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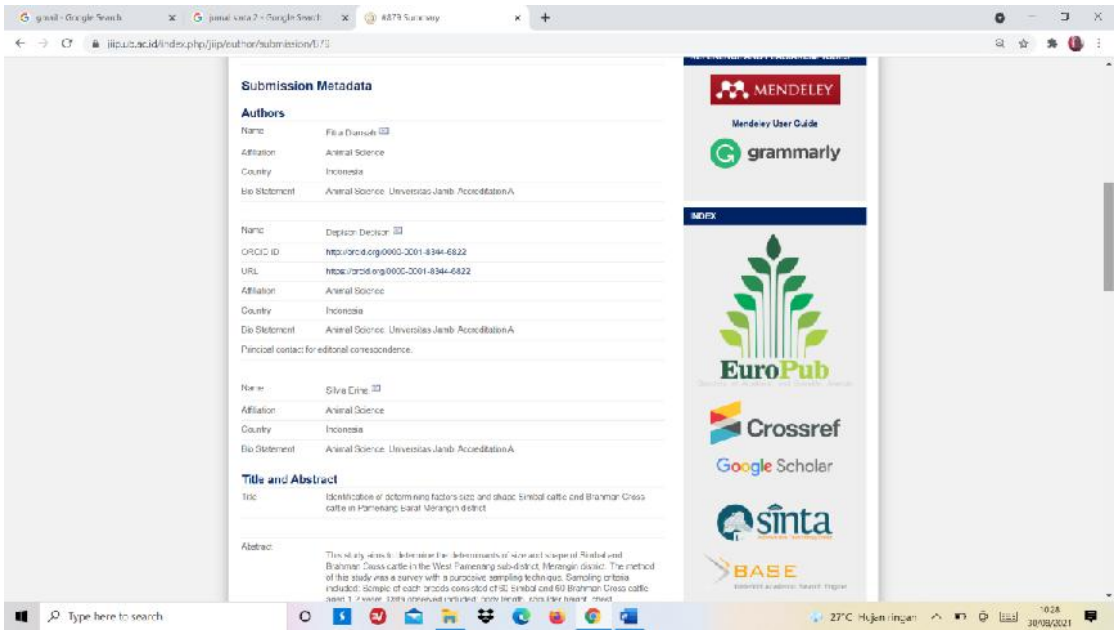
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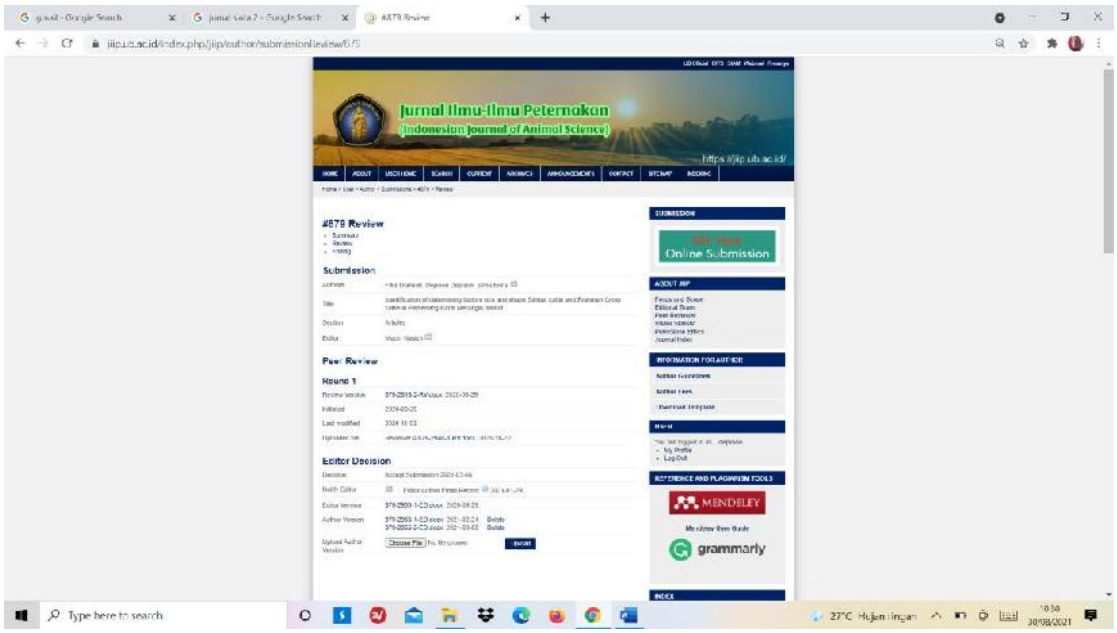
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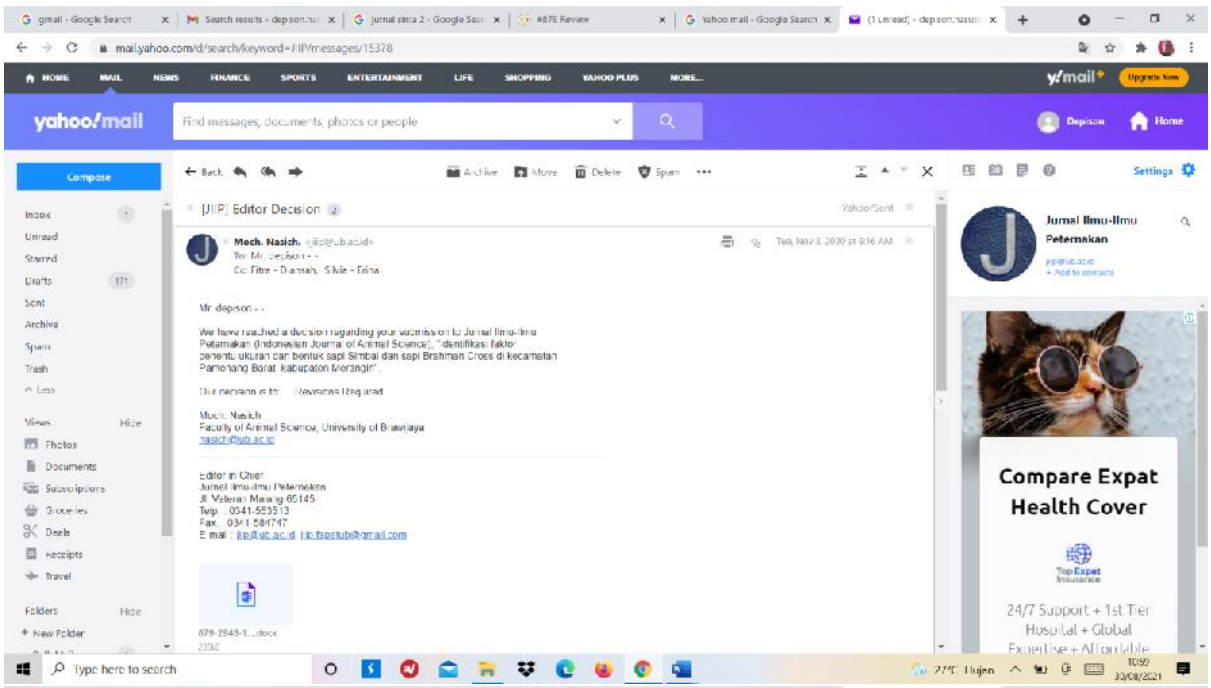
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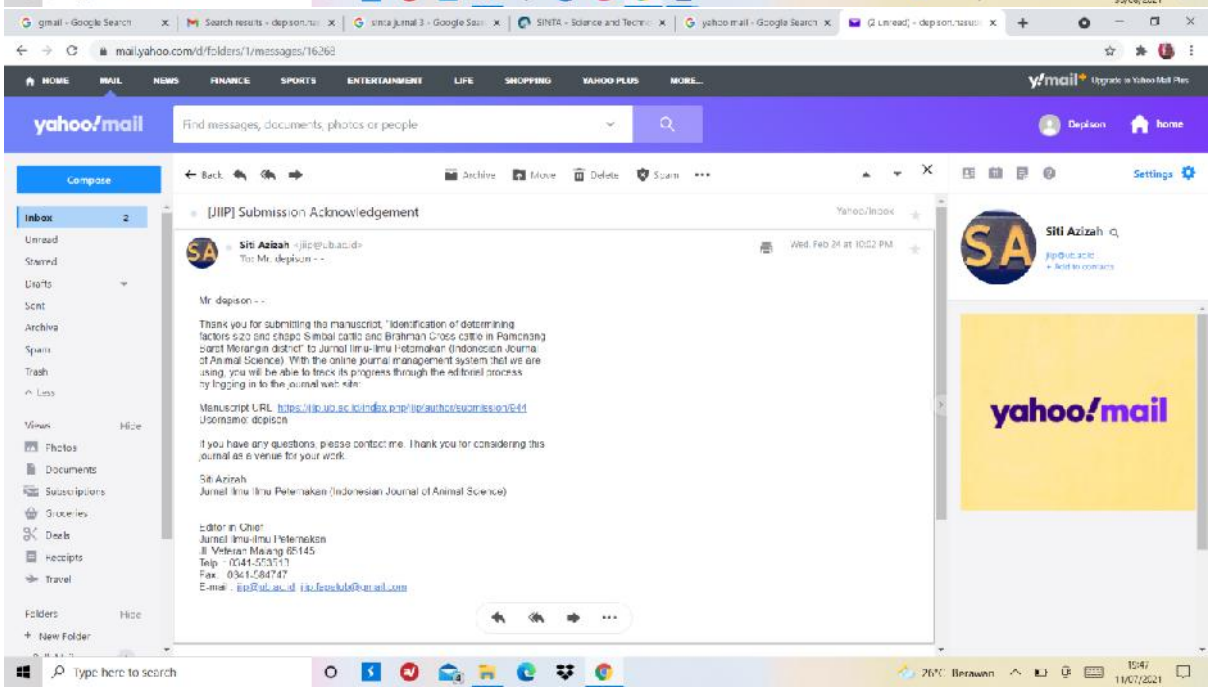
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Identifikasi faktor penentu ukuran dan bentuk sapi Simbal dan sapi Brahman *Cross* di kecamatan Pamenang Barat kabupaten Merangin

Identification of determining factors size and shape Simbal cattle and Brahman Cross cattle in Pamenang Barat Merangin district

Abstrak

Penelitian ini bertujuan untuk mengetahui faktor penentu ukuran dan bentuk sapi SimBal dan sapi Brahman *Cross* di kecamatan Pamenang Barat kabupaten Merangin. Metode yang digunakan dalam penelitian ini adalah survey[H1] dengan teknik pengambilan sampel secara *purposive sampling*. Kriteria sampling meliputi : jumlah sampel masing-masing bangsa terdiri dari 60 ekor ternak sapi SimBal dan 60 ekor ternak sapi Brahman *Cross* umur 1-2 tahun[H2]. Data yang diamati meliputi : Panjang Badan, Tinggi Pundak, Lingkar dada, Dalam Dada, Lebar Dada, Lingkar kanon, Tinggi Pinggul, Bobot Badan dan Pertambahan Bobot Badan. Perbedaan ukuran-ukuran tubuh antara sapi SimBal dan sapi Brahman *Cross* dianalisis menggunakan uji-t. Identifikasi penentu ukuran dan penentu bentuk sapi SimBal dan sapi Brahman *Cross* di analisis dengan metode Analisis Komponen Utama[H3]. Hasil penelitian ini menunjukkan bahwa bobot badan, pertambahan bobot badan dan ukuran-ukuran tubuh sapi SimBal berbeda nyata (P<0,05) lebih tinggi dibandingakn sapi Brahman *Cross* baik pada jantan maupun betina. Sapi SimBal dan sapi Brahman *Cross* jantan berbeda nyata (P<0,05) lebih tinggi dibandingkan betina[H4]. Kesimpulan penelitian ini menunjukkan bahwa bobot badan, pertambahan bobot badan dan ukuran-ukuran tubuh sapi Simbal lebih tinggi dibandingkan sapi Brahman *Cross*. Pertambahan bobot badan jantan lebih tinggi dibandingkan betina baik pada sapi Simbal maupun Branman *Cross*. Faktor penentu ukuran tubuh sapi SimBal dan sapi Brahman *Cross* adalah lingkar dada, faktor penentu bentuk tubuh sapi SimBal adalah tinggi pundak, sedangkan sapi Brahman *Cross* adalah panjang badan. Korelasi antara ukuran-ukuran tubuh dengan bobot badan pada sapi Simbal dan sapi Brahman *Cross* baik jantan maupun betina yang tertinggi adalah lingkar dada (LD).[H5][D6]

Kata Kunci : Bobot Badan; Pertambahan Bobot Badan; Ukuran-ukuran tubuh.

Abstrak[H7]

This study aims to determine the determinants of the size and shape of SimBal and Brahman Cross cattle in the West Pamenang sub-district, Merangin district. The method used in this study was a survey with a purposive sampling technique. Sampling criteria included: the number of samples from each nation consisted of 60 SimBal cattle and 60 Brahman Cross cattle aged 1-2 years. The data observed included: body length, shoulder height, chest circumference, inside chest, chest width, canon circumference, hip height, body weight, and body weight gain. The differences in body measurements between SimBal and Brahman Cross cattle were analyzed using the t-test. Identification of the determinants of the size and shape of the SimBal and Brahman Cross cattle were

analyzed using the Main Component Analysis method. The results of this study indicated that body weight, body weight gain, and body measurements of SimBal cattle were significantly different (P <0.05) higher than Brahman Cross cattle, both male and female. SimBal cattle and male Brahman Cross cattle were significantly different (P <0.05) higher than females. The conclusion of this study shows that the body weight, body weight gain, and body measurements of Cymbals are higher than that of Brahman Cross cattle. Male body weight gain was higher than that of females in both Simbal and Branman Cross cows. The determining factor for the body size of the SimBal and Brahman Cross cattle is the chest circumference, the determining factor for the body shape of the SimBal cow is the height of the shoulders, while the Brahman Cross is the body length. The highest correlation between body measurements and body weight in Simbal and Brahman Cross cattle, both male and female is chest circumference (LD).

Keywords: Body Weight; Increased Body Weight; Body measurements.

PENDAHULUAN

Indonesia merupakan Negara Agraris yang memiliki sumber daya alam yang melimpah serta masih mengandalkan sektor pertanian. Sektor pertanian terbagi lagi menjadi beberapa subsektor salah satunya yaitu subsektor peternakan. Salah satu subsektor peternakan yang berpotensi untuk dikembangkan yaitu ternak sapi potong. Namun peningkatan populasi sapi potong[H8] cenderung lambat dan tidak sejalan dengan permintaan. Kebutuhan daging sapi pada 2016 mencapai sebesar 674.690 ton. Sampai saat ini kemampuan produksi dalam negeri hanya sebesar 441.761 ton, maka kekurangan sebesar 232.929 ton harus di impor (Ihza, 2017). Produksi daging sapi nasional tahun 2018 mencapai 496 ribu ton. Disisi lain pada tahun 2018 Indonesia mengimpor daging sapi sekitar 160 ribu ton (Badan Pusat Statistik Indonesia, 2019[H9]).

Upaya Pemerintah Republik Indonesia untuk menekan nilai import, maka pemerintah telah mendatangkan darah baru seperti sapi Brahman *Cross* dan Simmental. Sapi Brahman *Cross* didatangkan dengan cara impor dalam bentuk bakalan langsung dari Australia (Muslim *et al.*, 2013), sedangkan sapi Simmental ada dalam bentuk bakalan dan ada juga dalam bentuk mani beku. Di Provinsi Jambi salah satu daerah pengembangan sapi Brahman *Cross* dan persilangan Simmental dengan induk sapi Bali melalui IB yaitu di kecamatan Pamenang Barat kabupaten Merangin. Daerah penyebaran sapi Brahman *Cross* berada di kecamatan Pamenang Barat dan di kecamatan ini juga dilakukan persilangan antara Simmental dengan induk sapi Bali.

Sampai saat ini tingkat produktivitas sapi SimBal dan Brahman *Cross* di daerah ini belum banyak diketahui, salah satu upaya yang dapat dilakukan untuk mendapatkan informasi tentang produktivitas sapi SimBal dan Brahman *Cross*, diantaranya dengan melakukan identifikasi karakteristik kuantitatif. Karakteristik kuantitatif merupakan sifat yang dapat diukur tetapi tidak dapat dibedakan dengan yang lainnya (Wahyuni, Nafiu dan Pagala, 2016). Karakterisasi karakteristik kuantitatif penting dilakukan dalam rangka pengembangan ternak sapi yang dapat dilihat dari, bobot badan, pertambahan bobot badan dan ukuran-ukuran tubuh. (Heryani *et al*., 2018).

Keragaman fenotipik sapi Simbal dan sapi Brahman Cross dapat diamati melalui pengamatan dan pengukuran karakteristik kuantitatif melalui analisis ukuran-ukuran tubuh. Identifikasi ukuran ukuran tubuh dapat dilakukan dengan pendekatan Analisis Komponen Utama (AKU) dengan menentukan penciri ukuran yang lebih dipengaruhi

faktor lingkungan dan bentuk lebih dipengaruhi faktor genetik. Informasi tersebut sangat penting dalam memberikan informasi dasar tentang karakteristik atau ciri khas suatu bangsa sapi. Ukuran tubuh bukan saja menentukan performans sapi itu sendiri tetapi juga menentukan kodisi turunanya. Selain itu dapat dijadikan standar untuk menilai produktifitas ternak sapi, dimana ukuran-ukuran tubuh dapat memberikan gambaran performan (Eksterior) seekor ternak dan menentukan bobot hidup serta dijadikan pedoman dasar seleksi dalam program pemuliaan ternak.

Berdasarkan itu maka perlu dilakukan penelitian tentang "Identifikasi Faktor Penentu Ukuran dan Bentuk Sapi Simbal dan Sapi Brahman *Cross* di Kecamatan Pamenang Barat Kabupaten Merangin".

MATERI DAN METODE

Penelitian ini dilaksanakan di kecamatan Pemenang Barat kabupaten Merangin yang berlangsung pada tanggal 19 Februari 2020 sampai 19 Maret 2020. Materi penelitian ini yaitu sapi SimBal dan Brahman *Cross*s. Peralatan yang digunakan adalah alat tulis, tongkat ukur, pita ukur, timbangan digital dan kamera digital. Metode yang digunakan dalam penelitian ini adalah survey dengan teknik pengambilan sampel secara *purposive sampling*. Kriteria sampling meliputi : jumlah sampel masing-masing bangsa terdiri dari 60 ekor ternak sapi SimBal dan 60 ekor ternak sapi Brahman *Cross* umur 1-2 tahun. Data yang diamati meliputi: Panjang Badan, Tinggi Pundak, Lingkar dada, Dalam Dada, Lebar Dada, Lingkar kanon, Tinggi Pinggul, Bobot Badan dan Pertambahan Bobot Badan.

Analisis Data

Data yang telah dikumpulkan, dikelompokkan berdasarkan jenis kelamin jantan dan betina baik pada bangsa sapi Simbal maupun Brahman *Cross*,[H10]. Faktor pembeda antar kedua bangsa meliputi : PB, TP, LD, DD, LeD, LK, TPi, dianalisis menggunakan uji beda rata-rata (uji-t) Gaspersz, (2006), dengan rumus sebagai berikut ;

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{\sum (X_{J1} - \overline{X}_1)^2}{n_1(n_1 - 1)} + \frac{\sum (X_{J2} - \overline{X}_2)^2}{n_2(n_2 - 1)}}}$$

Keterangan :

t = nilai t hitung

$\overline{\overline{X}}\, i$ = rataan sampel pada kelompok pertama,

$\overline{X}_2$ = rataan sampel pada kelompok kedua,

X_{j1} = nilai pengamatan ke-J pada kelompok pertama

X_{j2} = nilai pengamatan ke-J pada kelompok kedua

n_1 = jumlah sampel pada kelompok pertama, dan

n_2 = jumlah sampel pada kelompok kedua.

Selanjutnya data dikoreksi dari jantan ke betina. Tujuannya untuk menghilangkan salah satu faktor pembeda antar sampel yaitu data jenis kelamin, ketika sudah dikoreksi, data hasil koreksi tersebut akan digabungkan dengan data sapi jantan, sehingga parameter yang dibandingkan pada sampel penelitian ini yaitu hanya antar

bangsa sapi Simbal dan Brahman *Cross*. Rumus yang digunakan untuk koreksi data mengikuti penelitian Depison (2010) yaitu sebagai berikut :

$$R = \frac{\bar{x}i}{\bar{x}j}$$

Kemudian

$$K = R \,.\, (x_{1.1j},\, x_{1.2j}, \ldots x_{n.nj})$$

Keterangan :
K = Koreksi
R = Rataan antar jenis kelamin

AKU digunakan untuk mencari Faktor penentu ukuran dan betuk sapi Simbal dan Brahman *Cross* melaui ukuran-ukuran tubuh menurut petunjuk (Gaspersz, 2006) dengan model matematika sebagai berikut:

$$Yj = a_{1j}X_1 + a_{2j}X_2 + a_{3j}X_3 + \ldots\ldots + a_{7j}X$$

Keterangan :
Y_j = komponen utama ke-j (j = 1, 2; 1 = ukuran, 2 = bentuk)
$X_{1,2,3\ldots}$ = peubah ke 1,2,3….7
$a_{ij,2j,3j,..}$ = vektor eigen variable ke-i (1,2,3,….7) dan Komponen utama ke j

Analisis Regresi digunakan untuk melihat hubungan antara ukuran-ukuran tubuh dengan bobot badan sapi SimBal dan Brahman *Cross* menurut petunjuk Gaspersz, (2006) dengan model regresi sebagai berikut :

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \ldots\ldots + b_{19}X_{18}$$

Keterangan:
Y = Bobot Badan
b_0 = Konstanta
b_1 = Koefisien regresi dari panjang badan (X_1)
b_2 = Koefisien regresi dari tinggi pundak (X_2)
b_3 = Koefisien regresi dari lingkar dada (X_3)
b_4 = Koefisien regresi dari dalam dada (X_4)
b_5 = Koefisien regresi dari lebar dada (X_5)
b_6 = Koefisien regresi dari lingar kanon (X_6)
b_7 = Koefisien regresi dari tinggi pinggul (X_7)

Korelasi antara ukuran-ukuran tubuh dengan bobot badan sapi SimBal dan Brahman *Cross* dihitung berdasarkan petunjuk Gaspersz, (2006) dengan rumus sebagai berikut :

$$r_{xy} = \frac{n\sum x_i y_i - (\sum x_i)(\sum y_i)}{\sqrt{\{n\sum x_1^2 - (\sum x_i)^2\}\{n\sum y_2^1 - (\sum y_i)^2\}}}$$

Keterangan:
r_{xy} = Korelasi Pearson
x = Ukuran-ukuran tubuh
y = Bobot badan

Pengolahan data dibantu dengan menggunakan perangkat lunak statistika yaitu Minitab versi 18.

HASIL DAN PEMBAHASAN

Bobot badan dan pertambahan bobot badan sapi simbal dan sapi brahman *cross*

Bobot badan dan pertambahan bobot badan sapi SimBal dan sapi Brahman *Cross* jantan dan betina dapat dilihat pada Tabel 1.

Tabel 1. Rata-rata bobot badan dan pertambahan bobot badan sapi SimBal dan sapi Brahman *Cross.*

Uraian	Bangsa	
	Sapi SimBal	Sapi Brahman *Cross*
Bobot Badan (BB)		
Jantan (kg)	372,45 ± 33,00^{a}	298,41 ± 38,72^{b}
Betina (kg)	348,68 ± 29,30^{a}	274,78 ± 19,98^{b}
Koreksi Betina ke Jantan (kg)[H11]	372,45 ± 31,30^{a}[H12]	298,41 ± 21,70^{b}[H13]
Pertambahan Bobot Badan (PBB)		
Jantan (kg/ ekor/ hari)	0,526 ± 0,072^{a}A	0,340 ± 0,081^{b}A
Betina (kg/ ekor/ hari)	0,404 ± 0,053^{a}B	0,323 ± 0,031^{b}B
Koreksi Betina ke Jantan[H14] (kg)	0,526 ± 0,069^{a}A	0,340 ± 0,032^{b}B

Keterangan: Huruf yang berbeda pada baris yang sama berbeda nyata (P < 0,05)
Huruf yang berdena pada kolom yang sama berbeda nyata (P<0,05)

Berdasarkan tabel 1. menunjukkan bahwa hasil uji beda rata-rata bobot badan dan pertambahan bobot badan sapi SimBal berbeda nyata (P<0,05)[H15] lebih tinggi dibandingkan sapi Brahman *Cross* baik pada jantan maupun betina. Sapi SimBal dan sapi Brahman *Cross* jantan berbeda nyata (P<0,05) lebih tinggi dibandingkan betina. Perbedaan bobot badan sapi SimBal dan sapi Brahman *Cross* diduga karena adanya perbedaan bangsa antara sapi Simbal (Simental x Bali) dengan sapi Brahman *Cross*. Menurut Depison, (2010) persilangan induk sapi Bali dengan pejantan Simental menghasilkan turunan yang lebih baik dibanding persilangan induk sapi Bali dengan Limousin, Brahman dan PO ditinjau dari bobot sapih, bobot umur satu tahun dan ukuran ukuran tubuh ternak.

Pertambahan bobot badan sapi jantan SimBal dan Brahman *Cross* lebih besar dari pada pertambahan bobot badan sapi betina SimBal dan Brahman *Cross*. Perbedaan pertambahan bobot badan sapi SimBal dan sapi Brahman *Cross* jantan maupun betina diduga karena[H16] sapi jantan memiliki kemampuan makan yang lebih besar daripada betina, serta sapi jantan memiliki kecepatan pertumbuhan yang lebih cepat dibandingkan sapi betina.. Sesuai dengan pendapat Hamdani *et al.* (2017) yang menyatakan sapi jantan tumbuh lebih cepat bila dibandingkan dengan sapi betina dan pada umur yang sama lebih berat.

Ukuran-ukuran tubuh sapi simbal dan sapi brahman *cross*

Ukuran-ukuran tubuh sapi SimBal dan sapi Brahman *Cross* dapat dilihat pada tabel 2.

Tabel 2. Karakteristik kuantitatip sapi Simbal dan Brahman *Cross*

Uraian	Bangsa	
	SimBal	Brahman *Cross*
Panjang Badan (PB), cm		
- Jantan	135,93 ± 6,20[a]	130,83 ± 6,47[b]
- Betina	130,80 ± 6,38[a]	125,06 ± 4,40[b]
- Koreksi Betina ke Jantan[H17]	135,93 ± 6,63[a]	130,83 ± 4,46[b]
Tinggi Pundak (TP), cm		
- Jantan	126,26 ± 5,00[a]	124,90 ± 7,13[b]
- Betina	121,60 ± 4,02[a]	118,60 ± 2,66[b]
- Koreksi Betina ke Jantan[H18]	126,26 ± 4,17[a]	124,90 ± 2,80[b][H19]
Lingkar Dada (LD), cm		
- Jantan	163,46 ± 7,75[a]	154,66 ± 7,58[b]
- Betina	158,93 ± 9,61[a]	149,86 ± 5,95[b]
- Koreksi Betina ke Jantan[H20]	163,46 ± 9,88[a]	154,66 ± 6,14[b]
Dalam Dada (DaD), cm		
- Jantan	51,63 ± 3,57[a]	48,10 ± 3,59[b]
- Betina	49,73 ± 3,53[a]	45,26 ± 2,98[b]
- Koreksi Betina ke Jantan[H21]	51,63 ± 3,66[a]	48,10 ± 3,16[b]
Lebar Dada (LeD), cm		
- Jantan	44,53 ± 3,69[a]	38,26 ± 2,18[b]
- Betina	40,33 ± 2,96[a]	33,73 ± 1,48[b]
- Koreksi Betina ke Jantan[H22]	44,53 ± 3,27[a]	38,26 ± 1,68[b]
Lingkar Kanon (LK), cm		
- Jantan	20,01 ± 1,30[a]	17,76 ± 1,10[b]
- Betina	18,86 ± 1,99[a]	16,66 ± 0,99[b]
- Koreksi Betina ke Jantan[H23]	20,01 ± 2,11[a]	17,76 ± 1,05[b]
Tinggi Pinggul (TPi), cm		
- Jantan	129,43 ± 4,32[a]	127,10 ± 6,26[b]
- Betina	126,36 ± 4,08[a]	120,70 ± 2,79[b]
- Koreksi Betina ke Jantan[H24]	129,43 ± 4,18[a]	127,10 ± 2,94[b]

Keterangan : Huruf yang berbeda pada baris yang sama berbeda nyata (P < 0,05)

Berdasarkan tabel 2. Bahwa hasil analisis uji beda rata-rata ukuran-ukuran tubuh sapi SimBal baik jantan, betina serta koreksi betina ke jantan berbeda nyata (P<0,05) dengan Sapi Brahman *Cross*. Ukuran-ukuran tubuh sapi SimBal lebih tinggi bila dibandingkan dengan ukuran-ukuran tubuh sapi Brahman *Cross*. Perbedaan ini diduga akibat adanya pengaruh faktor genetik[H25] antara kedua bangsa sapi. Menurut Hikmawaty *et al.* (2014) ukuran tubuh ternak dapat berbeda antara satu sama lain disebabkan potensi genetik, lokasi asal, sistem pemeliharaan dan perkawinan yang diterapkan di daerah tersebut. Salah satu faktor penyebab perbedaan ukuran-ukuran tubuh yaitu genetik (Gunawan dan Putera, 2016), adanya interaksi faktor genetik dan faktor lingkungan akan mempengaruhi pertumbuhan pada suatu bangsa ternak (Rastosari, Sumadi dan Hartatik, 2014).

Faktor-faktor tersebut menyebabkan performan ternak berbeda-beda dari satu bangsa dengan bangsa lainnya. Simmental merupakan salah satu pejantan yang

berpengaruh cukup tinggi terhadap pertumbuhan pedet yang dihasilkan (Susanti, Ihsan dan Wahjuningsih, 2015). Diperjelas dengan Depison, (2010) yang menyatakan persilangan sapi Simmental, Ongole, Brahman dan Limousin dengan induk sapi Bali dapat meningkatkan mutu genetik turunannya dan turunan terbaik adalah hasil perkawinan pejantan Simmental dan induk Bali.

Koefisien keragaman ukuran - ukuran tubuh sapi simbal dan sapi brahman *cross*

Koefisien keragaman adalah keragaman antar populasi, dimana semakin tinggi tingkat keragamannya maka populasi tersebut dinyatakan semakin beragam. Koefisien keragaman ukuran - ukuran tubuh sapi Simbal dan sapi Brahman *Cross* dapat dilihat pada tebel 3.

Tabel 3. Koefisien keragaman (%) ukuran-ukuran tubuh sapi BimBal dan Brahman *Cross.*

Uraian	Koefisien Keragaman (%)	
	SimBal	Brahman *Cross*
Bobot Bodan (BB)		
Jantan	8,8	12,9
Betina	8,4	7,2
Koreksi Betina ke Jantan[H26]	8,4[H27]	7,2[H28]
Pertambahan Bobot Badan (PBB)		
Jantan	13,7	23,9
Betina	13,2	9,6
Koreksi Betina ke Jantan	13,2	9,6
Panjang Badan (PB)		
Jantan	4,5	4,9
Betina	4,8	3,5
Koreksi Betina ke Jantan	4,8	3,5
Tinggi Pundak (TP)		
Jantan	3,9	5,7
Betina	3,3	2,2
Koreksi Betina ke Jantan	3,3	2,2
Lingkar Dada (LD)		
Jantan	4,7	4,9
Betina	6,0	3,9
Koreksi Betina ke Jantan	6,0	3,9
Dalam Dada (DaD)		
Jantan	6,9	7,4
Betina	7,1	6,5
Koreksi Betina ke Jantan	7,1	6,5
Lebar Dada (LeD)		
Jantan	8,2	6,5
Betina	7,3	4,3
Koreksi Betina ke Jantan	7,3	4,3
Lingkar Kanon (LK)		
Jantan	6,5	6,2
Betina	1,0	5,9

Koreksi Betina ke Jantan	1,0	5,9
Tinggi Pinggul (TPi)		
Jantan	3,3	4,9
Betina	3,2	2,3
Koreksi Betina ke Jantan	3,2	2,3

Berdasarkan tabel 3. bahwa koefisien keragaman BB, PBB, TP, LD, DaD, LeD, LK dan TPi sapi SimBal jantan dan betina berkisar antara 1,0 % - 13,7 %[H29] sedangkan pada sapi Brahman *Cross* antara 2,2 % - 23,9 %[H30]. Koefsien keragaman yang tertinggi dari semua ukuran-ukuran tubuh baik pada sapi SimBal maupun sapi Bramhan *Cross* adalah PBB. Artinya PBB memiliki keragaman yang paling tinggi dari semua variable yang diamati, sehingga seleksi terhadap PBB sangat memungkinkan.

Penentu ukuran dan bentuk tubuh sapi simbal dan sapi brahman *cross*

Penentu ukuran, penentu bentuk, keragaman total, dan nilai *eigen* ternak sapi SimBal dan sapi Brahman *Cross* dapat dilihat pada Tabel 4.

Tabel 4. Penentu ukuran dan bentuk ternak sapi SimBal dan sapi Brahman *Cross* gabungan betina ke jantan.

Uraian			Persamaan	KT (%)	Λ
SimBal	Persamaan Ukuran Tubuh	=	0,388 PB + 0,366 TP + **0,395 LD** + 0,363 DaD + 0,370 LeD + 0,389 LK + 0,375 Tpi	88	6,158
	Persamaan Bentuk Tubuh	=	-0,227 PB + **0,413 TP** + 0,221 LD - 0,811 DaD + 0,046 LeD + 0,251 LK + 0,079 Tpi	3,6	0,2529
Brahman *Cross*	Persamaan Ukuran Tubuh	=	0,393 PB + 0,394 TP + **0,396 LD** + 0,394 DaD + 0,384 LeD + 0,279 LK + 0,391 Tpi	88,6	6,2016
	Persamaan Bentuk Tubuh	=	**0,177 PB** + 0,131 TP + 0,085 LD + 0,104 DaD + 0,027 LeD **-** 0,954 LK + 0,154 Tpi	14,5	1,1572

Keterangan : PB = Panjang Badan, TP = Tinngi Pundak, LD = Lingkar Dada, DaD = Dalam Dada, LeD = Lebar Dada, LK = Lingkar Kanon, TPi = Tinggi Pinggul, KT= Keragaman Total, λ = Nilai Eigen

Berdasarkan tabel 4. Bahwa persamaan skor koreksi betina ke jantan ukuran tubuh ternak sapi SimBal dan sapi Brahman *Cross* memiliki keragaman total secara berurutan 88 % dan 88,6 %. Persentase ini merupakan proporsi keragaman terbesar diantara komponen-komponen utama yang diperoleh. Vektor *eigen* tertingi yang diperoleh pada persamaan ukuran ternak sapi SimBal dan ternak sapi Brahman *Cross* adalah Lingkar Dada (LD). Hasil ini menunjukkan bahwa Lingkar Dada (LD) dapat dijadikan sebagai penentu ukuran karena memiliki kontribusi terbesar terhadap persamaan ukuran. Sedangkan penentu bentuk tubuh sapi SimBal adalah Tinggi Pundak (TP) dan penentu bentuk tubuh sapi Brahman *Cross* adalah Panjang Badan (PB).

Peningkatan tinggi pundak dan panjang badan pada ternak betina Simbal dan Brahman *Cross* akan meningkatkan skor bentuk tubuh dan sebaliknya.

Hasil penelitian ini sesuai dengan pendapat Gunawan dan Putera, (2016) bahwa lingkar dada menunjukkan korelasi tertinggi dengan bobot badan. Menurut Aguantara, Rozi dan Maskur, (2019) bahwa lingkar dada menjadi korelasi tertinggi karena berhubungan langsung dengan dada dan ruang abdomen dimana sebagian besar bobot badan ternak berasal dari bagian dada hingga pinggul. Hal itu berarti semakin besar ukuran lingkar dada pada ternak maka bobot badannya juga semakin besar atau berat. Selanjutnya pernyataan Ni'am, Purnomoadi dan Dartosukarno, (2012) bahwa lingkar dada pada setiap umur memiliki keeratan hubungan yang lebih baik dengan bobot badan jika dibandingkan dengan tinggi pundak, panjang badan dan lebar dada pada umur yang sama.

Regresi ukuran-ukuran tubuh dengan bobot badan sapi simbal dan sapi brahman *cross*

Analisis regresi menunjukan bahwa ukuran-ukuran tubuh sapi SimBal dan sapi Brahman *Cross* berpengaruh nyata ($P<0.05$) terhadap bobot badan. Artinya ukuran ukuran tubuh berhubungan dengan bobot badan. Besar kecilnya ukuran-ukuran tubuh akan mempengaruhi bobot badan. Persamaan regresi sapi SimBal dan sapi Brahman *Cross* dapat disajikan pada tabel 5.

Tabel 5. Persamaan regresi ukuran-ukuran tubuh dengan bobot badan (koreksi betina ke jantan) pada sapi Simbal dan sapi Brahman *Cross*

Bangsa	Variable	Persamaan
Sapi Simbal	Umum	= 6 + 1.29 PB - 0.33 TP + 0.68 LD + 1.85 DaD - 0.56 LeD + 5.28 LK - 0.424 Tpi
	PB	BB = -212.0 + 4.300 PB
	TP	BB = -404 + 6.149 TP
	LD	BB = -104.0 + 2.914 LD
	DaD	BB = -5.9 + 7.328 DaD
	LeD	BB = 19.4 + 7.93 LeD
	LK	BB = 100.8 + 13.57 LK
	Tpi	BB = 845 - 3.72 Tpi
Sapi Brahman Cross	Umum	BB = -351 - 0.381 PB + 1.71 TP + 1.15 LD - 0.37 DaD + 3.99 + 3.25 LK + 0.91 Tpi
	PB	BB = -78.6 + 2.881 PB
	TP	BB = -572.7 + 6.975 TP
	LD	BB = -211.7 + 3.298 LD
	DaD	BB = -6.4 + 6.336 DaD
	LeD	BB = -159.5 + 11.966 LeD
	LK	BB = 20.7 + 15.63 LK
	Tpi	BB = -553.4 + 6.702 Tpi

Keterangan : BB = Bobot Badan, PB = Panjang Badan, TP = Tinggi Pundak, LD = Lingkar Dada, DaD = Dalam Dada, LeD = Lebar Dada, LK = Lingkar Kanon, TPi = Tinggi Pinggul.

Tabel 4. Menunjukkan bahwa hubungan antara ukuran ukuran tubuh secara parsial dengan bobot badan positif. Artinya setiap kenaikan ukuran tubuh maka bobot badan juga akan naik. Hal ini sesuai dengan pendapat Ikhsanuddin *et al*, (2018) bahwa setiap terjadi peningkatan 1 cm pada ukuran-ukuran tubuh maka akan berdampak pada kenaikan bobot badan sesuai dengan nilai koefisiennya. Hasil penelitian ini menunjukkan bahwa ukuran ukuran tubuh mempunyai hubungan positif dengan bobot badan, dimana setiap kenaikan ukuran tubuh akan menyebabkan kenaikan bobot badan.[H31]

Korelasi ukuran-ukuran tubuh dengan bobot badan sapi simbal dan sapi brahman *cross*

Korelasi antara ukuran-ukuran tubuh dengan bobot badan (hasil gabungan betina ke jantan) pada sapi SimBal dan sapi Brahman *Cross* dapat dilihat pada tabel 6.

Tabel 6. Korelasi ukuran-ukuran tubuh dengan bobot badan (gabungan betina ke jantan) pada sapi SimBal dan sapi Brahman *Cross*

Variabel	Bangsa			
	SimBal		Brahman *Cross*	
	R	r^2	r	r^2
Simultan	0,960	0,922	0,942	0,889
Panjang Badan VS BB	0,912	0,831	0,611	0,373
Tinggi Pundak VS BB	0,820	0,672	0,900	0,810
Lingkar Dada VS BB	0,920	0,846	0,934	0,872
Dalam Dada VS BB	0,858	0,736	0,925	0,855
Lebar Dada VS BB	0,829	0,687	0,928	0,861
Tinggi Pinggul VS BB	0,915	0,837	0,908	0,824
Lingkar Kanon VS BB	0,918	0,842	0,763	0,582

Berdasarkan Tabel 6. Bahwa secara simultan keeratan hubungan antara ukuran-ukuran tubuh dengan bobot badan sapi SimBal dan sapi Brahman *Cross* secara berurutan adalah 0,960 dan 0,942. Nilai koefisien determinasi (r^2) antara ukuran ukuran tubuh dengan bobot badan sapi SimBal dan sapi Brahman *Cross* secara berurutan adalah 0,922 dan 0,889. Nilai determinasi ini menunjukkan bahwa 92,2% bobot badan pada sapi SimBal ditentukan oleh ukuran-ukuran tubuh sedangkan sisanya disebabkan oleh faktor lain yang tidak teramati, sedangkan pada sapi Brahman *Cross* 88,9% bobot badan ditentukan oleh ukuran-ukuran tubuh sedangkan dipengaruhi oleh faktor lain yang tidak teramati.

Secara parsial nilai korelasi tertinggi antara ukuran ukuran tubuh dengan bobot badan sapi SimBal dan sapi Brahman *Cross* adalah lingkar dada (LD). Hasil penelitian ini menunjukkan bahwa lingkar dada dapat digunakan untuk menduga bobot badan sapi SimBal dan sapi Brahman *Cross*. Menurut Ni'am, Purnomoadi dan Dartosukarno, (2012) menyatakan bahwa korelasi tertinggi bobot badan dengan ukuran-ukuran tubuh adalah lingkar dada. Kemudian Aguantara, Rozi dan Maksur, (2019) bahwa Lingkar dada memiliki koefisien korelasi paling tinggi terhadap bobot badan diikuti tinggi badan dan panjang badan. Keeratan hubungan antara lingkar dada dengan bobot badan diduga

karena lingkar dada merupakan ukuran tubuh terbesar jika dibandingkan dengan ukuran-ukuran tubuh lainnya.

KESIMPULAN

Bobot badan, pertambahan bobot badan dan ukuran-ukuran tubuh sapi SimBal lebih tinggi dibandingkan sapi Brahman *Cross*. Faktor penentu ukuran tubuh sapi SimBal dan sapi Brahman *Cross* adalah Lingkar Dada (LD). Faktor penentu bentuk tubuh sapi SimBal adalah Tinggi Pundak (TP) sedangkan faktor penentu bentuk tubuh sapi Brahman *Cross* adalah Panjang Badan (PB). Korelasi antara ukuran-ukuran tubuh dengan bobot badan sapi Simbal dan sapi Brahman Cross baik jantan maupun betina yang tertinggi adalah lingkar dada (LD).

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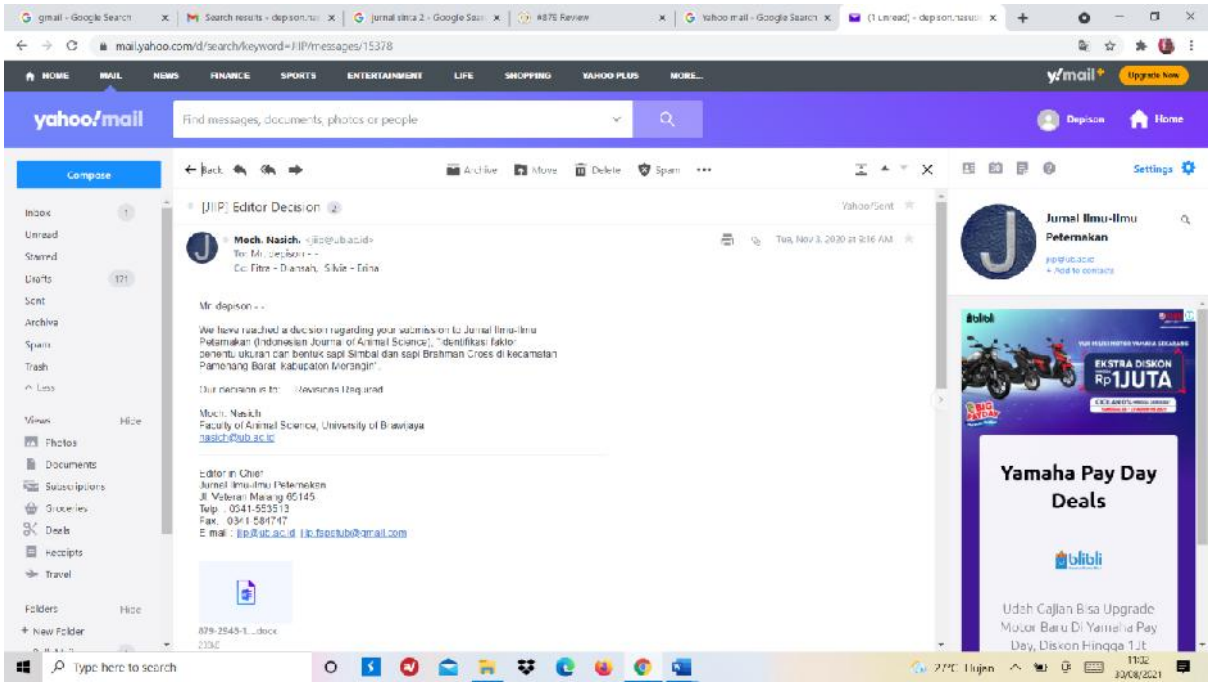
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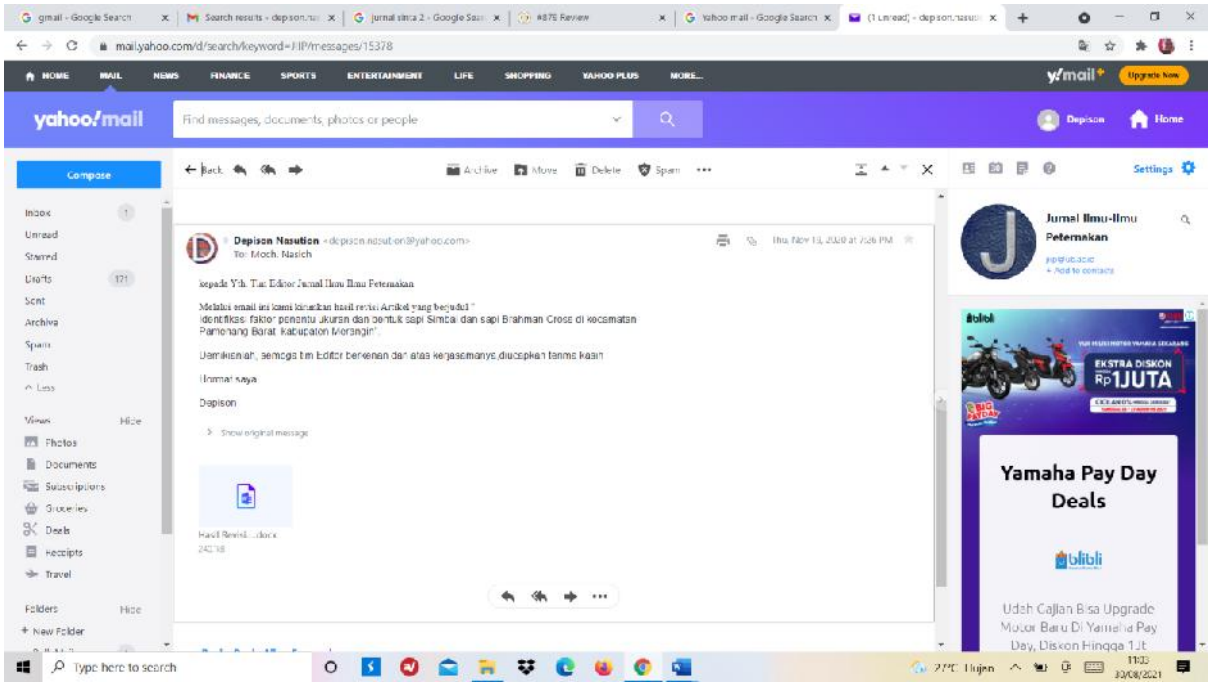
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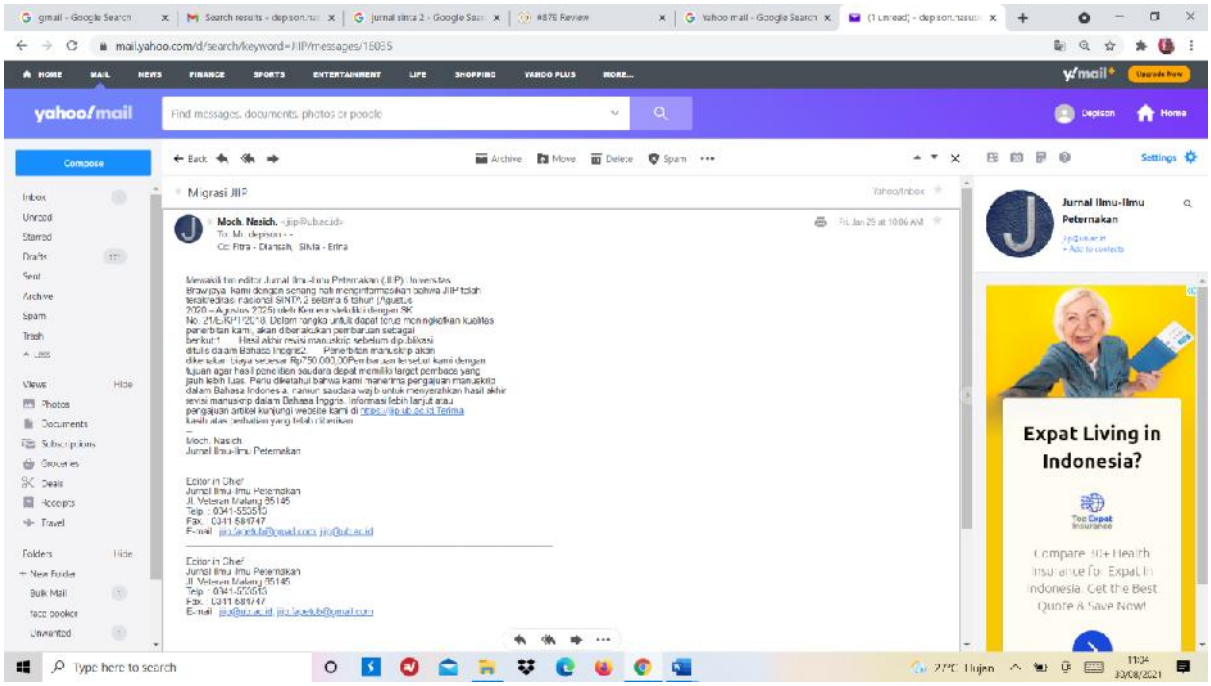
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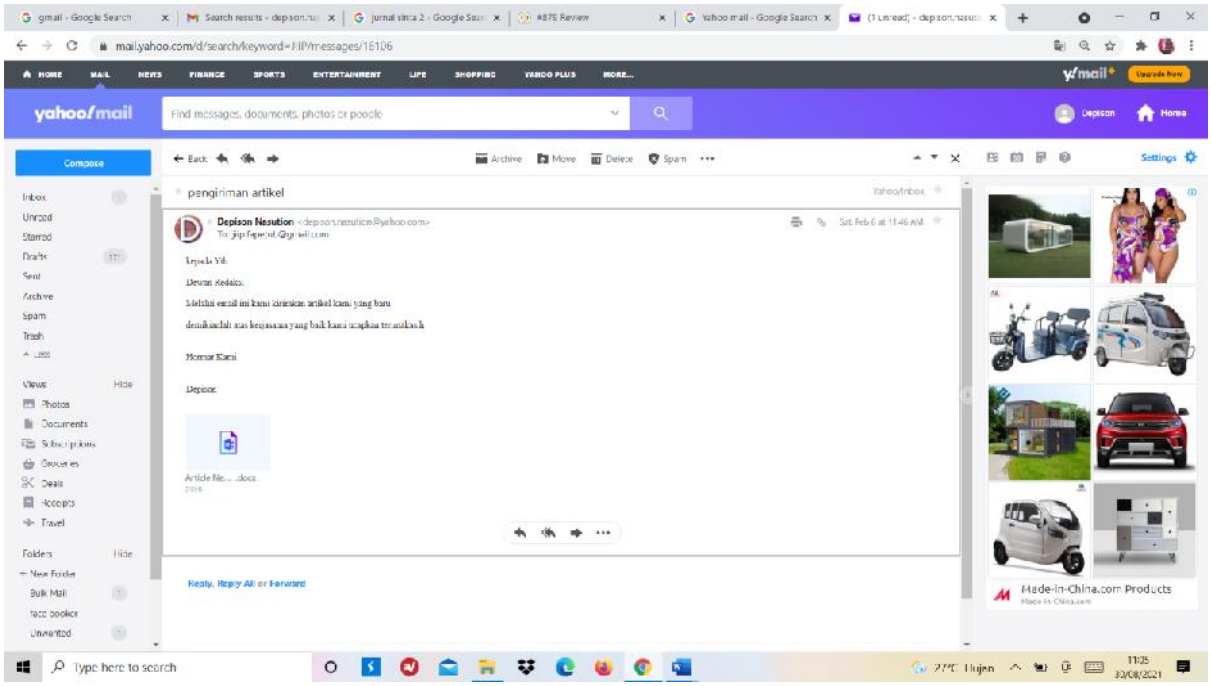
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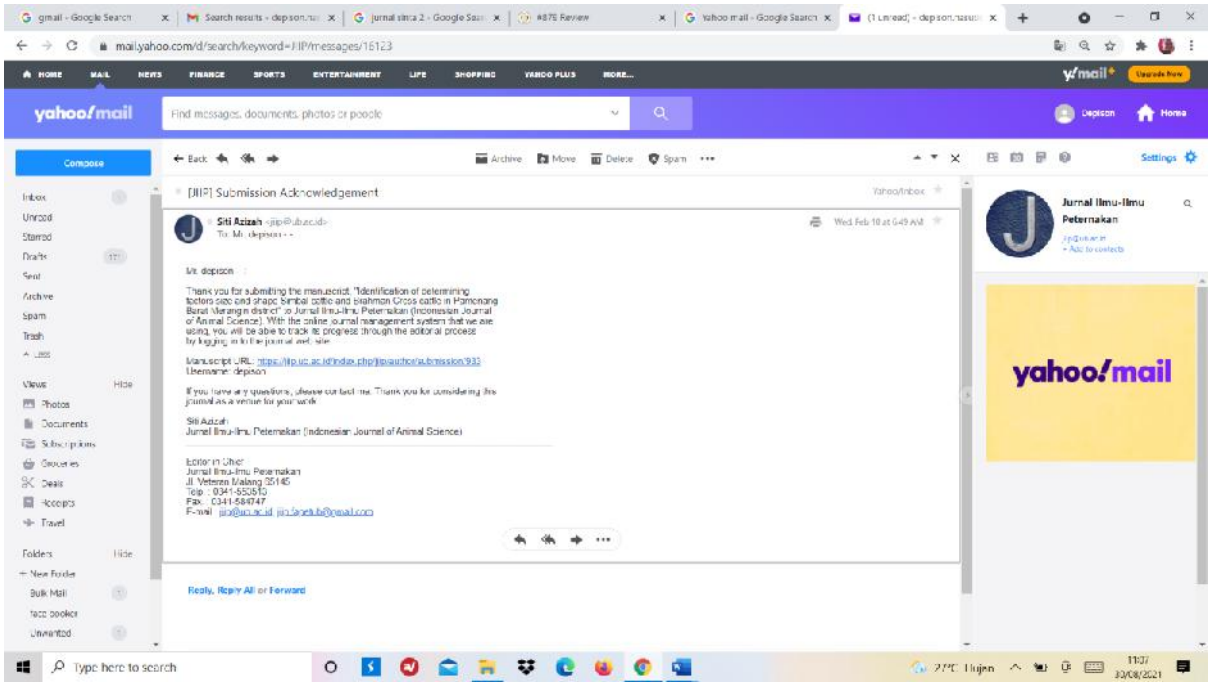
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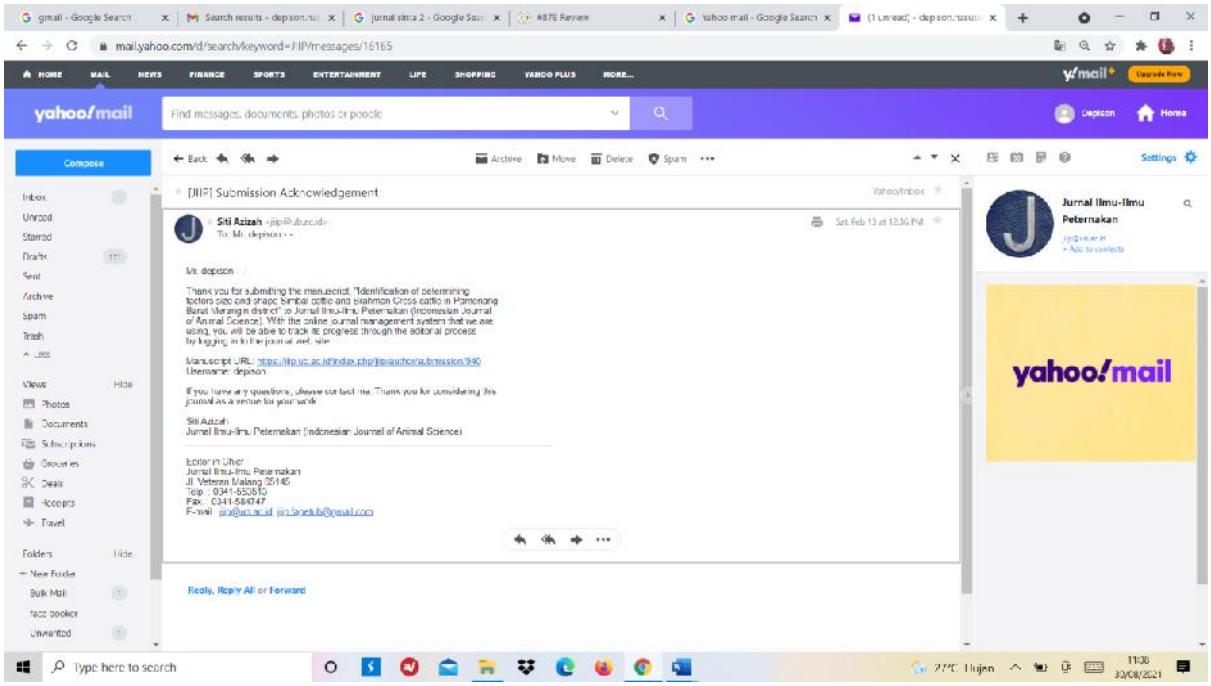
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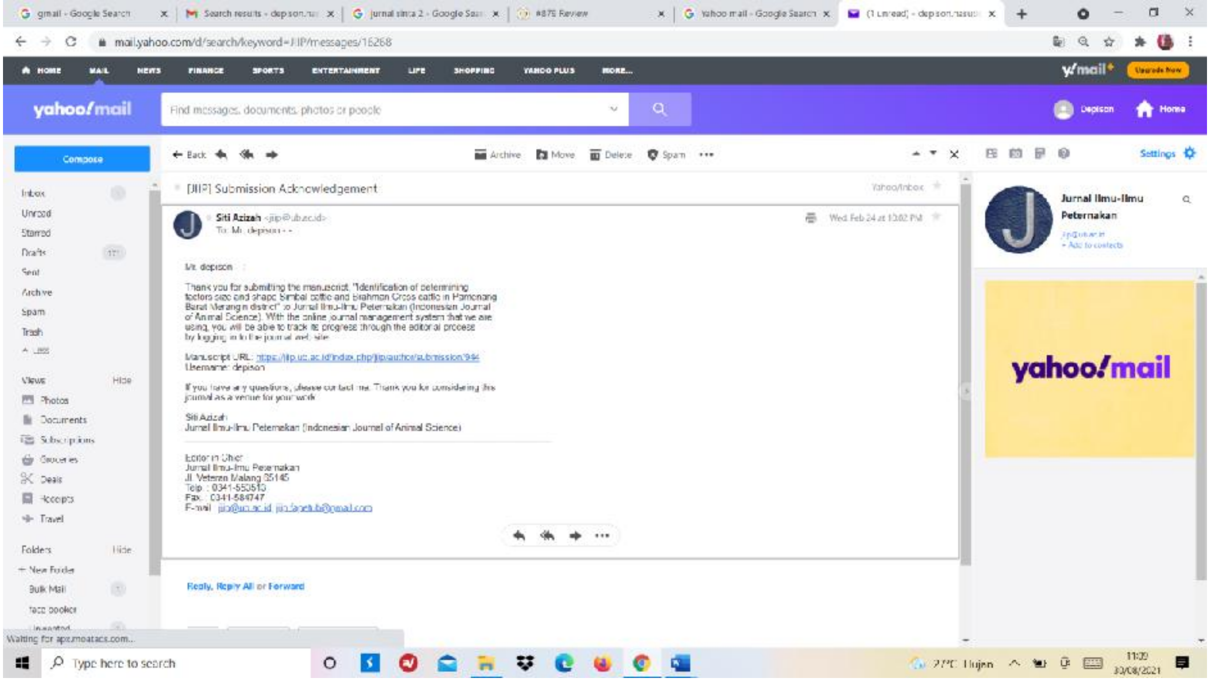

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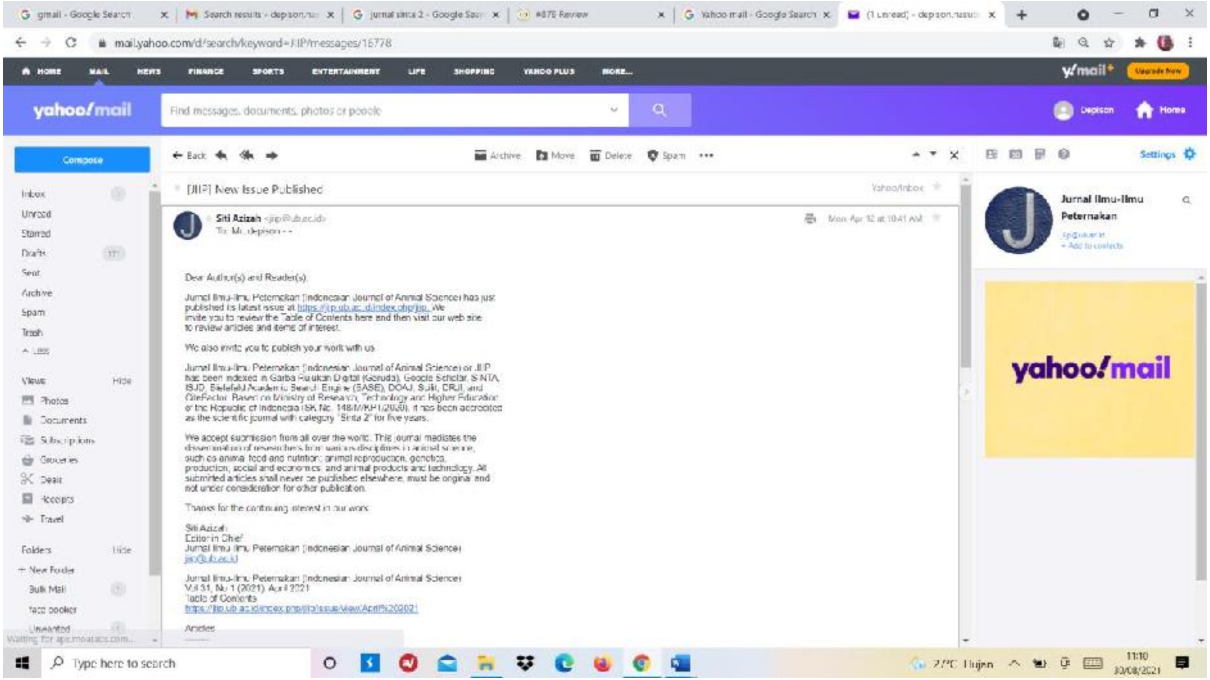

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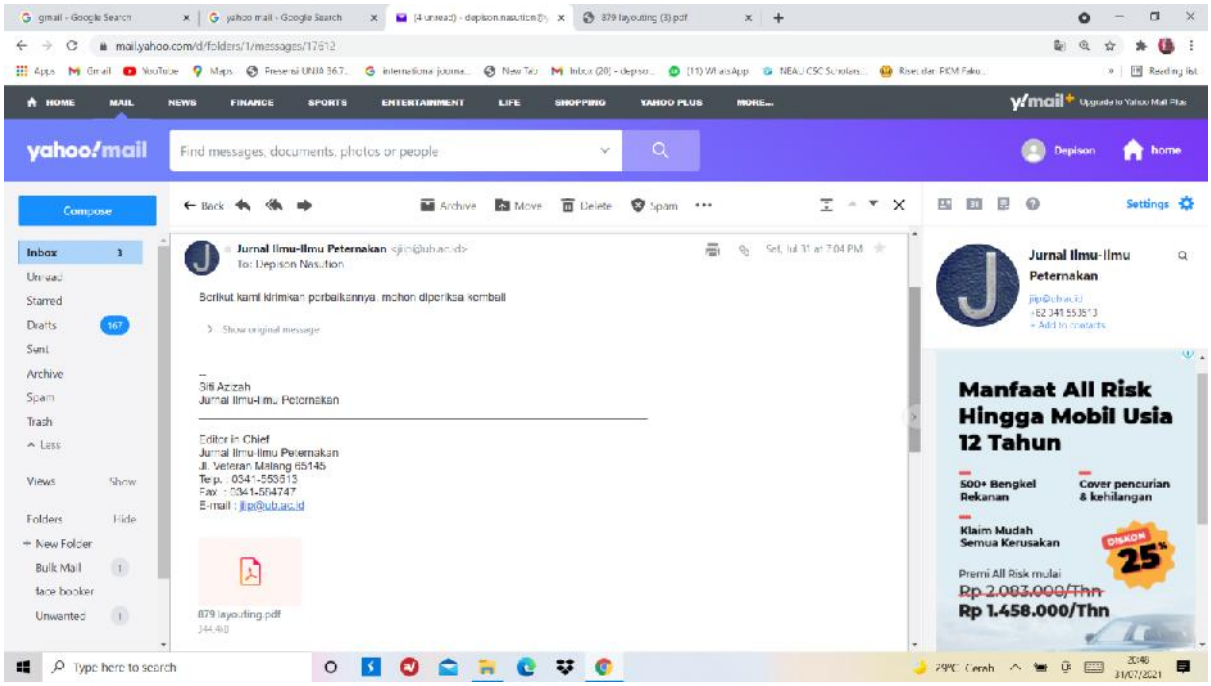
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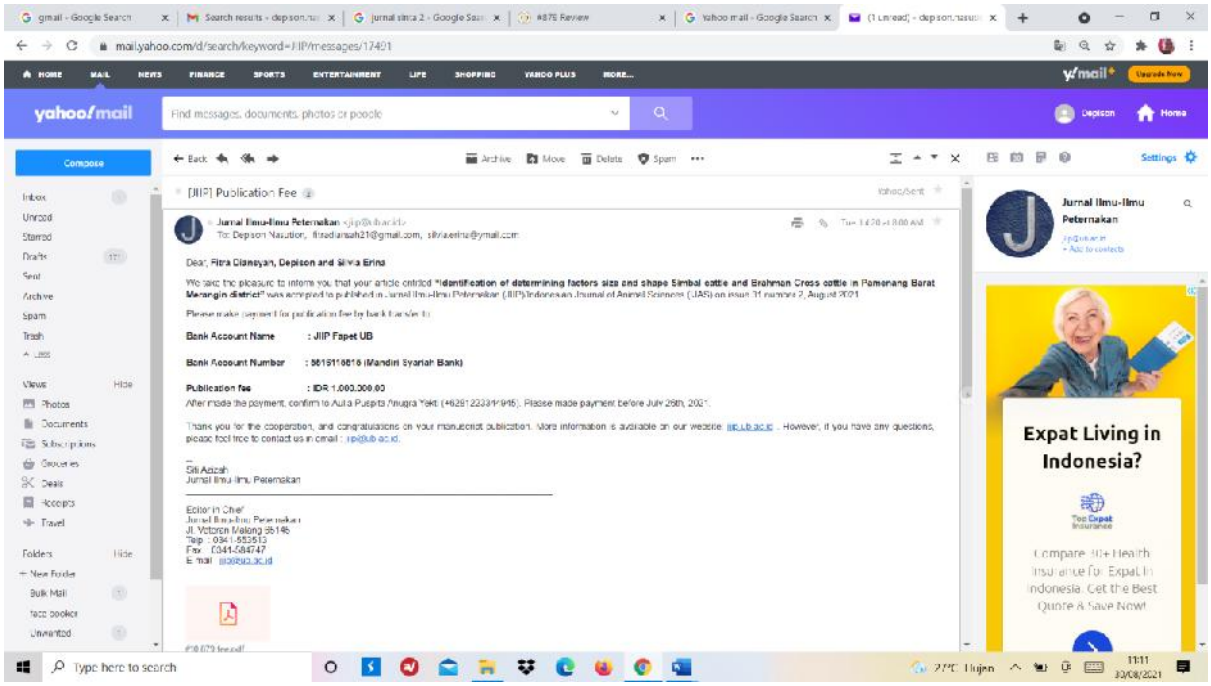
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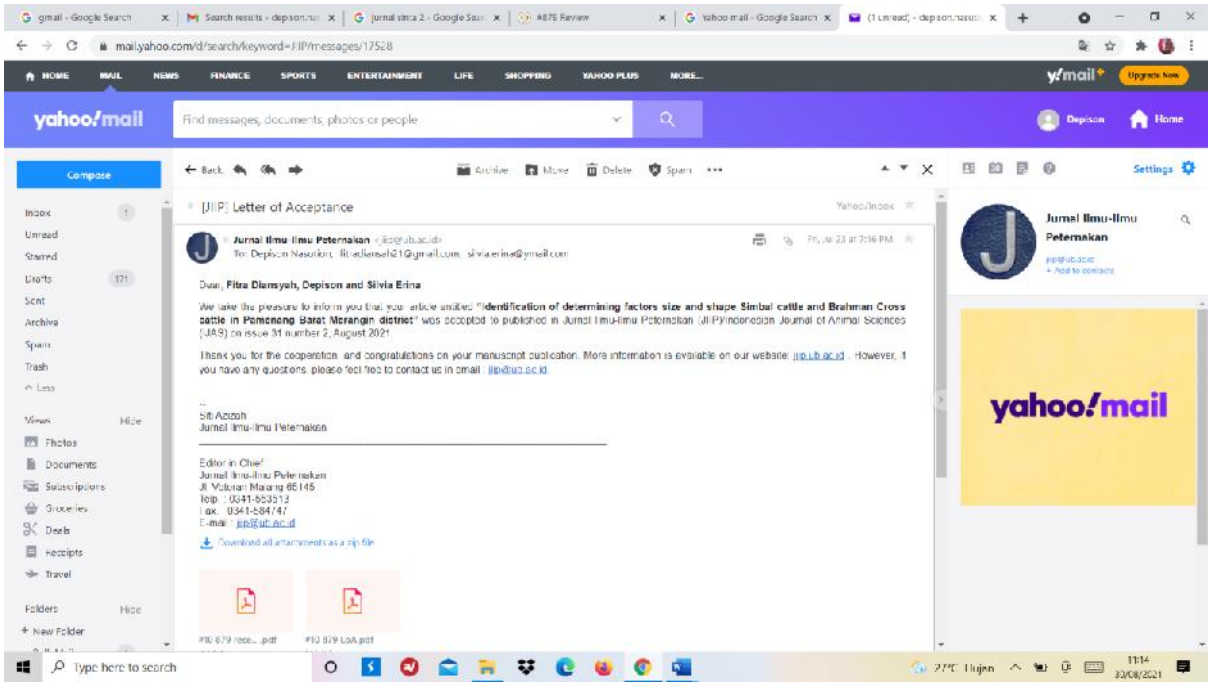
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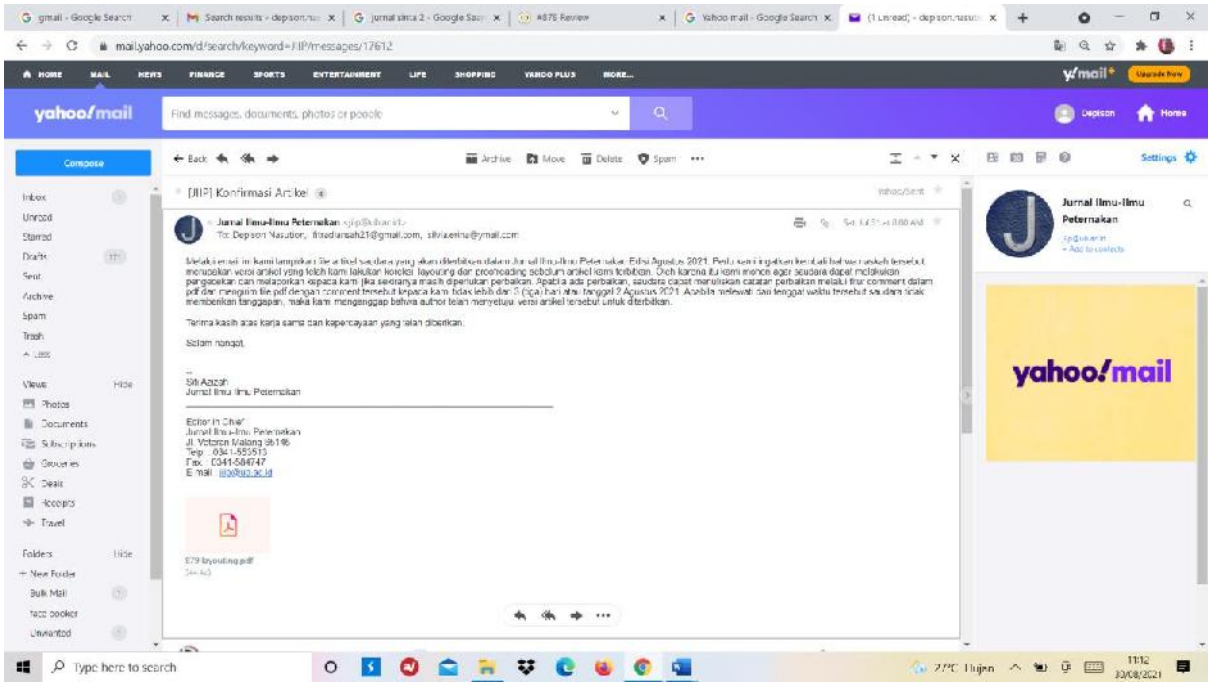
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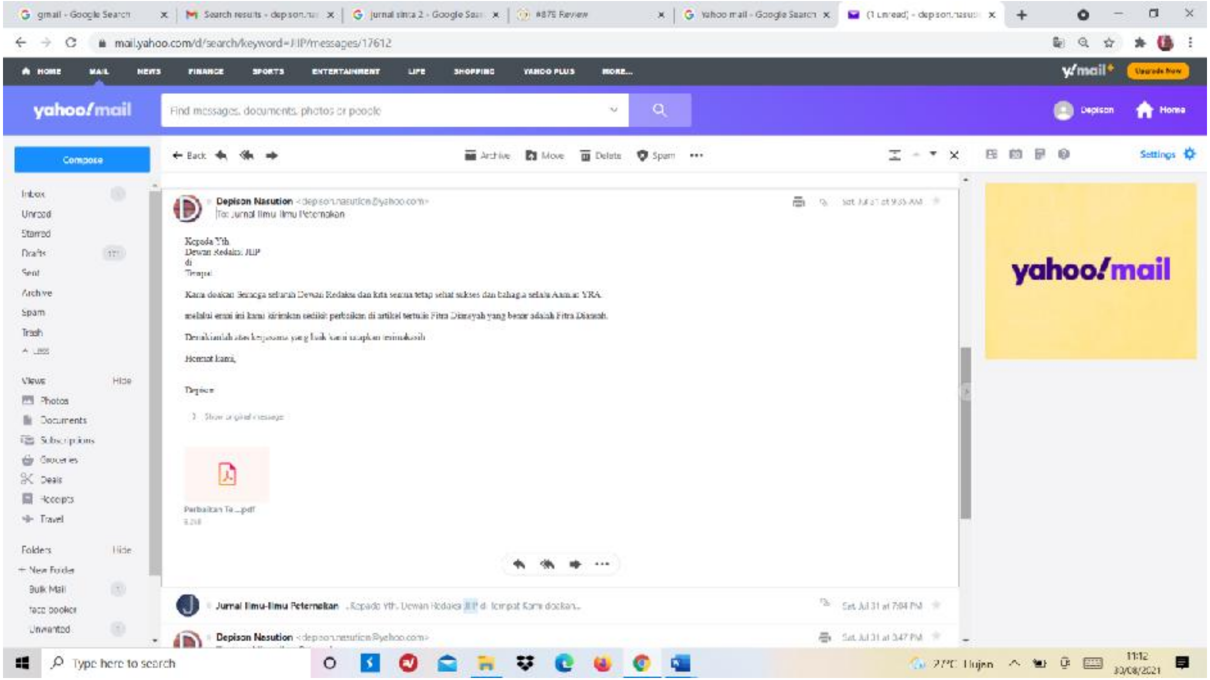
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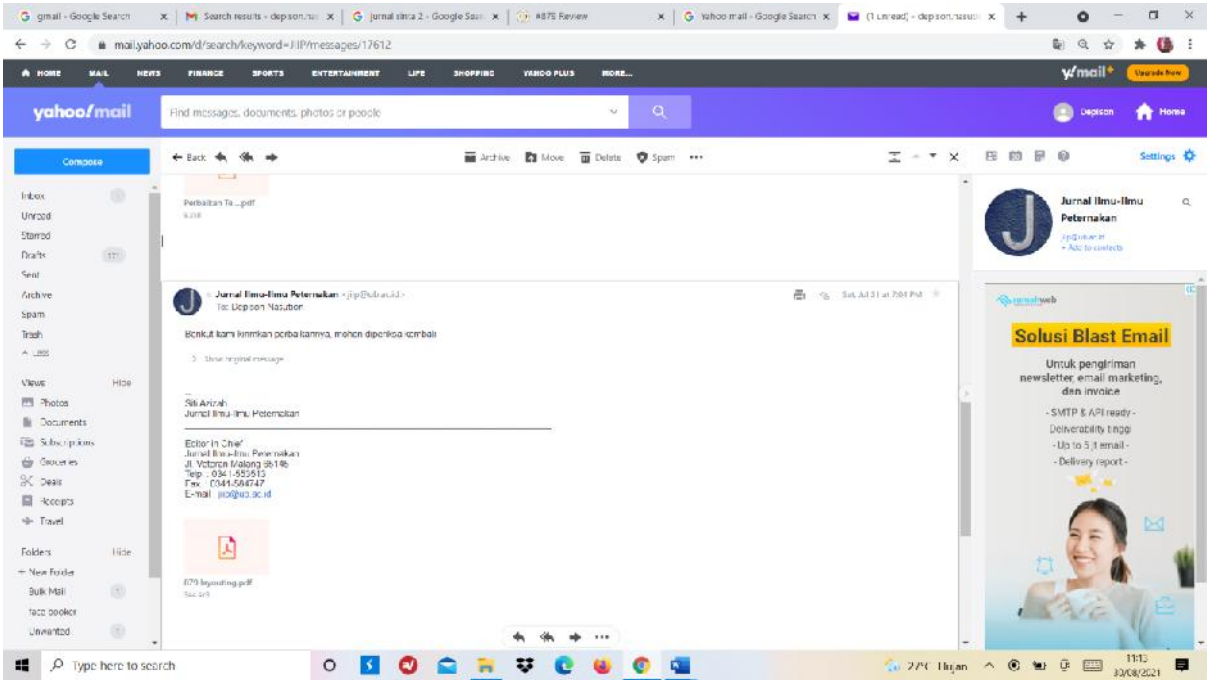
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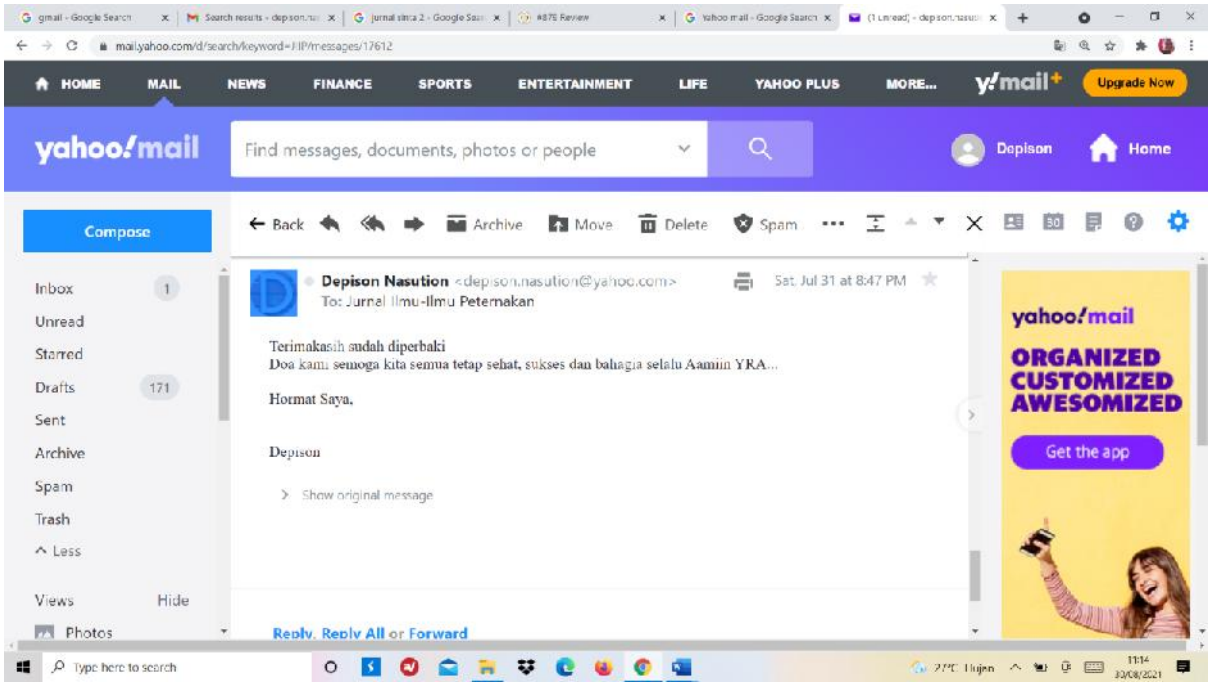
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Thank you for trusting JIIP for your research publication. We look forward to your future works.

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Identification of determining factors size and shape Simbal cattle and Brahman Cross cattle in Pamenang Barat Merangin district

Fitra Diansyah, Depison* and Silvia Erina

Animal Science Study Program, Faculty of Animal Science, University of Jambi,
Jl. Jambi - Ma.Bulian KM 15 Mendalo Darat Jambi kode pos 36361

Submitted: 16 July 2020, Accepted: 23 July 2021

ABSTRACT: This study aims to determine the determinants of size and shape of Simbal and Brahman Cross cattle in the West Pamenang sub-district, Merangin district. The method of this study was a survey with a purposive sampling technique. Sampling criteria included: Sample of each breeds consisted of 60 Simbal and 60 Brahman Cross cattle aged 1-2 years. Data observed included: body length, shoulder height, chest circumference, inside chest, chest width, canon circumference, hip height, body weight, and body weight gain. The differences in body measurements between Simbal and Brahman Cross cattle analyzed by T-test. Identification of the determinants of size and shape of Simbal and Brahman Cross cattle were analyzed using Main Component Analysis method. The results of this study were body weight, body weight gain, and body measurements of Simbal cattle were significantly different ($P < 0.05$) higher than Brahman Cross cattle, both male and female. Simbal cattle and male Brahman Cross cattle were significantly different ($P < 0.05$) higher than females. The conclusion shows that body weight, body weight gain, and body measurements of Simbal cattle are higher than Brahman Cross cattle. Male body weight gain was higher than females in both Simbal and Brahman Cross cattle. The determining factor for the body size of Simbal and Brahman Cross cattle is chest circumference, while the determining factor for body shape of Simbal cattle is the height of shoulders, while Brahman Cross is body length. The highest correlation between body measurements and body weight in Simbal and Brahman Cross cattle, both male and femal is chest circumference (LD).

Keywords: Body weight; Body weight gain; Body measurements.

*Corresponding Author: depison.nasution@unja.ac.id

INTRODUCTION

Indonesia is an agricultural country that has abundant natural resources and still relies on the agricultural sector. The agricultural sector is further divided into several sub-sectors, one of which is the livestock sub-sector. One of the livestock sub-sectors that have the potential to be developed is cattle. However, the increase in cattle population tends to be slow and not in line with demand. The need for cattle in 2016 reached 674,690 tons. Until now, the domestic production capacity is only 441,761 tons, so a shortage of 232,929 tons must be imported (Ihza, 2017). National cattle production in 2018 reached 496 thousand tons. On the other hand, in 2018 Indonesia imported about 160 thousand tons of cattle (Indonesian Central Bureau of Statistics, 2019).

The Government of the Republic of Indonesia attempts to reduce the value of imports, so the government has imported new blood, such as the Brahman Cross and Simmental cattle. Brahman Cross cattle are imported directly from Australia (Muslim et al., 2013), while Simmental cattle are in the feeder form and some are also in the form of frozen semen. In Jambi Province, one of the development areas for Brahman Cross cattle and Simmental crosses with Balinese cattle through IB is in Pamenang Barat sub-district, Merangin district. The distribution area for Brahman Cross cattle is in the West Pamenang sub-district and in this sub-district, a cross between Simmental and Bali cattle is also carried out.

Until now, the productivity level of Simbal and Brahman Cross cattle in this area has not been widely known. One of the efforts that can be made to obtain information about the productivity of Simbal and Brahman Cross cattle is by identifying quantitative characteristics. Quantitative characteristics are properties that can be measured but cannot be distinguished from others (Wahyuni et al., 2016). Characterization of quantitative characteristics is important in order to develop a cattle breed, which can be seen from body weight, body weight gain and body measurements (Heryani et al., 2018).

Phenotypic diversity of Simbal and Brahman Cross cattle can be observed through observation and measurement of quantitative characteristics through analysis of body measurements. Identification of body size can be carried out using the Main Component Analysis (AKU) approach by determining size characteristics that are more influenced by environmental factors and shape is more influenced by genetic factors. This information is essential in providing basic information about the characteristics or characteristics of a breed of cattle. Body size determines the performance of the cattle itself and determines the conditions for its descent. In addition, it can be used as a standard for assessing the productivity of cattle, where body measurements can provide an overview of the performance (exterior) of livestock and determine the live weight and serve as basic guidelines for selection in livestock breeding programs. Based on that, it is necessary to research "Identification of Determinants of Size and Shape of Simbal and Brahman Cross Cattle in Pamenang Barat Sub-District, Merangin District".

MATERIALS AND METHODS

This research was conducted in Pemenang Barat sub-district, Merangin district, which took place from February 19, 2020, to March 19, 2020. The materials of this study were Simbal cattle and Brahman Cross. The equipment used is stationery, measuring sticks, measuring tapes, digital scales, and digital cameras. The method used in this study was a survey with a purposive sampling technique. Sampling criteria included: The sample from each breed consisted of 60 Simbal cattle and 60 Brahman Cross cattle aged 1-2 years. The data observed included: body length, shoulder height, chest circumference, inside chest, chest width, canon circumference, hip height, body weight and weight gain.

DOI: 10.21776/ub.jiip.2021.031.02.00

Data Analysis

The data that has been collected were grouped based on male and female sex on Simbal and Brahman Cross cattle. The distinguishing factors between the two breeds include: PB, TP, LD, DD, LeD, LK, TPi, analyzed using the Gaspersz average difference test (t-test) Gaspersz, (2006), with the following formula;

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{\sum (X_{J1} - \overline{X}_1)^2}{n_1(n_1-1)} + \frac{\sum (X_{J2} - \overline{X}_2)^2}{n_2(n_2-1)}}}$$

Information:
t = value of t count
$\overline{\overline{X}}\, i$ = sample mean in the first group,
$\bar{X}_2$ = sample mean in the second group,
X_{j1} = the value of the J observation in the first group
X_{j2} = the value of the Jth observation in the second group
n_1 = number of samples in the first group, and
n_2 = number of samples in the second group

Furthermore, the data was corrected from male to female. The goal is to eliminate one of the distinguishing factors between the samples, namely the gender data. The corrected data will be combined with the male cattle data, so that the parameters compared in the sample of this study are only between Simbal and Brahman Crossbreeds. The formula used for data correction following Depison (2010) research is as follows:

$R = \frac{\bar{x}i}{\bar{x}j}$ Then $K = R \,.\, (x_{1.1j}, x_{1.2j}, \ldots x_{n.nj})$

Information:
K = Correction
R = Average between sexes

Principal Component Analysis was used to find the determining factors for the size and shape of the Simbal and Brahman Cross cattle through the body measurements according to the instructions (Gaspersz, 2006) with the following mathematical model:

$$Yj = a_{1j}X_1 + a_{2j}X_2 + a_{3j}X_3 + \ldots\ldots + a_{7j}X$$

Information:
Y_j = the j principal component (j = 1, 2; 1 = size, 2 = shape)
$X_{1,2,3\ldots}$ = variable to 1,2,3….7
$a_{ij,2j,3j,..}$ = the i variable eigenvector (1,2,3,….7) and the j principal component

Regression analysis was used to see the relationship between body measurements and bodyweight of the Simbal and Brahman Cross cattle according to Gaspersz, (2006) with the following regression model:

$$Y= b_0+b_1X_1+b_2X_2+b_3X_3+\ldots\ldots +b_{19}X_{18}$$

Information:
Y = Body weight
b_0 = Constant
b_1 = Regression coefficient of body length (X_1)
b_2 = Regression coefficient of shoulder height (X_2)
b_3 = Regression coefficient of bust (X_3)
b_4 = Regression coefficient of inside chest (X_4)
b_5 = Regression coefficient of width chest (X_5)
b_6 = Regression coefficient of canon circumference (X_6)
b_7 = Regression coefficient of hip height (X_7)

The correlation between body measurements and body weight of the Simbal and Brahman Cross cattle is calculated based on the instructions Gaspersz, (2006) with the following formula:

$$r_{xy} = \frac{n\sum x_i y_i - (\sum x_i)(\sum y_i)}{\sqrt{\{n\sum x_1^2 - (\sum x_i)^2\}\{n\sum y_2^1 - (\sum y_i)^2\}}}$$

Information: r_{xy}= Pearson Correlation
x = Body measurements
y = Body weight
Data processing is assisted by using statistical software, namely Minitab version 18.

RESULT AND DISCUSSION

Body weight and body weight gain Simbal cattle and Brahma cross cattle

Body weight and body weight gain of Simbal and Brahman Cross male and female cattle can be seen in Table 1. Based on table 1, The body weight of the research results, compared to several studies is not much different, the body weight of male Simbal is 379.88 ± 49.14 kg and female 350.03 ± 31.40 kg (Zafitra et al., 2020). Male simbal 373.73 ± 29.42 kg and female Simbal 340.11 ± 25.75 kg (Siska et al., 2020). The results of this study are not much different from those of Hamdani et al. (2018) which states that the average body weight of BX Cattle on people's farms is 271.12 ± 26.03 kg and in commercial companies is 383.92 ± 35.05 kg.

Furthermore, according to Rasyid et al. (2016) the average body weight of BX cattle aged> 12-15 is 128.1 ± 8.79 kg 128.1 ± 8.79 kg,> 15-18 months is 164.0 ± 9.40 kg, age> 18-21 months 179.2 ± 11.0 kg and> 21-24 month is 219.6 ± 13.1 kg. The difference test results in the average body weight and body weight gain of Simbal cattle are significantly different (P <0.05) higher than the Brahman Cross cattle, both male and female. Simbal cattle and male Brahman Cross cattle were significantly different (P <0.05) higher than female.

Simbal shows better body weight appearance and weight gain than Brahman Cross cattle. The difference in body weight of Simbal cattle and Brahman Cross cattle is thought to be due to differences in nationality between Simbal (Simental x Bali) cattle and Brahman Cross cattle. According to Depison, (2010), crossing of Balinese cattle with Simental produced better offspring than crosses of Balinese cattle with Limousin, Brahman and PO in terms of weaning weight, one year age weight and livestock body size. The body weight gain of Simbal and Brahman Cross male cattle is greater than body weight gain of Simbal and Brahman Cross female cattle.

Table 1. Average body weight and body weight gain for Simbal and Brahman Cross cattle.

Description	Nation	
	Simbal cattle	Brahman *Cross* cattle
Body Weight (BW)		
Male (kg)	372,45 ± 33,00[a]	298,41 ± 38,72[b]
Female (kg)	348,68 ± 29,30[a]	274,78 ± 19,98[b]
Correction of Females to Males (kg)	372,45 ± 31,30[a]	298,41 ± 21,70[b]
Body Weight Gain (BWG)		
male (kg/ head/ day)	0,526 ± 0,072[a]A	0,340 ± 0,081[b]A
female (kg/ head/ day)	0,404 ± 0,053[a]B	0,323 ± 0,031[b]B
Correction of Females to Males (kg)	0,526 ± 0,069[a]A	0,340 ± 0,032[b]B

Information: Different letters on the same line are significantly different (P <0.05)
Different letters in the same column are significantly different (P <0.0)

Table 2. Quantitative characteristics of Simbal and Brahman Cross cattle

Description	Nation	
	Simbal	Brahman *Cross*
Body Length (BL), cm		
- Male	135,93 ± 6,20[a]	130,83 ± 6,47[b]
- Female	130,80 ± 6,38[a]	125,06 ± 4,40[b]
- Correction of Females to Males	135,93 ± 6,63[a]	130,83 ± 4,46[b]
Shoulder Height (SH), cm		
- Male	126,26 ± 5,00[a]	124,90 ± 7,13[b]
- Female	121,60 ± 4,02[a]	118,60 ± 2,66[b]
- Correction of Females to Males	126,26 ± 4,17[a]	124,90 ± 2,80[b]
Chest Circumference (ChC), cm		
- Male	163,46 ± 7,75[a]	154,66 ± 7,58[b]
- Female	158,93 ± 9,61[a]	149,86 ± 5,95[b]
- Correction of Females to Males	163,46 ± 9,88[a]	154,66 ± 6,14[b]
Inside Chest (IC), cm		
- Male	51,63 ± 3,57[a]	48,10 ± 3,59[b]
- Female	49,73 ± 3,53[a]	45,26 ± 2,98[b]
- Correction of Females to Males	51,63 ± 3,66[a]	48,10 ± 3,16[b]
Chest Width (CW), cm		
- Male	44,53 ± 3,69[a]	38,26 ± 2,18[b]
- Female	40,33 ± 2,96[a]	33,73 ± 1,48[b]
- Correction of Females to Males	44,53 ± 3,27[a]	38,26 ± 1,68[b]
Canon Circumference (CaC), cm		
- Male	20,01 ± 1,30[a]	17,76 ± 1,10[b]
- Female	18,86 ± 1,99[a]	16,66 ± 0,99[b]
- Correction of Females to Males	20,01 ± 2,11[a]	17,76 ± 1,05[b]
Hip Height (HH), cm		
- Male	129,43 ± 4,32[a]	127,10 ± 6,26[b]
- Female	126,36 ± 4,08[a]	120,70 ± 2,79[b]
- Correction of Females to Males	129,43 ± 4,18[a]	127,10 ± 2,94[b]

Information: Different letters on the same line are significantly different (P <0.05)

The results showed that the difference in body weight gain between male and female Simbal and Brahman Cross cattle is thought to be due to the fact that male cattle have a greater ability to eat than female cattle, and male cattle have a faster growth rate than female cattle. Following the opinion of Hamdani et al. (2017), which states that male cattle grow faster than female cattle and are heavier at the same age. Furthermore, faster growth occurs in male cattle compared to female livestock due to the presence of the steroid hormone testosterone produced by the testes (Setiyono et al., 2017).

Body measurements of Simbal cattle and Brahman cross cattle

Body measurements of Simbal cattle and Brahman cross cattle can be seen in Table 2. Based on table 2. That the results of the analysis of average difference test body sizes of Simbal cattle for both male, female and female to male correction are significantly different (P <0.05) with Brahman Cross cattle. The body measurements of the Simbal cattle are higher than the body measurements of the Brahman Cross. This difference is thought to be due to the influence of genetic factors between the two breeds of cattle. According to Hikmawaty et al. (2014) body size of livestock can differ from one another due to genetic potential, location of origin, rearing and mating systems applied in the area. One of the factors that causes differences in body sizes is genetics (Gunawan and Putera, 2016), the interaction of genetic factors and environmental factors will affect the growth of a livestock breed (Rastosari et al., 2014).

These factors cause the performance of livestock to vary from one nation to another. Simmental is one of the males that has a high enough effect on the growth of calves produced (Susanti et al., 2015). Depison (2010) explains that crossing Simmental, Ongole, Brahman and Limousin cattle with Balinese cattle can improve the genetic quality of their offspring and the best breed is the result of the marriage of Simmental males and Balinese cattle.

Coefficient of variability of body sizes of Simbal and Brahman cross cattle

The coefficient of diversity is the diversity between populations, where the higher the level of diversity, the more diverse the population is. The coefficient of variability in body sizes of the Simbal and Brahman Cross cattle can be seen in table 3. Based on table 3. that the coefficient of variability of body weight, body weight gain, shoulder height, chest circumference, inside chest, canon circumference, and hip height for male and female Simbal cattle ranges from 1.0% - 13.7% while in Brahman Cross cattle between 2.2% - 23 , 9%. The highest coefficient of the diversity of all body sizes in both Simbal and Brahman Cross cattle is body weight gain. This means that the body weight gain has the highest diversity of all observed variables so that the body weight gain selection is possible.

The determinants of the size and shape of the Simbal and Brahman cross cattle.

The determinants of size, shape determinants, total diversity, and eigenvalues of Simbal cattle and Brahman Cross cattle can be seen in Table 4. Based on table 4. The equation of the female to male correction score, the body size of Simbal cattle and Brahman Cross cattle has a total diversity of 88% and 88.6%, respectively. This percentage is the largest proportion of diversity among the main components obtained. The highest eigenvector obtained in the equation for the size of the Simbal cattle and the Brahman Cross cattle is the chest circumference.

These results indicate that chest circumference can be used as a determinant of size because it has the greatest contribution to the size equation. While the determinant of the body shape of the Simbal cattle is shoulder height and the determinant of the body shape of the Brahman Cross cattle is body length. The increase in shoulder height and body length in female Simbal and Brahman Cross will increase the body shape score. The results of this study are following the opinion of Gunawan and Putera, (2016) that chest circumference

shows the highest correlation with body weight. According to Aguantara et al. (2019), chest circumference is the highest correlation because it is directly related to the chest and abdominal space. Most of the livestock body weight comes from the chest to the hips. This means the greater size of the chest circumference of the livestock, the greater the body weight or heavier. Furthermore, Ni'am et al. (2012) stated that chest circumference at each age has a better closeness to body weight when compared to shoulder height, body length and chest width at the same age.

Table 3. Coefficient of diversity (%) body sizes of Simbal and Brahman Cross cattle.

Variable	Coefficient of Diversity (%)	
	Simbal	Brahman *Cross*
Body Weight (BW)		
Male	8,8	12,9
Female	8,4	7,2
Correction of Females to Males	8,4	7,2
Body Weight Gain (BWG)		
Male	13,7	23,9
Female	13,2	9,6
Correction of Females to Males	13,2	9,6
Body Length (BL)		
Male	4,5	4,9
Female	4,8	3,5
Correction of Females to Males	4,8	3,5
Shoulder Height (SH)		
Male	3,9	5,7
Female	3,3	2,2
Correction of Females to Males	3,3	2,2
Chest Circumference (ChC)		
Male	4,7	4,9
Female	6,0	3,9
Correction of Females to Males	6,0	3,9
Inside Chest (IC)		
Male	6,9	7,4
Female	7,1	6,5
Correction of Females to Males	7,1	6,5
Chest Width (CW)		
Male	8,2	6,5
Female	7,3	4,3
Correction of Females to Males	7,3	4,3
Canon Circumference (CaC)		
Male	6,5	6,2
Female	1,0	5,9
Correction of Females to Males	1,0	5,9
Hip Height (HH)		
Male	3,3	4,9
Female	3,2	2,3
Correction of Females to Males	3,2	2,3

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Table 4. Determinants of the size and shape of the Simbal cattle and the combined female to male Brahman Cross cattle.

Description			Equation	KT (%)	Λ
Simbal	Body Size Equation	=	0,388 BL + 0,366 SH + **0,395 ChC** + 0,363 ID + 0,370 CW + 0,389 CaC + 0,375 HH	88	6,158
	Body Shape Equation	=	-0,227 BL + **0,413 SH** + 0,221 ChC - 0,811 ID + 0,046 CW + 0,251 CaC + 0,079 HH	3,6	0,2529
Brahman *Cross*	Body Size Equation	=	0,393 BL + 0,394 SH + **0,396 ChC** + 0,394 ID + 0,384 CW + 0,279 CaC + 0,391 HH	88,6	6,2016
	Body Shape Equation	=	**0,177 BL** + 0,131 SH + 0,085 ChC + 0,104 ID + 0,027 CW - 0,954 CaC + 0,154 HH	14,5	1,1572

Information: BL = Body Length, SH = Shoulder Height, ChC = Chest Circumference, ID = Inside Chest, CW = Chest Width, CaC = Canon Circumference, HH = Hip Height, TD = Total Diversity, λ = eigenvalues

Regression of body measurements with body weight of Simbal cattle and Brahman cross cattle

Regression analysis showed that the body measurements of the Simbal and Brahman Cross cattle had a significant effect ($P < 0.05$) on body weight. This means that body size is related to body weight. The size of the body measurements will affect body weight. The regression equation for Simbal cattle and Brahman Cross cattle can be presented in Table 5.

Table 5. This shows that the relationship between partial body size and body weight is positive. This means that with every increase in body size, body weight will also increase. This is in accordance with Ikhsanuddin et al, (2018) that every 1 cm increase in body measurements will impact increasing body weight according to the coefficient value. This study indicates that body size has a positive relationship with body weight, where any increase in body size will cause an increase in body weight.

Correlation of body measurements with body weight of Simbal cattle and Brahman cross cattle

The correlation between body sizes and body weight (the result of combining female to male) in Simbal and Brahman Cross cattle can be seen in Table 6.

Based on Table 6, the simultaneous closeness of the relationship between body measurements and body weight of Simbal and Brahman Cross cattle are 0.960 and 0.942, respectively. The coefficient of determination (r^2) between body size and body weight of Simbal and Brahman Cross cattle are 0.922 and 0.889, respectively. This determination value indicates that body measurements determine 92.2% of body weight in Simbal cattle while the rest is caused by other unobserved factors, while in Brahman Cross cattle 88.9% of body weight is determined by body measurements, whereas it is influenced by other factors that were not observed.

The highest correlation value between body size and body weight of Simbal and Brahman Cross cattle is chest circumference. This study indicates that chest circumference can be used to estimate the body weight of Simbal and Brahman Cross cattle. According to Ni'am et al. (2012), the highest correlation between body weight and body measurements is chest circumference. Then Aguantara et al. (2019) stated that chest circumference has the highest correlation coefficient with body

weight followed by height and body length. The closeness of the relationship between chest circumference and body weight is thought to be because chest circumference is the largest body size compared to other body measurements.

Table 5. The regression equation of body measurements with body weight (female to male correction) in Simbal and Brahman Cross cattle

Nation	Variable	Equation
Simbal cattle	General	= 6 + 1.29 BL - 0.33 SH + 0.68 ChC + 1.85 ID - 0.56 CW + 5.28 CaC - 0.424 HH
	BL	BW = -212.0 + 4.300 BL
	HH	BW = -404 + 6.149 HH
	ChC	BW = -104.0 + 2.914 ChC
	ID	BW = -5.9 + 7.328 ID
	CW	BW = 19.4 + 7.93 CW
	CaC	BW = 100.8 + 13.57 CaC
	HH	BW = 845 - 3.72 HH
Brahman Cross cattle	General	BW = -351 - 0.381 BL + 1.71 SH + 1.15 Chc - 0.37 ID + 3.99 CW + 3.25 CaC + 0.91 HH
	BL	BW = -78.6 + 2.881 BL
	HH	BW = -572.7 + 6.975 HH
	ChC	BW = -211.7 + 3.298 ChC
	ID	BW = -6.4 + 6.336 ID
	CW	BW = -159.5 + 11.966 CW
	CaC	BW = 20.7 + 15.63 CaC
	HH	BW = -553.4 + 6.702 HH

Information: BW = Body Weight, BL = Body Length, SH = Shoulder Height, ChC = Chest Circumference, ID = Inside Chest, CW = Chest Width, CaC = Canon Circumference, HH = Hip Heigh

Table 6. Correlation of body measurements with body weight (combined female to male) in Simbal and Brahman Cross cattle

Variable	Nation			
	Simbal		Brahman *Cross*	
	R	r^2	r	r^2
Simultaneous	0,960	0,922	0,942	0,889
Body Length VS BW	0,912	0,831	0,611	0,373
Shoulder Height VS BW	0,820	0,672	0,900	0,810
Chest Circumference VS BW	0,920	0,846	0,934	0,872
Inside Chest VS BW	0,858	0,736	0,925	0,855
Width Chest VS BW	0,829	0,687	0,928	0,861
Hip Height VS BW	0,915	0,837	0,908	0,824
Canon Circumference VS BW	0,918	0,842	0,763	0,582

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CONCLUSIONS

The body weight, body weight gain, and body measurements of the Simbal cattle are higher than those of the Brahman Cross. The determining factor for the body size of the Simbal and Brahman Cross cattle is the chest circumference. The determining factor for the body shape of the Simbal cattle is the shoulder height, while the determining factor for the body shape of the Brahman Cross cattle is the body length. The highest correlation between body measurements and body weight of Simbal and Brahman Cross cattle, both male and female is chest circumference.

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