SERTIFIKAT ETIK PENELITIAN
No: 14/ANVET/VII/2019

Yang Bertanda Tangan Di Bawah Ini, Ketua Komisi Etik Penelitian (Animal Care and Use Comitee) Divisi Anatomi Veteriner Fakultas Kedokteran Hewan Universitas Airlangga

Dengan Ini Menyatakan Persetujuan Tentang Pelaksanaan Penelitian Yang Diusulkan

Judul	: Mars Modelling of The Ossa Costarum Sequence on The Rib Cage of Ettawah Crossbreed Goat (Pemodelan Ossa Costarum Kambing Peranakan Etawah)
Peneliti Utama	: Dr. Soeharsono, Drh.,M.Si
Unit Lembaga	: Laboratorium Anatomi Veteriner
Dinyatakan	: LAIK ETIK

Dapat disetujui pelaksanaannya selama tidak bertentangan dengan nilai-nilai kesejahteraan hewan.

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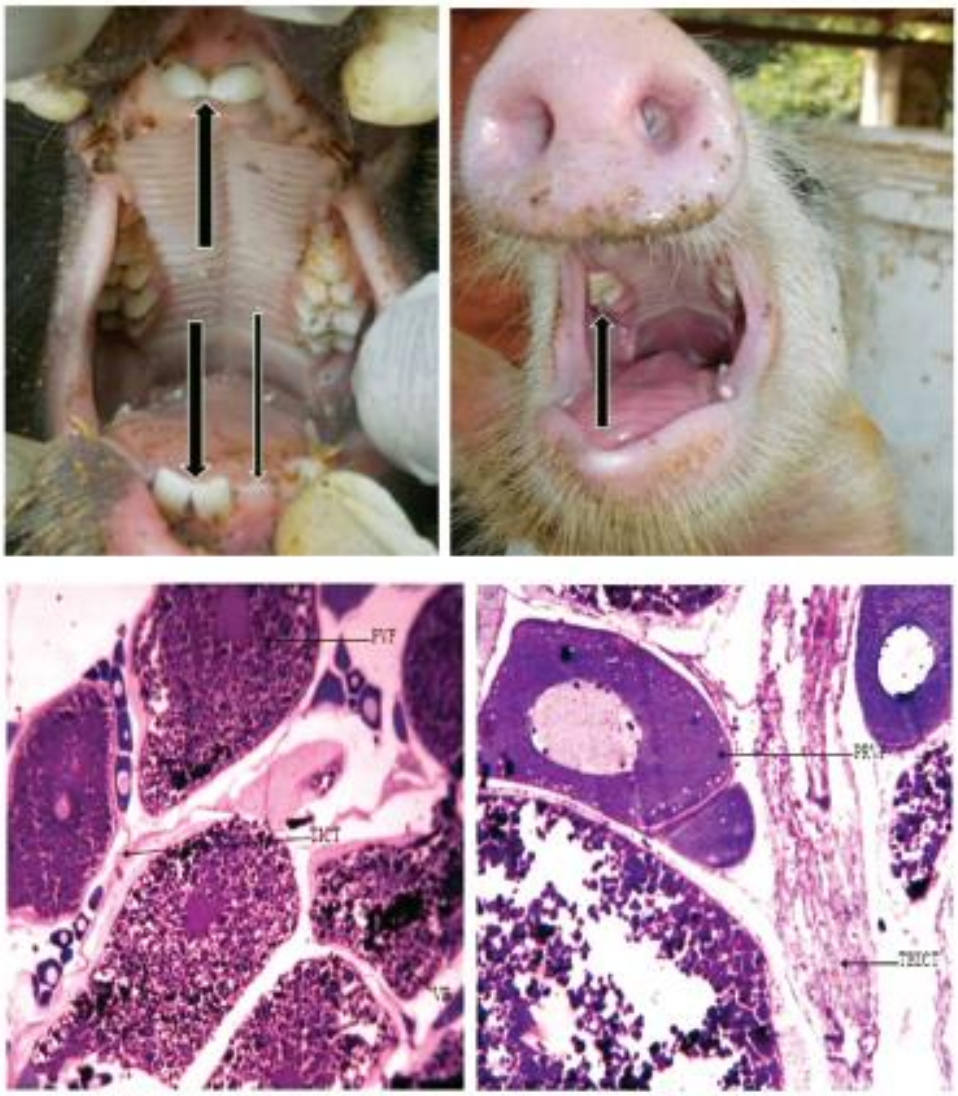

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Volume & Issue: Volume 14, Issue 2, Summer and Autumn 2021, Page 1-78

1. **The Eruption Patterns of the Teeth of Nigerian Local Pigs (*Sus scrofa*): Profile of Deciduous Teeth**. Page 1-15

Michael E Okandeji; Ayodeji D Lijoka; Folusho A Atiba; James O Olopade

2. **Performance in and Preference for Anatomy Amongst Para-Clinical and Clinical Students of Veterinary Medicine, At the University of Ibadan.** Page 17-29

Awosanya Emmanuel; Olopade Funmilayo; Sowemimo Damilola; James O Olopade

3. **Comparative Anatomy of Wild Adult African Catfish (Clarias garIepinus) Ovary During Rainy and Dry Periods in Zaria, Nigeria.** Page 31-37

Tauheed Abubakar Muazu; Mohammed Hadi Sulaiman; Abdullahi Baso; Mansur Zubairu; Nura Aliyu Ahmad; Abubakar Umar Hawwat

4. **Proximate Aspects of Starvation-Related Morbidity and Mortality Among Young California Sea Lions (*Zalophus californianus*).** Page 39-56

Dennis F Lawler; Basil Tangredi; Keith Matassa; Michele Hunter; Richard H. Evans,

5. **Morphometric and Stereological Studies of the Pons and Medulla Oblongata of the African Striped Ground Squirrel (*Xerus erythropus*).** Page 57-71

Sherif Olawale Ajeigbe; Tauheed Abubakar Muazu; James Oliver Nzalak; Ibrahim Abdullahi Iliya

6. **Relations of Weight and Age to the Front Feet Sole Area of Merino Ram (*Ovis aries*).** Page 73-78

Benjamin Christoffel Tehupuring; Soeharsono Widjiati; Viski Fitri Hendrawan; Epy Muhammad Luqman

Relations of Weight and Age to the Front Feet Sole Area of Merino Ram *(Ovis aries)*

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Abstract

Age and activities are factors that influence the anatomy of the body. This study aims to describe the correlation between the body weight and age to the front feet sole area of Merino ram. These objectives were achieved by performing measurements of front feet sole of fifteen Merino rams. Measurements were taken every month started from one-month-old until six-month-old. All data were modeled using analytical MARS (*Multivariate Adaptive Regression Spline Longitudinal*). Data analysis resulted an equation model: Y = 11. 575 + 0.95 * BF2 (BF1 = max (0, weight – 8.000); BF2 = max (0, age – 1.000) * BF1 for front right foot sole area and Y = 20.582-0.683 * BF2 for front left foot sole area. The results of this study indicate that there is a different pattern in the correlation between the body weight and age to the right and left front feet sole areas.

Keywords: Animals, body weight, age, front feet sole area, Merino ram

Introduction

Locomotor function of four-legged animals, is more focused as loco-motor and body braces. The pro-portion of the carrying capacity / power of the legs to support body weight varies depending on the position and type of animal. Anatomically, support functions played by the leg skeletons. Load transfer from the body to the front feet causes morphological diversity and or bone morphometry (Lieberman *et al*., 2004; Khandoker *et al*., 2017).

Most of the materials that make up the load on the body, originates from visceral organs. Viewed from the anatomical position, the location of the visceral organs in the body are not symmetrical, for example: the stomach occupying most of the left side of the abdominal cavity (Getty, 1975). Ruminant stomach composed of four

chambers, namely the rumen, reticulum, omasum and abomasum. The four-chamber stomach have different capacities depending on age and activity (Nwaogu and Ezeasor, 2008).

One of the types of small ruminants in Indonesia, which has been known since the beginning of the 19th Century to the time of the New Order Era, is the Merino sheep. Merino sheep are one type of sheep, bred in a country that has four seasons. Merino sheep breeding, often to take advantage of his fur, as wool material (Tiesnamurti and Subandriyo, 2005).

In connection with this, research was conducted to describe the area of the feet sole of Merino sheep, associated with age and body weight. The results can be used as anatomical vocabulary especially in veterinary science and can be used as a reference for related science.

Materials and Methods

Research conducted on fifteen Merino rams that were kept on a sheep farm in Pulosari village, Wonosalam subdistrict, Jombang regency. Data collection was conducted in six months. The data included age, weight, sole area of front right and left feet. The feet sole area measure-ments were done by way of coloring the soles of the front feet in pairs, then the stained soles were pressed on a flat white paper that reflected the foot sole. Then the foot sole projections were measured, where the longest length was the cranio-caudal/diagonal diameter, and the width was measured by the diameter perpendicular to the length (Koluman and Göncü, 2017).

Data Analysis

The collected data is presented in the form of the mean and its standard deviation. For the correlation between age and body weight on the front feet sole areas, data analysis was performed using Multivariate Adaptive Regression Spline (Otok, 2008). The validity of the model results of this study were obtained by comparing the actual and broad sole area that were analyzed using paired t test.

Results

Table (1) presents the front right foot sole area at various ages and at actual weight, included the estimated size. Correlation between the estimator and the front right foot sole area was determined by two variables estimator, respectively age and weight ($F_{0.05,\ 2.88}$ = 37.052, p = 0.29 x 10^{-7}) (Figure 1). As shown in Figure (1), the validity of the results of front right foot sole area were estimated from the model of the correlation between the two variables, calculated on actual front right foot sole area. Statistical testing of the estimation results, stating that the front right foot sole area models are valid.

T test analysis revealed that the estimated results are not significantly dif-

ferent from the actual results ($t_{0.05, 89}$ = - 0.021, p = 0.983).

As shown in Figure (1), the increase of front right foot sole area was started at the age of one month with the body weight of eight kilograms. This growth continues until the age of six months, the maximum value of the front right foot sole area was unknown.

In contrast to the front right sole area, the front left sole area could only be estimated by two variables offered, which were the body weight and age (Figure 2). T-test results showed a valid estimation model ($t_{0.05, 89}$ = 0.116, p = 908).

As shown in Figure (2), the increase in cross sectional area of front left foot sole starts at body weight of less than 8 kg and stops when the body weight reaches 24 kg. Measurement data of estimated front left sole area on actual front left sole area are pre-sented in Table (2).

Discussion

Results of the study on the Merino sheep front feet sole areas showed two different patterns. The increase of the front right foot sole area was affected by the interaction between age and body weight. This was in contrast with the increase of the front left foot sole area which is pre-dominantly affected by weight.

Definitely, differences in the growth patterns of lamb legs is not directly known, but it is strongly suggested that the digestive system, which in this case is the rumen, is involved in the mechanism. Rumen capacity, as one part of the stomach, changes according to the age where the life span is divided into three periods the fetal, calf and adult life with the apparent biggest difference is the period of the calf to the adult (Nwaogu, and Ezeasor, 2008). Rumen capacity is affected by the function induced by environmental factors such as food composition, but changes in rumen morphology is not constantly followed by changes in the intestine (Wang *et al*., 2009).

Results of this study illustrate that the front left foot sole area is closely related to body weight during growth, that is at the body weight of 16.08 ± 3.63 kg and it is not so different from the estimated results (15.98 ± 3.02 kg), while the front right foot sole area is resulted from the interaction between age and body weight.

References

Getty N. G. (1975): Sisson and Grossman's The Anatomy of the Domestic Animals, Vol. 1, Fifth edition Philadelphia, W.B. Saunders Comp. Goshal.

Khandoker M. A. M. Y., Syafiee M., Rahman M. S. R. (2017): Morpho-

metric characterization of Katjang goat of Malaysia. Bangladesh Journal of Animal Science., 45:17-24.

Koluman N., & Serap Göncü S. (2017): Measurements of healthy hooves, their interrelation and correlation with body mass in some improved goat breeds. International Journal of Agriculture, Environment and Bioresearch., 2: 1-9

Lieberman D.E., Polk J.D., & Demes B. (2004): Predicting long bone loading from cross-sectional geometry. The American Journal of Physical Anthropology., 123:156–171.

Nwaogu I.C., & Ezeasor D.N. (2008): Morphological studies on rumen development in West African Dwarf goats (Capra hircus). Sokoto Journal of Veterinary Sciences.7: 1-6.

Otok B.W. (2008): Multivariate Adaptive Regression Spline (MARS). Laboratorium Statistika Sosial & Bisnis Jurusan Statistika Institut Teknologi Sepuluh Nopember. Surabaya.

Silanikove N. (2000): The physiological basis of adaptation in goats to harsh environments (review). Small Ruminant Research., 35: 181 – 193.

Tiesnamurti B., & Subandriyo. (2005): The behavior of the caged Merino and Sumatran lambs. Seminar Nasional Teknologi Peternakan dan Veteriner. 505 – 511.

Wang Y.H., Xu M., Wang F. N., Yu Z.P., Yao Z.H., Zan L.S., Yang F.N. (2009): Effect of dietary starch on rumen and small intestine morphology and digesta pH in goat. Livestock Science., 122: 48 – 52

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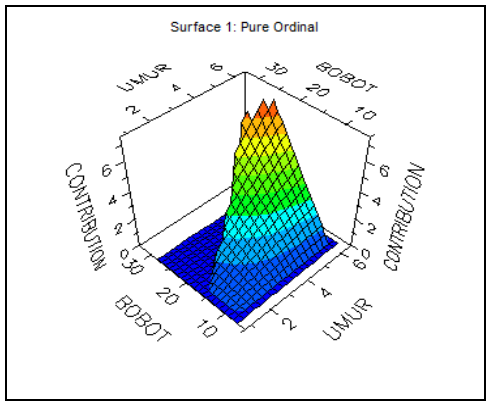
Table (1): Age, Body Weight, Front Right Foot Sole Area (measurement and estimation results) of Merino Sheep.

Age (month)	Body Weight (kg)	Actual measurement of right foot sole area (cm^2)	Estimated right foot sole area (cm^2)
1	11,73 ± 2,09	11,01 ± 3,01	11,5750 ± 0,00
2	10,80 ± 1,78	11,93 ± 2,54	11,8410 ± 0,17
3	10,80 ± 1,78	11,93 ± 2,54	12,1070 ± 0,34
4	11,67 ± 1,76	11,70 ± 1,93	12,6200 ± 0,50
5	17,27 ± 4,41	16,08 ± 3,62	15,0963 ± 1,68
6	15,80 ± 4,06	15,66 ± 4,17	15,2800 ± 1,93

Table (2): Age, Body Weight, Front Left Foot Sole Area (measurement and estimation results) of Merino Sheep.

Age (month)	Body Weight (kg)	Actual measurement of left foot sole area (cm^2)	Estimated left foot sole area (cm^2)
1	11,73 ± 2,09	11,01 ± 3,01	12,21 ± 1,42
2	10,80 ± 1,78	11,93 ± 2,54	11,57 ± 1,22
3	10,80 ± 1,78	11,93 ± 2,54	11,57 ± 1,22
4	11,67 ± 1,76	11,70 ± 1,93	12,16 ± 1,21
5	17,27 ± 4,41	16,08 ± 3,63	15,98 ± 3,02
6	15,80 ± 4,06	15,66 ± 4,17	14,98 ± 2,77



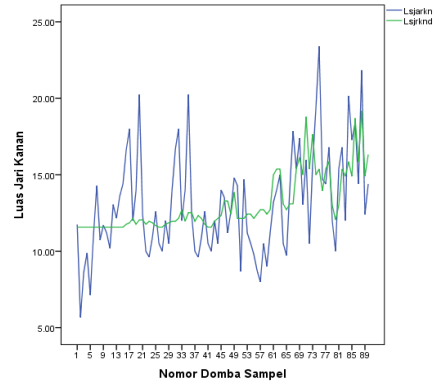


Fig (1): Correlation between age and body weight to the front right foot sole area.

This figure illustrates that the front right foot sole area is a function of the interaction between age and body weight. The best correlation models were obtained at BF = 6, MI = 3 M0 = 2 and GCV = 8.816 with the equation Y = 11.575 0.095 * BF2 (BF1 = max (0, weight - 8000); BF2 = max (0, age -1000) * BF1 (a). The estimated area is depicted as the green line while the actual area is reflected in the blue line.

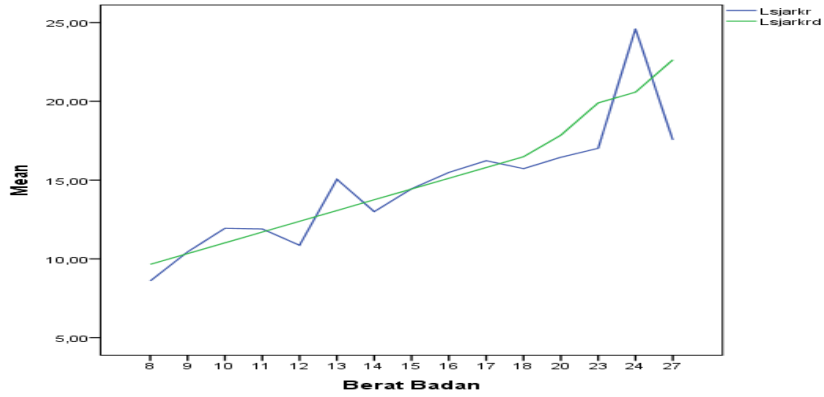


Fig (2): Correlation of age and body weight to the front left foot sole area. This figure illustrates that the front left foot sole area is only determined by body weight. The best model for the correlation is Y = 20582-0683 * BF2, BF2 = max (0, 24,000 - HEAVY); BF = 8, MI = 1, MO = 1, GCV = 7.110. The estimated area is depicted as the green line while the actual area is reflected in the blue line.