: Lane 1, 3 and 5 are negative controls, lane 2, 4 and 6 are using 0.6, 0.8 and 1.0 µM ENT_66/ENT168 primer concentration respectively.

The primer pairs were specific towards its target (Figure 3) with *S.* Typhimurium DNA only generated 2 products at 650 bp and 500 bp size (lane 2), while *S.* Enteritidis DNA only generated 2 products at 500 bp and 103 bp (lane 3) and *S.* Typhi DNA produced a single product at 500 bp size (lane 4) which represent *Salmonella* spp. amplification. No amplification was observed when DNA from non-*Salmonella* strains, *E. coli* O157:H7 (lane 5) and *L. monocytogenes* (lane 6) was used.

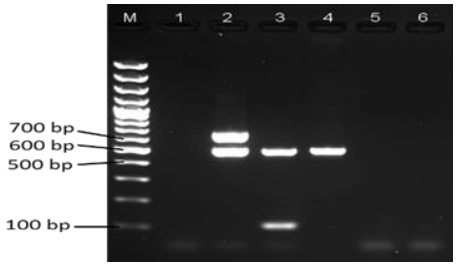


Figure 3. Specificity test of multiplex PCR with optimized condition using DNA of *S. Typhimurium, S. Enteritidis and S. Typhi, E. coli O157:H7 and L. monocytogenes. Note: Lane 1 is negative control, S. Typhimurium (lane 2 and 8), S. Enteritidis (lane 3), S. Typhi (lane 4), E. coli O157:H7 (lane 5) and L. monocytogenes (lane 6).*

In conclusion, the mPCR was successfully established with optimized conditions of 2.5 mM $MgCl_2$, Ta of 54ºC, 0.1 µM of STM_1/STM_650 and invA_3/invA_502 primer pairs and 0.8 µM ENT_66/ENT_168 primers with 0.2 mM dNTPs, 1 U Taq DNA polymerase and 5 µL DNA template.

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SURVEY OF FEEDING PRACTICES AMONG A SUBPOPULATION OF HORSE STABLE MANAGERS IN SELANGOR AND WILAYAH PERSEKUTUAN KUALA LUMPUR

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Nutrition is a key component of equine health and performance. Nutritional imbalances contribute to nutrition-related disorders such as obesity, colic and laminitis (1). A number of studies have been published examining feeding practices of horse owners (1, 2, 3). Data on the current feeding practices in the Malaysian equine industry has not been reported. The present study was conducted to survey the current feeding practices of horses as well as to determine the balance of digestible energy and crude protein intakes.

A total of six stable managers from six stables in Selangor and Kuala Lumpur were given each a survey questionnaire. The survey included questions on the horses' type of use, breed, age and weight, feed and supplement information as well as feeding practices. Information on feed nutrient compositions were obtained from feed packaging and the internet. Then, horse data and feed information obtained from the survey were incorporated into the Horse Ration Formulation software (CFC Tech Services Inc., Minnesota, USA) to determine the balance of digestible energy and crude protein intakes. A total of 134 horses were used. Body condition score was evaluated using Henneke horse body condition scoring system (4). This system evaluates a horse's body condition on a scale of 1 to 9, regardless of breed, body type, sex or age. The most common breed represented were Thoroughbred and Pony (n = 5, for each) followed by Warmblood cross (n = 4). Other reported breed were Thoroughbred cross, Arabian Anglo, Belgium Draft cross (n = 2, for each). Variety of other breeds were also represented. The most common type of horse represented were light work (n = 5) and maintenance (n = 5), followed by moderate (n = 4) and heavy work (n = 4), and intense work (n = 2) and growing (n = 2). The most common weight of horse represented was 600-700 kg (n = 6), followed by 400-500 kg (n = 4) and 500-600 kg (n = 4), 200-300 kg (n = 3) and 700-800 kg (n = 3), 300-400 kg (n = 1) and >799 kg (n = 1).

All six managers reported to include wheaten chaff in their horses' diet (n = 6), four managers reported to include timothy hay (n = 4) and two managers reported to include lucerne hay (n = 2). All managers reported feeding commercial pre-mixed feed (n = 6) and at least one type of concentrate to horses at their respective stables. Three managers reported feeding concentrate in combination with either wheat bran, soybean hull or palm kernel extract (n = 3, for each). Five managers reported feeding at least one dietary supplement (n = 5), while one manager did not include any supplement. The most commonly used supplement was electrolytes (n = 5), followed by hoof supplement (n = 3). Other reported supplements included were minerals for bone health (n = 2), oils (n = 2), salt (n = 2), multivitamins (n = 1) and molasses (n = 1). Three managers reported feeding their horses 3 times/day (n = 3), two managers reported 4 times/day (n = 2) and one 5 times/day (n = 1). Five managers reported providing daily intake level (dry matter) of 2.5% of body weight (n = 5) and one manager reported 2% of body weight (n = 1). Results from the software showed that horses in most stables had excessive (n = 5) and deficient (n = 6) daily digestible energy intake. None of the horses had a balanced daily digestible energy intake (n = 0). Majority of the stables had horses with body condition

score of 7 (fleshy) (n = 6), followed by score of 6 (moderately fleshy) and 8 (fat) (n = 4, for each), score of 5 (moderate) (n = 3) and score of 4 (moderately thin) (n = 1).

Horses with excessive intake of digestible energy in the long term, may increase body fat resulting in fleshy and fat horses. Evidence of inappropriate feeding practices have been reported in other countries (1, 3, 5). Classification of workloads requires determination of heart beat rate during exercise which made it difficult to measure (6). Thus, it was challenging to determine the actual workload and this may have contributed to the imbalance energy intake in the current study. Horses in all stables had excessive and deficient daily crude protein intake (n = 6, for each). None of the horses had a balanced crude protein intake (n = 0). Crude protein may be met if digestible energy was increased in the diets of horses studied. This is because higher protein feeds tend to be also high in energy.

In conclusion, all managers fed their horses with combinations of varieties of forages, pre-mixed feeds and supplements. Horses in all six stables had imbalance energy and protein intakes. Horses in majority of the stables were considered fleshy and fat. These results may reflect incorrect feeding and inaccurate workload estimation. The results of this survey suggest that there is a need for further investigation on the knowledge of stable managers in feeding and nutritional management of horses.

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THE EFFECT OF *Leucaena leucocephala* SUPPLEMENTED DIET ON RUMEN MICROBIAL POPULATION OF GOATS

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Leucaena leucocephala are widely known for its excellent source of high protein fodder. It can be used to improved diet quality, feed intake and post ruminal protein degradability in comparison to other forages containing secondary metabolites (2, 4). However, *L. leucocephala* contains two secondary metabolites; tannins and mimosine that may impair animal growth and performance. The presence of these metabolites may affect the rumen ecology through changing its microbial population. With new emerging technologies such as real-time PCR, the rumen ecology of the animal can be explored in faster way with more accurate methods. This method provide high sensitivity, fast and accurate result in which the manual quantification method lack of. It can give us a clear picture on which rumen microbial population has been affected by *L. leucocephala* based diet. This study was conducted to know which microbial population in the rumen were affected by feeding the goats with different level of *L. leucocephala* in the diets through quantification of rumen microbial population by real-time PCR method.

Rumen samples were obtained from the goats fed with 0% of *L. leucocephala* leaves, 25% of *L. leucocephala* leaves, 50% of *L. leucocephala* leaves and 75% of *L. leucocephala* leaves. The DNA were extracted from the rumen samples and were quantified by real-time PCR for 3 major cellulolytic bacteria; *Ruminococcus albus, Ruminococcus flavefaciens,* and *Fibrobacter succinogenes.*

Rumen microbial population were found significantly different ($p<0.05$) between different percentages of *L. leucocephala* inclusion. The higher amount of *L. leucocephala* was included in the diet, the amount of *R. albus* and *F. succinogenes* found in the rumen show a decreasing trend (Table 1).

Table 1. The effect of different level of *L. leucocephala* leaves on three cellulolytic bacteria in the rumen of goats.

Item	*Leucaena leucocephala*			
Log_{10} copy no. per ml	0%	25%	50%	75%
R. albus	$8.26^{a} \pm 0.19$	$7.52^{ab} \pm 0.13$	$6.80^{b} \pm 0.31$	$6.87^{b} \pm 0.44$
R. flavefaciens	$11.31^{c} \pm 0.07$	$11.44^{cd} \pm 0.11$	$11.58^{d} \pm 0.02$	$11.66^{d} \pm 0.08$
F. succinogenes	$7.66^{e} \pm 0.16$	$6.85^{f} \pm 0.20$	$7.33^{ef} \pm 0.13$	$6.88^{f} \pm 0.26$

Values are mean ± SD for three goats in each group. Values with different superscripts in a row differed significantly at $p < 0.05$

This may be related to the increasing amount of secondary metabolites (tannin and mimosine) in the diets that may reduce the activity of cellulolytic bacteria as (2) found that in sheep fed with tannin containing diets has low amount of rumen cellulolytic bacteria however with their microbial protein synthesis remain intact. Meanwhile, the increment of *R. flavefaciens* population may have caused by high amount of leaf fraction in the treatment diets as the percentage of *L. leucocephala* leaves included were increased. This is in line with a study by (3), where *R. flavefaciens* colonisation in the rumen of sheep was found to occur into the plant leaves rather than into the stem.

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COMPARATIVE STUDY ON THE EFFECTS OF FEEDING FORMULATED RATIONS BASED ON LOCAL BY-PRODUCTS AND IMPORTED FEEDSTUFFS ON GROWTH RATE AND MILK YIELD OF LACTATING DORPER EWES

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The utilization of local feed resources is a priority to overcome the high cost of imported feed stuffs (1). Local agro-industrial by-products such as palm kernel cake, copra meal, rice bran and palm fatty acid distillates (PFAD) are available for use in the animal feed industry to reduce the cost of ruminant feed. Most of these feedstuffs have limitations in terms of nutrient content and the presence of anti-nutritive factors, which limit their nutrient digestibility and absorption. Lactating animal needs adequate nutrition for optimum milk production. The objective of this study was to evaluate the effect of feeding rations based on local agricultural by-products on rate of growth and milk yield of lactating Dorper ewes.

Twenty (20) lactating Dorper ewes with single lambs of mixed sex were randomly allocated into two treatment groups and fed, T1; feed formulated based on local by-products or T2; based on imported feed stuffs (control group) (Table 1). In both treatment groups, all the animals were fed Napier grass *(Pennisetum purpureum)* silage and concentrate ration over 30 days trial period at a ratio of 60:40 based on an estimated dry matter intake (DMI) of 2.5% of body weight. Each ewe was fed 340g of concentrate twice per day divided in two portions 0800 and 1600, while fresh Napier grass silage was given throughout the trial period. Drinking water was provided *ad libitum.* Both concentrate rations (T1 & T2) were formulated to meet the requirements of lactating Dorper ewes (Table 1) (2).

Table 1. Composition of concentrate diets

	T1	T2
Feed stuffs	(%)	(%)
Corn	16.0	34.0
Soybean Hull	25.0	24.0
Wheat pollard	-	35.0
Copra Meal	25.0	-
Palm Kernel Cake (PKC)	9.5	-
Rice Bran	17.0	-
Palm Fatty Acid Distillates (PFAD)	1.0	-
Di calcium phosphate (DCP)	1.5	2.0
Molasses	3.0	3.0
Salt	1.0	1.0
Mineral-Vitamin premix	1.0	1.0
Calculated cost (RM/kg)	109.8	117.1

The body weight changes of ewes were recorded before and after the trial period, while their milk yield was recorded once a week based on weighing-suckling-weighing methods (3). The nutritive values and intake of both rations was measures but not reported in this article

Data on body weight gain (BWG) and milk yield are shown in Table 2. There was no significant differences in the final BWG and milk yields. Milk yields compared favourably to those of hair sheep and dairy sheep with values of 1.11 kg/day (3) and 1.37 kg/day (4) respectively.

Table 2. Body weight changes and milk yield of lactating Dorper ewes fed with two formulated TMR

Parameter	T1	T2 (Control)	SEM	P value
Initial body weight (kg)	33.78	34.02	7.75	0.81
Final body weight (kg)	38.06	38.94	8.83	0.80
Weight gain (g/day)	145	165	0.001	0.21
Milk yield (kg/day)	1.09	1.33	0.085	0.08

It was concluded from this study that lactating Dorper ewes can be fed rations formulated based on local agro-industrial by-products.

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EFFECTS OF SUPEROVULATION HORMONES ON *IN VIVO* BOVINE EMBRYO PRODUCTION

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Superovulation is one of the crucial steps in multiple ovulation and embryo transfer (MOET) techniques which directly influences the quality and quantity of embryos harvested (1). However, the response to induced superovulation is very unpredictable and continues to be one of the most frustrating problems to solve in MOET. Therefore, the objective of this study was to compare the superovulatory response (SR) of donors, embryos production rate, and quality of embryos collected from thirty-three Charoke cows treated with either FSH or eCG superovulation hormones.

All donor cows were hormonally treated according to established protocol (2). Each cow received a controlled internal drug releasing device (CIDR-B; pfizer®, Eazy-Breed, New Zealand) containing 1.9 g progesterone for 12 days. On day 9 to 12, a total of 10 ml follicle stimulating hormone (FSH) (ovine pituitary extract, ICPbio limited, Auckland, New Zealand) was administrated intramuscularly for four consecutive days at a decreasing dose in eighteen cows, whereas, another fifteen cows received 800 IU Equine Chorionic Gonadotrophin (eCG, Folligon, Intervet International B.V.) on day 10. These were followed by 2 ml intramuscular injections of Prostaglandin-F2α (PGF2: Estrumate, Schering-Plough) on day 11 prior to CIDR-B removal. Six hours after detection of standing heat, 2 ml of receptal (Schering-Plough) was given and artificial insemination (AI) was carried out at 48, 60 or 72 h after CIDR removal. *In vivo* embryos were collected non-surgically from donor cows on day 6 after the last insemination.

As shown in Table 1, no significant differences were observed between all parameters in the FSH and eCG groups. However, the number of donors with positive SR was higher in the FSH group compared to eCG group. The results were similar to those reported by Purohit et al. (3) that the effects of superovulation with FSH treatments were at least similar or higher than that of using eCG. In the present study, 56% of donor cows responded to the FSH superovulation treatments compared to 40% in the eCG treatments. In another study, 70-94% of the donor cows were responsive to gonadotrophin FSH treatment (3, 4, 5). The reduced number of donors that responded to the superovulation treatment in the present study may be related to the type and dosage of hormones used (6). In the present study, however, embryos harvested per animal did not differ between FSH and eCG group. In eCG group, no degenerated embryos were found but higher number of unfertilized oocytes were observed compared to FSH group. A previous study reported that the number of in vivo embryos recovered from superovulatory treatments was highly variable (7). Super ovulated beef cows were showed to produce an average of 6.76 transferable quality embryos (8). In the present study, however, an average of three transferable embryos was collected per animal using either FSH or eCG hormones. In a previous study, the number of transferable quality embryos collected ranged between 4.0 – 8.2 among treatments which was associated to

the type and dosage of hormones used (6). The differences between our results and those reported earlier may be due to the variability in the superovulatory responses of donor cows following gonadotrophin treatments, breed of donor cows, and environmental conditions (5, 6). Numbers of embryos collected was reported to vary significantly among donors (5).

Table1: Effect of gonadotrophins on superovulatory response (SR) and embryo production in Charoke cows.

Parameter	Gonadotrophin treatments			
	FSH-Ovagen		eCG-Folligon	
Number of donors	18		15	
Positive SR	2.50 ± 1.19 [a, xy]	10 (56%)	1.50 ± 0.29 [a, xy]	6 (40%)
Total ova recovered -n	6.00 ± 1.41 [a, y]	30	2.75 ± 0.75 [a, y]	19
Viable embryos	4.50 ± 2.06 [a, xy]	18	2.75 ± 0.75 [a, y]	11
Degenerated embryos	1.00 ± 0.58 [a, x]	8	0 [a, x]	0
Non-fertilised oocytes	2.00 ± 0.76 [a, xy]	4	2.00 ± 0.82 [a, y]	8

Values for recovery of embryos are mean ± standard error of the mean, per cow with positive SR.
a mean between coloum within the same row were significantly different at $p>0.05$.
x,y means within same coloum with different superscrifts were significantly different at $p<0.05$.

In conclusion, both gonadotrophins hormones can be used to superovulate Charoke cows under local conditions.

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FIRST REPORT ON DEVELOPMENT OF GOAT BREED IDENTIFICATION MARKERS BASED ON COMMERCIAL SNP ARRAY

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The demand for goat meat has increased over the year since 2000. This is reflected by the increased in the number of goat slaughtered from 37, 653 to 63, 638 in 2012 and 2014 respectively (MOA, 2014). However, according to MOA, this contributed to only 18.1% of the national SSL rate. Therefore, proactive efforts are needed to increase our national SSL rate for the goat meat production. There are about 4500 farmers and entrepreneurs currently rearing goat in Malaysia but 75% of them are small-scale farming. Improper breeding and selection due to the lack of knowledge and information in the genetic backgrounds is one of the factors contributing to the slow growing of Malaysia's goat farming industry. The goat population in Malaysia is comprised of the indigenous Katjang goat with several exotic goats such as Jamnapari, Boer, Kalahari, Saanen and Savanna goat. The Katjang goat has a high tolerance to the local environment but it has low meat quantity. Thus, several attempts have been made to cross Katjang goat with the exotic introduced breeds to develop goat breed with both high local environment tolerance and meat quantity. However, disorganized and uncontrolled crossbreeding activities have caused inbreeding and loss of genetic diversity. This is supported by a study conducted by MARDI through the use of microsatellite markers that showed a low genetic diversity was detected in several goat populations in Malaysia. Several studies also stated that the indigenous Katjang goats were being excluded in breeding efforts which lead to the extinction of the Katjang purebred. Through the discussion with Animal Science Research, MARDI with Malaysian Department of Veterinary Service had claimed the pureness of Katjang goat was only 70% based on the phenotypic data recorded. Although MARDI has applied microsatellite marker in the study of several goat populations, it is still insufficient for researchers to analyse the pureness of Katjang goat. This study therefore aims to apply the commercial whole genome markers panel to determine the ancestors of mixed breed of the current Katjang goat for the establishment of purebred. In addition to conservation purposes, the purebred Katjang goat population can be used in any genetic improvement program in Malaysia. The advancement of SNP genotyping technology (Illumina iScan) in MARDI has allowed the application of high throughput genotyping to this study resulting more powerful resolution in achieving the objectives targeted. Currently high Density SNP panel (50K SNP) is available to help breeders and researchers in assisting any goat improvement program. However this technology is very costly and therefore it limits the

SNP panel application by the target user. Thus, a cheaper, smaller and more precise SNP panel need to be develop for widespread application.

There are two types of samples that will be used in this study. The first sample is Katjang goat from different location in Malaysia consists of Katjang from Selangor (MARDI), Langkawi, Pahang (Tasik Bera), Negeri Sembilan, Pantai Timur, and Borneo. These Katjang goat are claimed to be pureline and have no history recorded of being cross with other exotic goat breeds in Malaysia. The second sample is other possible exotics goat purebreeds such as Kalahari, Saanen, Boer, Savannah, and Jamnapari. At least 30 individuals will be collected for each breed/location. The DNA from all blood samples will be extracted using modified DNA extraction protocol kit from Qiagen®. The quality control for the DNA will be further conducted using agarose gel electrophoresis system (DNA qualification) and fluoroskan (DNA quantification). Illumina commercial goat 50K SNP Panel will be used to genotype Single Nucleotide polymorphisms (SNPs) on a genome wide scale for 384 samples collected. This process consists of 3 days of beadchip process before Illumina iScan is used to scan the beadchips. This SNP panel was developed by members of the International Goat Genome Consortium from Saanen, Alpine, Creole, Boer, Katjang, and Savanna goat breeds. Genotyped data will be viewed using Genome Studio software and will be screened and filtered under strict criteria of data quality control such as Gen Train Score, Cluster Separation, Call Frequencies, Heterozygous excess, Minor Allele Frequencies and many more. All the final genotyped data will be used as input data for secondary analysis software such as Package for Elementary Analysis of SNP Data V1.0 (PEAS), STRUCTURE V2.3.3, Cluster Matching and Permutation Program (CLUMP), and GenAlex.

The availability of this smaller SNP Panel that is cheaper, precise, and more flexible to be applied in goat improvement program and would permit discrimination between goat breed in Malaysia. The result indicates the potential of 50K SNP array as a powerful tool for developing breed identification markers.

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EFFECT OF INCLUSION OF PALM KERNEL MEAL IN EXTRUDED PELLET FEED ON THE GROWTH OF TILAPIA

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Palm kernel meal (PKM) is a by-product of palm kernel oil extraction from the palm tree (*Elaeis guineensis* Jacq) nut. In Malaysia, about 4.7 million tonnes of palm kernel were harvested in 2012 producing about 2.16 million tonnes of palm kernel oil together with 2.40 million tonnes of palm kernel meal (1). Crude palm kernel oil is extracted from the kernels either by mechanical screw pressing or solvent extraction. However, due to cost and the safety issue, solvent extraction is not common as mechanical screw press method.

Palm kernel meal produced from the mechanical screw press method contains about 14.5-19.6% crude protein, 13.0-20.0% crude fiber, 5.0-8.0% fat, 3.0-12.0 ash and 5.4-12% moisture (2). Due to its availability, nutrient composition and cost competitive, PKM has been used as animal feed in ruminant, poultry and swine industry. It also suitable as energy and protein feed for tilapia with the supplementation of amino acids. However, it may not be suitable if included at high levels in animal diets due to its low digestibility in animal. Many researches have been conducted to increase the level of PKM in animal feed. One of the ways is using extrusion method to increase the digestibility of PKM. In extrusion, high temperature and steam condition can decrease the content of non-polysaccharides and thus increase the digestibility of crude fiber in animal. Thus, this study was conducted to evaluate the effect of inclusion of 15% PKM in extruded pellet feed on the growth performance of red hybrid tilapia.

A total of 300 monosex juvenile red hybrid tilapias with the initial weight of 23 g were purchased from a hatchery in Rawang, Selangor. Fish were adapted to the cultured tank system for 14 d before starting the experiment. The fish were then assigned randomly to three diets, each treatment with five replications of 30 fish per replicate. The fish were fed either Diet A (control diet) or Diet B. Diets were formulated to be isocaloric (12 MJ/kg) and isonitrogenous (34% crude protein). The fish were fed the experimental diets at a rate of 3% of the tank fish biomass twice a day at 0900 and 1600. All fish were reared in a 400 L polyethylene tank with 30 min of aeration every hour. Water exchange was done once the water quality is not in the acceptable range for tilapia growth, with about 30 to 80% of the water replaced. Measurement of body weight gain was carried out fortnightly using a weighing machine before morning feeding. Feed intake was recorded weekly. Data were subjected to analysis of variance using Tukey's test at the 0.05 level with software SAS 9.4.

In this study, fish fed on 15% PKM had higher final body weight and weight gain compare to control diet. This is due to inclusion of PKM diet might enrich the flavour of the extruded pellet diet. Higher feed intake of 15% PKM by fish is shown in Table 1. Besides that, FCR of fish fed on 15% PKM was better than control diet. This might due to digestibility of PKM diet is higher than control diet. This study is in line with a study by Omoregie and Ogbemudia (3) whereby they found out inclusion of 15% PKM is recommended in Nile tilapia diet.

Table 1. Growth performance of red hybrid tilapia fed with palm kernel meal-based diets for 16 weeks.

Growth performance	Control	15% PKM
Initial body weight (g/fish)	23.61	24.17
Final body weight (g/fish)	224.44b	278.33a
Weight gain (g/fish)	200.84b	254.17a
Feed intake (g/fish)	262.72b	303.10a
FCR	1.31a	1.19b
SGR (%/day)	2.01b	2.18a

Feed conversion ratio, FCR= Total feed intake in dry basis (g)/weight gain (g)
Specific growth rate, SGR (%/day) = (Log_a final weight/ Log_a initial fish weight)/time interval x 100
Values in each row with different superscripts have significant differences ($P<0.05$)

In conclusion, fish fed on 15% inclusion of PKM diets had better growth performance when compared to diet without PKM. Further study on the utilization of PKM in fish diets is suggested to develop a sustainable aquaculture using local feed ingredients.

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DETECTION OF *EIMERIA* SPECIES BY POLYMERASE CHAIN REACTION BASED ON SPECIES-SPECIFIC SCAR MARKERS IN COMMERCIALLY-REARED CHICKENS IN SELANGOR, MALAYSIA

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Coccidiosis induced by *Eimeria* species infection is an important parasitic disease of poultry. It causes production losses, interruptions of feeding, digestion and nutrient absorption processes, blood loss, dehydration, and increased susceptibility to other disease agents, ultimately resulting in high morbidity and mortality rates. Species identification has been classically based on observation of oocyst shape, size and color, prepatent period, location of the lesions in the intestine, sporulation time, and characteristics of the endogenous stages in the intestinal mucosa. However, oocyst size and shape are less useful diagnostic characteristics in chickens than once thought because of the extensive overlapping in size. The objective of this study is to survey the presence of *Eimeria* spp. in local farms by using SCAR-PCR.

The samples of litter were collected from throughout different district of Selangor which involved 8 farms that were 7 closed systems and 1 opened system farms in Kuala Selangor. Litter samples (faeces) were took randomly over one flock in single house (~30+ grams) x 10 in falcon tubes were taken. The samples were pooled and treated as one test unit. Oocyst collection, purification and sporulation followed standard procedures. The DNA was then extracted with phenol:chloroform:isoamyl alcohol (25:24:1) (Fluka, Sigma-Aldrich, US).The multiplex PCR using SCAR primers for identification of the seven *Eimeria* species that infect chickens (1) was standardized using pure DNA samples

The amplified PCR products from different broiler farm were run in 1% agarose gel. Figure 1 and 2 indicates the corresponding amplified band in different commercial poultry farms in Selangor. During this study it was found that three out of seven species namely *E. tenella, E. acervulina* and *E. mitis* were successfully detected from 8 farms samples. From the 8 farm samples analyzed, 6 showed the presence of multiple infections of Eimeria spp. Coccidiosis is considered as one of the most economically important diseases of domestic poultry that is responsible for significant economic losses to the worldwide poultry industry. It is remains to be one of the major diseases problems of poultry industry spite of advances made in prevention and control through chemotherapy, management and nutrition. The detection of coccidiosis in chickens by traditional technique are not sufficiently reliable and PCR based method of DNA sequence could resolve this problem. The present study was able to verify that that modern molecular tools might replace the traditional approach and this knowledge can be invaluable in developing species-specific single strain or multi-strain vaccine. The data also can be helpful to conduct molecular epidemiological investigation of coccidiosis in the whole country or in the region.

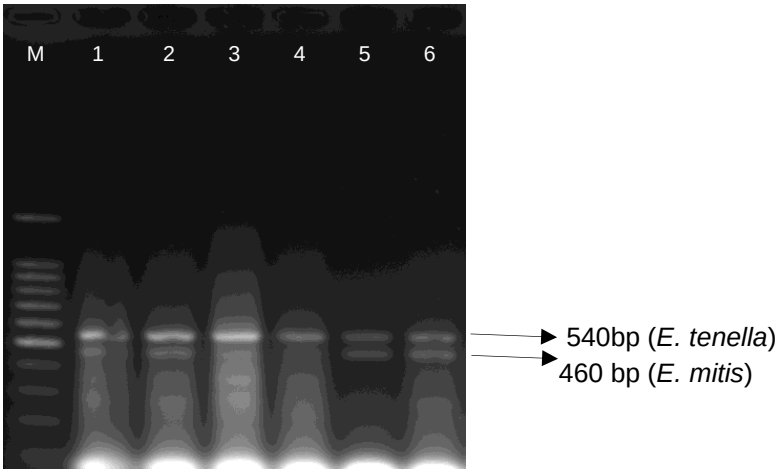


Figure 1. Lane 1: Kuala Selangor (23 days), Lane 2: West Port (33) Lane 3-4: Kuang (27, 34); Lane 5-6: Semenyih (21, 28) and Lane M: 100-bp DNA ladder

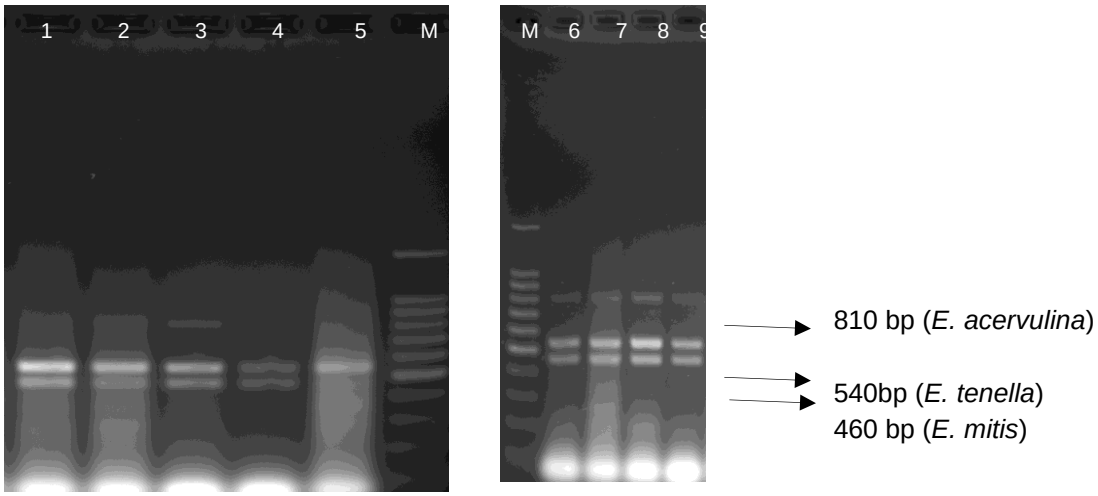


Figure 2. Lane 1-2: Jalan Kebun (25,33), Lane 3-4: Tanjung Sepat (23, 32), Lane 5: Kundang (21), Lane 6-7: Sungai Besar (28,30), Lane 8: Jalan Kebun (29), Lane 9: Tanjung Sepat (33) and Lane M: 100-bp DNA ladder

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THE EFFECTIVENESS OF ENCLOSED POULTRY HOUSE WITH EVAPORATIVE COOLING PAD SYSTEM DURING EL-NINO HEATWAVE IN MALAYSIA

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Heat stress is a major limiting factor that can negatively influence the productivity of poultry. Most poultry are comfortable at ambient temperatures below 25° C. When temperature exceeds 25° C, poultry productive performance is reduced. Our local environment is fairly constant throughout the year with temperatures fluctuating between 23° C to 34° C and relative humidity 55% to 94% (1). The most recent El Nino cycle in early 2016, bringing with it dry spells and drought throughout the country have a severe impact on agriculture production in Malaysia.

El Niño is the warm phase of the El Niño Southern Oscillation (commonly called ENSO) and is associated with a band of warm ocean water that develops in the central and east-central equatorial Pacific including off the Pacific coast of South America (2). El Niño is accompanied by high air pressure in the western Pacific and low air pressure in the eastern Pacific. The El Niño effect is found to be most severe in the Asia and Pacific region. For instance, it causes hot and dry weather and also increases the frequency and severity of bush fires. El Niño conditions usually coincide with a period of weak monsoon and rising temperatures which adversely affects Southeast Asia's agricultural sector, increases domestic food prices, and adds to inflation and inflation expectations (3). Various evaporative cooling methods have been implemented to reduce heat stress during hot weather. There are two types of evaporative cooling system that are commonly used in animal housing: misting or fogging system and evaporative cooling pad system. Evaporative cooling pad system are currently the most effective and efficient system for cooling animal house. The system is employed in a fan-ventilated animal house and cannot be used with natural wind ventilation because it requires a static pressure drop across the pad. Previous studies showed that evaporative cooling methods were not just efficient in low humidity areas but also effective in hot humid environments (4, 5).

This study was conducted at Malaysia Agricultural Research and Development Institute to evaluate the effectiveness of the MARDI's improved design enclosed poultry house equipped with evaporative cooling pad system during El-Nino phenomenon. The temperature and humidity of the enclosed house and the outside environment were monitored using the electronic temperature-relative humidity data loggers (Extech®-USA, Temp/RH-Log). Both temperature and humidity were recorded at an interval of 30 minutes. Results showed that the environmental parameters of the enclosed house were significantly ($p<0.05$) lower than the outside temperature (Table 1). In can be observed from this study that the enclosed house system was effective in keeping the internal temperature of the environment suitable for poultry production under extreme hot weather condition especially during El-Niño heatwaves events. These values have been reported in numerous studies (4, 5), but it should be noted from this study that there is a significant variation (1.37°) between ends of the poultry house. This has to be taken into consideration when designing and populating enclosed poultry houses to account for variation in growth performance.

Table 1. Mean temperature of the MARDI's improved enclosed house as compare to the environmental temperature.

Treatments	Mean Temperature (C)	Mean Humidity (%)
Temperature reading at point A (fan end of enclosed house)	27.48[a]	80.21[a]
Temperature reading at point B (middle enclosed house)	27.50[b]	85.15[b]
Temperature reading at point C (cooling pad end of enclosed house)	26.11[c]	89.67[c]
Environmental Data	33.52[d]	56.10[d]

Means within the same column with different superscripts differed significantly ($p<0.05$)

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MARDI NANOSENS ANTIBIOTIC: RAPID AND COST-EFFECTIVE METHOD FOR THE ANALYSIS OF ANTIBIOTIC RESIDUES IN CHICKEN SAMPLE

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Antibiotics are used in animal farming to prevent disease, to treat disease and to promote the growth of animals. Antibiotic growth promoters improve production by cutting animal finishing times, dropping the feed conversion rates, decreasing the incidence of animal mortality and by improving the animal's overall condition. Many countries have been moving towards a complete ban on antibiotic growth promoters for some time. The use of antibiotics for agricultural purposes has created concerns about antimicrobial resistance. According to World Health Organisation (WHO), more than half of global production of antibiotics is used on farm animals. In the last 30 years the use of penicillin-type drugs in farm animals has increased by 600%. Therefore, many other countries in the world are increasingly shifting towards banning and monitoring the use of antibiotics in animal farming industry. This paper described the performance of the MARDI NANOSENS ANTIBOTIC biosensor for the detection of antibiotic residues in chicken samples. The detection methods are based on competitive enzyme immunoassay for the quantitative analysis of Tetracycline, Streptomycine, Vancomycine, Nitrofuran and Chloramphenicol using disposable screen-printed electrode and portable electrochemical reader for the measurement of the antibiotic residues. MARDI NANOSENS ANTIBIOTIC strip (screen printed electrode) was developed by immobilizing the capture antibody (polyclonal antibody raised against antibiotic) on the working carbon electrode surface. The detection enzyme conjugates (antibiotic-HRP) will form the competitive assay on the sensor surface during the sample application. The current measurement of the enzymes-substrate reaction was then measured using digital portable electrochemical reader comprise an electron transfer mediator, 3,3',5,5'-tetramethylbenzidine dihydrochloride (TMB) with H_2O_2 as the substrate system (1). This resulted in current amplification since several enzyme molecules were attached to each particle acting as signal enhancement enabling lower detection limit for antibiotic in chicken samples as compared with ELISA (Figure 2).

A total of 74 chicken samples (5 grams) from various sources (local outlet, supermarket kampong chicken and MARDI experiment chicken) were mixed with 5g sodium sulphate and were placed in 50mL centrifuge tube before grinding with the homogeniser. Later all samples were tested using MARDI NANOSENS ANTIBIOTIC (3).

Figure 3, indicates the performance of the MARDI NANOSENS ANTIBIOTIC after validated with ELISA and LCMS/MS for chicken samples analysis, and shows significant correlation plot which demonstrated the comparable results for MARDI NANOSENSE ANTIBIOTIC with both established commercial detection methods ELISA and LCMS/MS. The residues result shows that chicken from local outlet still contains antibiotic residues but the amount detected were lower from the Maximum Residual Limits (MRLs, 100ppb).

As conclusions, MARDI NANOSENS ANTIBIOTIC strip which applied an electrochemical immunosensor approach using nano-particle amplification was successfully developed and tested for antibiotic residues from local chicken samples and the sensor performance was validated with ELISA and LCMS/MS method. MARDI NANOSENS ANTIBIOTIC is a promising tool for real time, sensitive and can be used for on-site analysis of antibiotic residues in poultry industry.

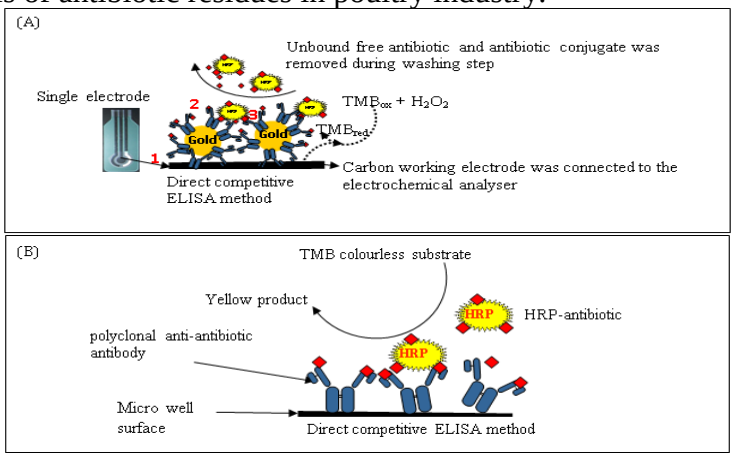


Figure 2. The principle of detection using MARDI NANOSENS ANTIBIOTIC strip and ELISA for antibiotic

(A): Schematic of sensor surface showing antibiotic capturing by its antibody using competitive assay; (1) Indicate the specific antibody against antibiotic was coated on gold surface of nano-particle and physically adsorbed on carbon working electrode (2) Antibiotic were captured by the antibody and, (3) Antibiotic conjugated with HRP which act as the detector which will give the signal when TMB-H2O2 substrate was applied to the electrode surface.

(B): Schematic of ELISA microplate surface showing antibiotic capturing by its antibody using competitive assay and yellow product from enzyme-substrate reaction was measured using spectrophotometer at wavelength 405nm which indicates the antibiotic content in the samples

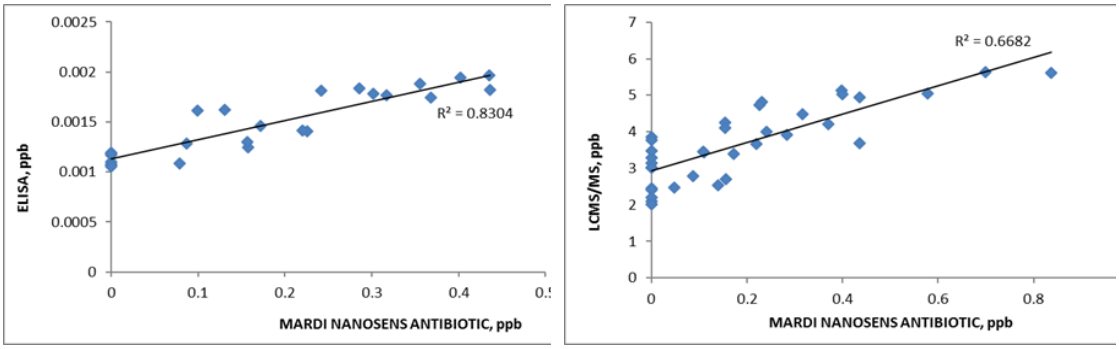


Figure 3. Correlation plot of the antibiotic residues from chicken samples analysed using MARDI NANOSENS ANTIBIOTIC strip, ELISA and LCMS/MS method.

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