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Title Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to the Use of Lactation Cow Concentrate by Calf Starter Substitution

Abstract The aim of the study was to analyze the increase in body dimensions of post-weaning female Holstein Friesian (HF) calves fed with lactation cow concentrate with different levels of calf starter substitution. The material was 4 post-weaning female HF calves aged 4-5 months, with an average weight of 101.38 ± 14.21 kg. The feed consisted of elephant grass, calf starter (CS), and lactation cow concentrate (LCC). The study used a Latin square design, with 4 concentrate treatments, i.e. P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), P4 (100% LCC); and 4 replications in 4 periods (each period in 1 month). The concentrate was given 1% BW in the dry matter; elephant grass and drinking water were provided in a measurable ad libitum. The research parameters were the increase in body dimensions (heart girth (HG), body length (BL), and withers height (WH)). The treatments had no significant effect (p>0.05) on the increase in body dimensions, were P1 (HG = 2.31 cm/month, BL = 4.75 cm/month, WH = 1.95 cm/month), P2 (HG = 4.23 cm/month, BL = 4.38 cm/month, WH = 2.23 cm/month), P3 (HG = 4.60 cm/month, BL = 4.38 cm/month, WH = 2.35 cm/month), P4 (HG = 4.10 cm/month, BL = 3.48 cm/month, WH = 2.18 cm/month). It was concluded that with sufficient quality forage feed, giving 100% LCC to post-weaning female HF calves could result in an increase in body dimensions that was relatively the same as the substitution of CS (25-75%) in LCC as concentrate feed.

Keywords: post-weaning female HF calves, body dimensions, calf starter, lactation cow concentrate

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References

References Alim, A.F. & T. Hidaka. 2002. Pakan dan Tatalaksana Sapi Perah. Dairy Technology Improvement Project in Indonesia. Bandung. [Indonesian]

[ASAS] American Society of Animal Science. 2020. The Guide for the Care and Use of Agricultural Animals in Research and Teaching. 4th ed. American Society of Animal Science. Champaign, IL.

Anderson, J.L., K.F. Kalscheur, A.D. Garcia, & D.J. Schingoethe. 2015. Feeding fat from distillers dried grains with solubles to dairy heifers: I. Effects on growth performance and total-tract digestibility of nutrients. *Journal of Dairy Science* 98(8): 5699-5708.

Atabany, A., B.P. Purwanto, A. Yani, L. Cyrilla, I. Komala, S. Prabowo, W.A. Zahra, D. Permadi, T. Suprijatna, & Surajudin. 2020. *Budidaya Sapi Perah*. IPB Press. Bogor. [Indonesian]

[BSN] Badan Standardisasi Nasional. 2017. SNI 3148.1:2017, Pakan Konsentrat-Bagian 1: Sapi Perah. Badan Standardisasi Nasional. Jakarta. [Indonesian]

Hardiono, R., T. Sailli & L.O. Nafiu. 2016. Respon pertumbuhan dan mortalitas pedet sapi bali dari induk yang diberi pakan tambahan dan obat cacing. *JITRO* 3(2): 39-47. [Indonesian]

Imran, S.P.S. Budhi, N. Ngadlyono, & Dahlanuddin. 2012. Pertumbuhan pedet sapi bali lepas sapih yang diberi rumput lapangan dan disuplementasi daun turi (*Sesbania grandiflora*). *Agrinimal Jurnal Ilmu Ternak dan Tanaman* 2(2):55-60. [Indonesian]

Kargar, S., M. Kanani, M. Albenzio, & M. Caroprese. 2019. Substituting corn silage with reconstituted forage or nonforage fiber sources in the starter diets of Holstein calves: effects on performance, ruminal fermentation, and blood metabolites. *Journal of Animal Science* 97(7):3046- 3055.

Kusumawati, E.D., S. Rahadi, J. Peso, & A.T.N. Krisnaningsih. 2018. Pengaruh umur lepas sapih dan umur induk terhadap produksi susu sapi perah Peranakan Friesian Holstein (PFH). *JITRO* 5(1):62-68. [Indonesian]

Lardy, R., A. de Boyer des Roches, J. Capdeville, R. Bastien, L. Mounier, & I. Veissier. 2020. New recommendations for self-locking barriers to reduce skin injuries in dairy cows. *Animal* 14(8):745-1756.

Maluhima, R.J., J.H. Manopo, A. Lomboan & S. H. Turangan. 2019. Rekondisi beberapa ukuran tubuh ternak sapi perah Fries Holland di Balai Pengembangan Bibit dan Pakan Ternak Tampusu. *Zootec* 39(1):165-170. [Indonesian]

Manthey, A. K., J. L. Anderson & G. A. Perry. 2016. Feeding distillers dried grains in replacement of forage in limit-fed dairy heifer rations: Effects on growth performance, rumen fermentation, and total-tract digestibility of nutrients. *Journal of Dairy Science* 99(9):7206-7215.

Manthey, A.K. & J.L. Anderson. 2018. Growth performance, rumen fermentation,



1 **Pertambahan Ukuran Tubuh Pedet *Friesian Holstein* Betina Lepas Sapih Akibat**
2 **Penggunaan Konsentrat Sapi Perah Yang Disubstitusi *Calf Starter***
3
4

5 ***Increase in Body Measurements of Post-Weaning Female Holstein Friesian Calves Due to***
6 ***the Use of Concentrated Dairy Cows Substituted by Calf Starter***
7
8

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18

19 **ABSTRAK**
20

21 Penelitian bertujuan untuk menganalisis pertambahan ukuran tubuh pedet *Friesian*
22 *Holstein* (FH) betina lepas sapih yang diberi konsentrat sapi perah dengan substitusi *calf*
23 *starter* yang berbeda level. Materi adalah 4 ekor pedet FH betina lepas sapih umur 4 – 5
24 bulan, BB rata-rata $101,38 \pm 14,21$ kg. Pakan berupa rumput gajah, *calf starter* serta
25 konsentrat sapi laktasi. Penelitian menggunakan rancangan bujur sangkar latin (RBSL),
26 dengan 4 perlakuan konsentrat yaitu P1 (75% *calf starter* dan 25% konsentrat sapi laktasi), P2
27 (50% *calf starter* dan 50% konsentrat sapi laktasi), P3 (25% *calf starter* dan 75% konsentrat
28 sapi laktasi), P4 (100% konsentrat sapi laktasi); dan 4 ulangan dalam 4 periode (setiap periode
29 berlangsung 1 bulan). Konsentrat diberikan 1% BB dalam bahan kering; rumput gajah serta
30 air minum diberikan secara *adlibitum* terukur. Parameter penelitian adalah pertambahan
31 ukuran tubuh (lingkar dada (LD), panjang badan (PB), tinggi pundak (TP)). Data dianalisis
32 menggunakan Anova. Hasil menunjukkan perlakuan tidak berpengaruh nyata ($P > 0,05$)
33 terhadap pertambahan ukuran tubuh pedet FH betina lepas sapih. Pertambahan ukuran tubuh
34 pada P1 (LD = 2,30 cm/bulan, PB = 4,75 cm/bulan, TP = 1,95 cm/bulan), P2 (LD = 4,20
35 cm/bulan, PB = 4,38 cm/bulan, TP = 2,23 cm/bulan), P3 (LD = 4,60 cm/bulan, PB = 4,38
36 cm/bulan, TP = 2,35 cm/bulan), P4 (LD = 4,10 cm/bulan, PB = 3,48 cm/bulan, TP = 2,18
37 cm/bulan). Disimpulkan bahwa dengan pakan hijauan berkualitas dalam jumlah cukup,
38 pemberian 100% konsentrat sapi laktasi pada pedet FH betina lepas sapih dapat menghasilkan
39 pertambahan ukuran tubuh yang relatif sama dengan pemberian substitusi *calf starter* (25-
40 75%) pada konsentrat sapi perah sebagai pakan konsentratnya.
41

42 **Kata Kunci** : pedet FH betina lepas sapih, ukuran tubuh, *calf starter*, konsentrat
43
44

45 **ABSTRACT**

46 The aim of the study was to analyze the increase in body measurements of post-
47 weaning female Holstein Friesian (HF) calves fed with dairy cow concentrate with different
48 levels of *calf starter* substitution. The material was 4 post-weaning female HF calves aged 4-5
49 months, with an average weight of 101.38 ± 14.21 kg. The feed consisted of elephant grass,

50 calf starter and lactating cow concentrate. The study used a Latin square design (RBSL), with
51 4 concentrate treatments, namely P1 (75% calf starter and 25% lactating cow concentrate), P2
52 (50% calf starter and 50% lactating cow concentrate), P3 (25% calf starter and 75% lactating
53 cow concentrate), P4 (100% lactating cow concentrate); and 4 replications in 4 periods (each
54 period in 1 month). Concentrate is given 1% BW in dry matter; elephant grass and drinking
55 water were provided in a measurable ad libitum. The research parameters were the increase in
56 body measurements (heart girth (HG), body length (BL) and shoulder height (SH)). Data were
57 analyzed using ANOVA. The results showed that the treatment had no significant effect
58 ($P>0.05$) on the increase in body size of post-weaning female HF calves. Increase in body
59 measurements at P1 (HG = 2.30 cm/month, BL = 4.75 cm/month, SH = 1.95 cm/month), P2
60 (HG = 4.20 cm/month, BL = 4.38 cm/month, SH = 2.23 cm/month), P3 (HG = 4.60
61 cm/month, BL = 4.38 cm/month, SH = 2.35 cm/month), P4 (HG = 4,10 cm/month, BL = 3.48
62 cm/month, SH = 2.18 cm/month). It was concluded that with sufficient quality forage feed,
63 giving 100% lactating cow concentrate to post-weaning female HF calves could result in an
64 increase in body measurements that was relatively the same as the substitution of calf starter
65 (25-75%) in lactating cow concentrate as concentrate feed.

66

67 **Keywords:** post-weaning female HF calves, body measurements, calf starter, concentrate

68

69

PENDAHULUAN

70

71 Pemberian pakan dan minum serta kesehatan pedet merupakan faktor penting yang
72 perlu diperhatikan guna mendapatkan pertumbuhan pedet yang baik, dimasa pra sapih
73 maupun lepas sapih. Pedet yang sudah lepas sapih tidak mendapatkan susu dari induknya dan
74 memenuhi kebutuhan nutrisinya secara penuh dari hijauan dan konsentrat (Kusumawati *et al.*,
75 2018; Atabany *et al.*, 2020). Pedet mulai dapat disapih saat berumur 8 minggu, yaitu setelah
76 mampu mengkonsumsi pakan starter 0,5 – 0,68 kg /hari, tetapi penyapihan di umur ini
77 memiliki resiko kematian pedet yang tinggi sehingga pedet pada umumnya disapih saat umur 3
78 bulan (NRC, 2001; Prihantoro *et al.*, 2012). Saat lepas sapih, pedet memasuki fase awal
79 pertumbuhan, sehingga sebagian besar nutrisi yang dikonsumsi akan digunakan untuk
80 pertumbuhan seperti pembesaran kerangka tubuhnya (Imran *et al.*, 2012; Welboren *et al.*,
81 2018).

82 Pembentukan ukuran tubuh pedet betina saat lepas sapih sangat perlu diperhatikan

83 karena pedet betina yang dari awal sudah mempunyai ukuran tubuh ideal, akan menjadi

84 indukan yang ideal pula. Selain penambahan bobot badan, penambahan ukuran tubuh
85 (lingkar dada, tinggi pundak, panjang tubuh) pada pedet lepas sapih juga merupakan ukuran
86 tampilan atau performans pedet (Hardiono *et al.*, 2016; Rotondo *et al.*, 2021). Pedet saat lepas
87 sapih sebaiknya memiliki ukuran lingkar dada 96 cm dan tinggi badan 75 cm, supaya
88 nantinya dapat memenuhi target lingkar dada 155 cm dan tinggi badan 115 cm pada saat
89 masuk usia 15 bulan untuk IB pertama kali (Alim dan Hidaka, 2002). Pembentukan ukuran
90 tubuh ini dipengaruhi oleh kecukupan akan kebutuhan nutriennya. Pedet lepas sapih biasanya
91 diberi pakan hijauan berkualitas tinggi dan konsentrat yang diformulasikan untuk memenuhi
92 kebutuhan nutrisi serta meningkatkan bobot badannya (American Society of Animal Science,
93 2020).

94 Namun pada praktik di lapangan, pemberian pakan untuk pedet lepas sapih belum
95 diperhatikan dengan baik oleh para peternak kecil. Umumnya peternakan rakyat memberikan
96 konsentrat sapi laktasi pada pedet dengan pertimbangan harga konsentrat yang lebih murah.
97 Konsentrat sapi laktasi minimal memiliki kandungan PK sebesar 14% dan TDN 68%,
98 sedangkan pada *calf starter* kadungan PK 16-21% dan TDN 70-80% (BSN, 2017). Padahal
99 kebutuhan nutrisi pedet mulai dari lepas sapih hingga dara berbeda dengan kebutuhan sapi
100 dewasa, sehingga pedet perlu diberikan pakan yang berbeda pula dengan sapi dewasa.

101 Substitusi *calf starter* pada konsentrat sapi laktasi dilakukan dengan tujuan untuk
102 meningkatkan kualitas nutrien pada pakan konsentrat yang diberikan pada pedet lepas sapih.
103 *Calf starter* berbeda dengan konsentrat sapi laktasi baik secara fisik maupun kualitasnya
104 (Mukodiningsih *et al.*, 2012). Pedet lepas sapih yang mendapatkan pakan yang lebih
105 berkualitas akan menghasilkan performen dalam ukuran tubuh yang lebih baik juga. Bobot
106 badan dan ukuran tubuh yang lebih besar pada umur yang sama menunjukkan adanya
107 pertumbuhan yang lebih baik (Turiello *et al.*, 2016; Nemati *et al.*, 2016).

108 Penelitian ini bertujuan untuk mengetahui dan mengkaji tentang penambahan ukuran
109 tubuh pedet FH betina lepas sapih yang diberi konsentrat sapi perah dengan substitusi *calf*
110 *starter* yang berbeda level.

111
112

MATERI DAN METODE

113
114

Materi

115
116

Materi yang digunakan yaitu 4 ekor pedet FH betina lepas sapih umur 4 – 5 bulan
117 dengan BB rata-rata $101,38 \pm 14,21$ kg. Pedet dipelihara dalam kandang metabolik selama
118 penelitian berlangsung. Pita ukur merek 300 cm dengan keakuratan 0,1 cm dan tongkat ukur
119 dari *stainless steel* 1,5 m dengan kepekaan 0,1 cm untuk mengukur dimensi tubuh ternak.
120 Pakan yang digunakan yaitu rumput gajah, konsentrat sapi laktasi (KSL), dan *calf starter*
121 (CS) produksi Teaching Farm FPP Undip.

122
123

Metode

124
125

Pakan yang diberikan berupa hijauan dan konsentrat perlakuan yang disesuaikan
126 dengan kebutuhan BK ternak. Konsentrat perlakuan (dalam BK) diberikan sebanyak 1% BB
127 dalam dua kali pemberian, yaitu pagi pukul 06.00 dan sore pukul 15.00. Hijauan dan air
128 minum diberikan secara *ad libitum* terukur. Konsentrat perlakuan terdiri atas P1 (75% CS dan
129 25% KSL), P2 (50% CS dan 50% KSL), P3 (25% CS dan 75% KSL), dan P4 (100% KSL).
130 Kandungan nutrisi pakan yang diberikan terlihat pada tabel 1. Rancangan penelitian yang
131 digunakan yaitu rancangan bujur sangkar latin (RBSL) dengan 4 perlakuan dan 4 periode.

132
133

Pemberian dan sisa dari pakan serta air minum pada ternak dicatat di buku catatan
133 secara rutin. Penelitian dilakukan dalam 4 periode, setiap periode dilakukan selama 30 hari
134 pengamatan. Parameter yang diukur yaitu lingkaran dada (LD), panjang badan (PB), tinggi

135 pundak (TP). Pengukuran ukuran tubuh dilakukan pada awal dan akhir periode, dilanjutkan
136 istirahat selama 5 hari, dan dilanjutkan ke periode berikutnya.

137

138 Tabel 1. Kandungan Nutrien Pakan

	Air	Abu	TDN	PK	LK	SK	Ca	P
	----- % -----							
Konsentrat Sapi Laktasi	9,42	9,90	64,91	16,40	6,42	26,87	0,51	0,56
<i>Calf starter</i>	11,17	12,32	76,13	19,70	5,25	8,74	0,08	0,50
Rumput Gajah	7,73	13,31	58,5	12,13	2,17	28,64	0,30	0,27
Konsentrat P1	10,73	11,71	73,32	18,87	5,54	13,27	0,18	0,51
Konsentrat P2	10,29	11,11	70,52	18,05	5,83	17,80	0,29	0,53
Konsentrat P3	9,86	10,50	67,71	17,25	6,13	22,33	0,40	0,54
Konsentrat P4	9,42	9,90	64,91	16,40	6,42	26,87	0,51	0,56

139

140

141 Analisis Data

142

143 Semua data dianalisis menggunakan analisis ragam (ANOVA). Jika terdapat pengaruh
144 perlakuan maka dilanjutkan uji Duncan.

145

146

HASIL DAN PEMBAHASAN

147

148 Hasil penelitian pengaruh pemberian substitusi *calf starter* pada konsentrat sapi laktasi
149 terhadap penambahan ukuran tubuh pedet FH betina lepas sapih disajikan pada Tabel 2.

150 Perlakuan substitusi *calf starter* pada konsentrat sapi laktasi (P1, P2, P3, dan P4) tidak

151 berpengaruh nyata ($P>0,05$) terhadap rata-rata ukuran tubuh di akhir penelitian dan

152 penambahan ukuran tubuh ternak yang meliputi lingkaran dada, panjang badan, dan tinggi

153 pundak. Hasil ini memiliki fenomena yang sama dengan penelitian Purwadi (2017) bahwa

154 pemberian konsentrat dengan kandungan protein yang berbeda, yaitu 10,23% dan 13,79%

155 pada pedet betina lepas sapih usia 3,5 bulan memberikan pengaruh yang tidak nyata terhadap

156 pertambahan ukuran tubuh pedet FH betina lepas sapih.

157

158 Tabel 2. Rataan Ukuran Tubuh Pedet FH Betina Lepas Sapih

Parameter	Perlakuan			
	P1	P2	P3	P4
	------(cm)-----			
Awal				
Lingkar Dada	116,92±8,45	115,25 ±13,58	114,55 ±9,84	115,40 ±6,30
Panjang Badan	96,33 ±8,68	97,27 ±10,82	98,95 ±7,93	99,25 ±3,30
Tinggi Pundak	70,40 ±4,62	70,92 ±4,83	71,50 ±3,76	71,20 ±2,48
Akhir				
Lingkar Dada	119,23 ±7,82	119,48 ±12,25	119,15 ±7,46	119,50 ±6,46
Panjang Badan	101,08 ±7,89	101,65 ±9,72	103,33 ±7,67	102,73 ±4,22
Tinggi Pundak	72,35 ±3,92	73,15 ±3,67	73,85 ±3,23	73,38 ±1,60
Pertambahan Ukuran Tubuh (cm/bulan)				
Lingkar Dada	2,31 ±1,36	4,23 ±1,85	4,60 ±2,81	4,10 ±1,13
Panjang Badan	4,75 ±3,10	4,38 ±1,80	4,38 ±1,41	3,48 ±1,83
Tinggi Pundak	1,95 ±1,08	2,23 ±1,58	2,35 ±2,16	2,18 ±1,48

159

160 Pertambahan ukuran tubuh yang tidak berbeda antar perlakuan dapat disebabkan oleh

161 jumlah konsumsi harian yang relatif sama sehingga nutrisi yang dicerna oleh pedet juga sama.

162 Rataan konsumsi BK juga tidak berbeda nyata, yaitu P1 3,43 kg/hari, P2 3,54 kg/hari, P3 3,58

163 kg/hari dan P4 3,34 kg/hari. Substitusi *calf starter* ditujukan untuk membuat kandungan

164 nutrisi pada pakan konsentrat untuk pedet lepas sapih di peternakan rakyat menjadi lebih baik

165 jika dibandingkan dengan pakan dari konsentrat sapi laktasi saja. Pakan hijauan diberikan

166 secara *ad libitum* terukur dengan tujuan pedet dapat memenuhi kekurangan nutrisi dari

167 konsumsi konsentrat dengan cara mendapatkannya dari konsumsi hijauan. Namun pemberian

168 konsentrat yang 1% dari BB atau dengan imbang H : K sebesar 70 : 30 ini maka diduga jika
169 konsumsi BK relatif sama akan diikuti konsumsi nutrisi lain yang relatif sama juga. Nutrien
170 dari proses pencernaan pakan yang berupa energi, protein, lemak, mineral, dan sebagainya
171 akan digunakan pedet untuk memenuhi kebutuhan nutrisi untuk pertumbuhan pedet. Imran *et*
172 *al.* (2012) menyatakan bahwa nutrisi yang dicerna oleh pedet akan digunakan untuk
173 memenuhi kebutuhan dalam mendukung pertumbuhan pedet sesuai dengan genetiknya.
174 Penelitian Kargar *et al.* (2019) juga menunjukkan ukuran tubuh pedet lepas sapih yang tidak
175 berbeda karena jumlah konsumsi bahan kering dan kandungan nutrisi yang dikonsumsi relatif
176 sama. Menurut Winarti dan Widyastuti (2016) jika konsumsi BK yang hampir sama akan
177 menghasilkan pertumbuhan pedet antar perlakuan tidak memiliki perbedaan karena konsumsi
178 zat gizinya hampir sama, baik dari konsumsi protein kasar, lemak kasar, serta serat kasar.

179 Pertumbuhan pedet lepas sapih ditunjukkan oleh pertambahan ukuran tubuhnya. Hasil
180 penelitian ini menunjukkan bahwa pertambahan ukuran tubuh pedet lepas sapih antar
181 perlakuan relatif sama. Hal ini diduga karena saat lepas sapih kondisi dan fungsi rumen sudah
182 berkembang sempurna, sehingga hasil pencernaan pakan secara fermentatif dalam rumen
183 yang dapat dimanfaatkan untuk pertumbuhan pedet lepas sapih pada setiap perlakuan relatif
184 sama, sehingga menghasilkan ukuran tubuh yang relatif sama walaupun *calf starter* memiliki
185 kualitas yang lebih baik dibanding konsentrat sapi perah laktasi. Hal tersebut dapat
186 disebabkan oleh kondisi rumen pada pedet lepas sapih yang sudah siap untuk mencerna pakan
187 padat. McCurdy *et al.* (2019) menyatakan bahwa ketika pedet sudah lepas sapih maka rumen
188 pedet sudah siap untuk mencerna pakan padat dan rumen menjadi jauh lebih peka terhadap
189 fermentabilitas makanan. Mikroba rumen diduga sudah mampu untuk memfermentasi
190 konsentrat dan hijauan dengan baik, sehingga sudah tersedia protein mikroba yang cukup
191 untuk pedet lepas sapih baik pada P1, P2, P3 maupun P4. Pramita *et al.* (2016) menyatakan
192 bahwa mikroba rumen merupakan sumber protein utama bagi induk semang, selain itu

193 mikroba rumen berperan penting dalam mencerna pakan karena dapat menghasilkan enzim
194 yang dapat mencerna serat pada pakan berkualitas rendah.

195 Rumén pedet lepas sapih memiliki mikroorganismé yang sudah cukup lengkap. Dengan
196 kondisi rumén yang sudah siap, pedet lepas sapih mampu untuk memanfaatkan hijauan dan
197 konsentrat dengan baik untuk memenuhi kebutuhan nutrisinya. Hal tersebut mengakibatkan
198 pemberian konsentrat sapi laktasi dengan kandungan PK 16,40% dan TDN 64,91% (P4)
199 sudah memberikan hasil pertambahan ukuran tubuh yang relatif sama dengan konsentrat yang
200 disubstitusi *calf starter* (P1, P2, P3), jika diiringi dengan pemberian hijauan yang optimal.

201

202 **Pertambahan Lingkar Dada**

203

204 Pertambahan ukuran lingkar dada pedet yang diberi perlakuan substitusi *calf starter*
205 pada konsentrat sapi laktasi (P1, P2, P3, dan P4) masing-masing yaitu $2,31 \pm 1,36$ cm/bulan,
206 $4,23 \pm 1,85$ cm/bulan, $4,60 \pm 2,81$ cm/bulan, dan $4,10 \pm 1,13$ cm/bulan. Hasil tersebut lebih
207 rendah dari hasil penelitian Manthey *et al.* (2016) dengan perlakuan penambahan DDGS pada
208 konsentrat dengan konsentrasi yang berbeda pada pedet Holstein yaitu rata-rata 5,22
209 cm/bulan, juga hasil penelitian Wang *et al.* (2017) yang melakukan pemberian konsentrat
210 dengan kandungan *physically effective neutral detergent fiber* (peNDF) yang berbeda pada
211 pedet Holstein yaitu 5,36 cm/bulan. Hal tersebut sesuai pernyataan Ratnasari *et al.* (2019)
212 bahwa perbedaan pertumbuhan pada ternak dapat disebabkan oleh iklim, kemampuan genetik
213 masing-masing ternak, manajemen pemeliharaan dan pakan.

214 Pemberian substitusi *calf starter* pada konsentrat sapi laktasi tidak berpengaruh
215 terhadap pertambahan ukuran lingkar dada pedet FH betina lepas sapih ($P > 0,05$). Kondisi
216 tersebut mungkin terjadi karena nutrisi dari pakan yang dikonsumsi pedet telah digunakan
217 untuk pertumbuhan tulang, pertumbuhan organ, dan pertumbuhan dagingnya. Hal tersebut
218 sesuai dengan pendapat Parsons *et al.* (2020) yang menyatakan bahwa ukuran tubuh berkaitan

219 erat dengan bobot badan yang dipengaruhi oleh pertumbuhan tulang kemudian deposisi
220 lemak. Pertumbuhan daging dan tulang mempengaruhi ukuran lingkaran dada, lebar dada,
221 lingkaran perut dan bobot badan ternak, sedangkan pertumbuhan tulang berpengaruh terhadap
222 panjang badan, tinggi badan, serta bobot badan ternak. Pertambahan ukuran lingkaran dada
223 terjadi karena lingkaran dada berkaitan erat dengan bobot badan ternak, sehingga ketika bobot
224 ternak naik maka lingkaran dada akan semakin besar, termasuk pada pedet sapi FH
225 (Sulistiyowati *et al.*, 2009; Hardiono *et al.*, 2016; Rotondo *et al.*, 2021). Syaiful *et al.* (2020)
226 menyatakan bahwa semakin besar lingkaran dada maka semakin besar pula organ-organ yang
227 berada di dalam rongga dada seperti jantung dan paru-paru, oleh sebab itu lingkaran dada dapat
228 digunakan sebagai indikator kapasitas tubuh pedet.

229

230 **Pertambahan Panjang Badan**

231

232 Pemberian substitusi *calf starter* pada konsentrat sapi laktasi tidak berpengaruh
233 terhadap pertambahan ukuran panjang badan pedet FH betina lepas sapih ($P > 0,05$). Hasil dari
234 masing-masing perlakuan yaitu $4,75 \pm 3,10$ cm/bulan, $4,38 \pm 1,80$ cm/bulan, $4,38 \pm 1,41$
235 cm/bulan, dan $3,48 \pm 1,83$ cm/bulan. Hasil tersebut lebih tinggi dari hasil penelitian Anderson
236 *et al.* (2015) dengan perlakuan pemberian konsentrat dari biji-bijian dengan kandungan lemak
237 dan protein yang berbeda pada pedet Holstein yaitu rata-rata 3,93 cm/bulan, namun lebih
238 rendah dari hasil rata-rata penelitian Wang *et al.* (2017) dengan perlakuan konsentrat dengan
239 kandungan *physically effective neutral detergent fiber* (peNDF) yang berbeda pada pedet
240 Holstein yaitu 6,15 cm/bulan. Hasil penelitian tersebut berbeda karena disebabkan oleh
241 beberapa faktor, yaitu umur ternak, genetik, kualitas pakan, dan manajemen pemeliharaan.
242 Hal tersebut sesuai dengan pendapat Vavrisinova *et al.* (2019) yang menyatakan bahwa model
243 pertumbuhan pada pedet dipengaruhi oleh umur, genetik, pemberian pakan dan manajemen
244 yang berbeda.

245 Ukuran panjang tubuh pedet yang tidak berbeda, akibat dari perlakuan pemberian
246 substitusi *calf starter* pada konsentrat sapi laktasi, dapat disebabkan oleh pengaruh genetik
247 dan umur yang hampir sama. Hal tersebut sesuai dengan hasil penelitian Senevirathne *et al.*
248 (2016) bahwa tidak adanya perbedaan antar perlakuan terhadap ukuran tubuh pedet
249 menunjukkan bahwa pedet berada di periode yang sama sehingga tingkat pertumbuhan
250 kerangka tubuhnya tidak berbeda. Pada saat penelitian dilaksanakan, pedet berada di fase
251 percepatan pertumbuhan sehingga pakan yang dikonsumsi pedet akan digunakan maksimal
252 untuk pertumbuhan kerangka tubuhnya. Putra dan Fajrina (2020) menyatakan bahwa laju
253 pertumbuhan maksimal terjadi pada saat pedet berumur 4 – 8 bulan.

254

255 **Pertambahan Tinggi Pundak**

256

257 Pemberian substitusi *calf starter* pada konsentrat sapi laktasi tidak memiliki pengaruh
258 yang berbeda terhadap pertambahan ukuran tinggi pundak pedet FH betina lepas sapih
259 ($P>0,05$). Pemberian konsentrat perlakuan memberikan pertambahan ukuran tinggi pundak
260 masing-masing sebanyak $1,95 \pm 1,08$ cm/bulan pada P1; $2,23 \pm 1,58$ cm/bulan pada P2; $2,35$
261 $\pm 2,16$ cm/bulan pada P3 dan $2,18 \pm 1,48$ cm/bulan pada P4. Hasil tersebut lebih rendah dari
262 hasil penelitian Manthey dan Anderson (2018) dengan pemberian konsentrat berbasis jagung
263 dan kedelai (dengan pemberian hijauan *ad libitum*) pada pedet Holstein memiliki hasil rata-
264 rata pertambahan tinggi gumba sebesar $3,03$ cm/bulan. Perbedaan hasil penelitian ini dapat
265 dipengaruhi oleh faktor umur ternak, iklim lingkungan, pakan yang diberikan, serta
266 manajemen pemeliharaan. Hal tersebut sesuai pendapat Place dan Mitloehner (2010) bahwa
267 iklim, umur, manajemen pakan dan manajemen pemeliharaan merupakan faktor-faktor yang
268 berpengaruh terhadap pertumbuhan ternak.

269 Hasil pertambahan tinggi pundak yang tidak berbeda dari semua perlakuan pemberian
270 substitusi *calf starter* pada konsentrat sapi laktasi juga dikarenakan oleh umur pedet yang

271 sedang dalam masa awal pertumbuhan sehingga nutrisi dari pakan yang dikonsumsi
272 digunakan untuk pertumbuhan tulangnya. Hal tersebut sesuai dengan pendapat Syaiful *et al.*
273 (2020) yang menyatakan bahwa bahwa pada umur 0 – 6 bulan pedet mengalami pertumbuhan
274 yang lebih cepat pada kaki depannya karena kaki depan digunakan untuk aktif bergerak pada
275 saat pedet menyusui pada induknya, selain itu kaki depan digunakan untuk menopang berat
276 tubuh pedet. Pertambahan tinggi pundak berkaitan erat dengan pertumbuhan tulang kerangka
277 tubuh pedet. Hal tersebut sesuai dengan pendapat Maluhima *et al.* (2019) yang menyatakan
278 bahwa tinggi pundak dipengaruhi oleh beberapa faktor, diantaranya adalah karena manajemen
279 pemberian pakan, genetik, kondisi ternak itu sendiri, serta mempunyai kaitan erat dengan
280 ukuran kerangka pedet.

281
282

KESIMPULAN

283
284

Substitusi *calf starter* pada pakan konsentrat sapi laktasi tidak memberikan pengaruh
285 yang berbeda terhadap pertambahan ukuran tubuh (lingkar dada, panjang tubuh, tinggi
286 pundak) pedet FH betina lepas sapih. Pemberian pakan konsentrat sapi laktasi dengan PK
287 16,40% dan TDN 64,91% serta diikuti hijauan yang berkualitas baik dalam jumlah cukup,
288 sudah mampu mencukupi kebutuhan nutrisi pada pedet lepas sapih.

289
290

DAFTAR PUSTAKA

291
292

Alim, A. F. & T. Hidaka. 2002. Pakan dan Tatalaksana Sapi Perah. Dairy Technology
293 Improvement Project in Indonesia. Bandung.

294

American Society of Animal Science. 2020. The Guide for the
295 Care and Use of Agricultural Animals in Research and Teaching. 4th ed. American
296 Society of Animal Science. Champaign, IL.
297

298

Anderson, J. L., K. F. Kalscheur, A. D. Garcia & D. J. Schingoethe. 2015. Feeding fat from
299 distillers dried grains with solubles to dairy heifers: I. Effects on growth performance
300 and total-tract digestibility of nutrients. *Journal of Dairy Science* 98(8): 5699 – 5708.
301

302

Atabany, A., B. P. Purwanto, A. Yani, L. Cyrilla, I. Komala, S. Prabowo, W. A. Zahra, D.
303 Permadi, T. Suprijatna & Surajudin. 2020. Budidaya Sapi Perah. IPB Press. Bogor.
304

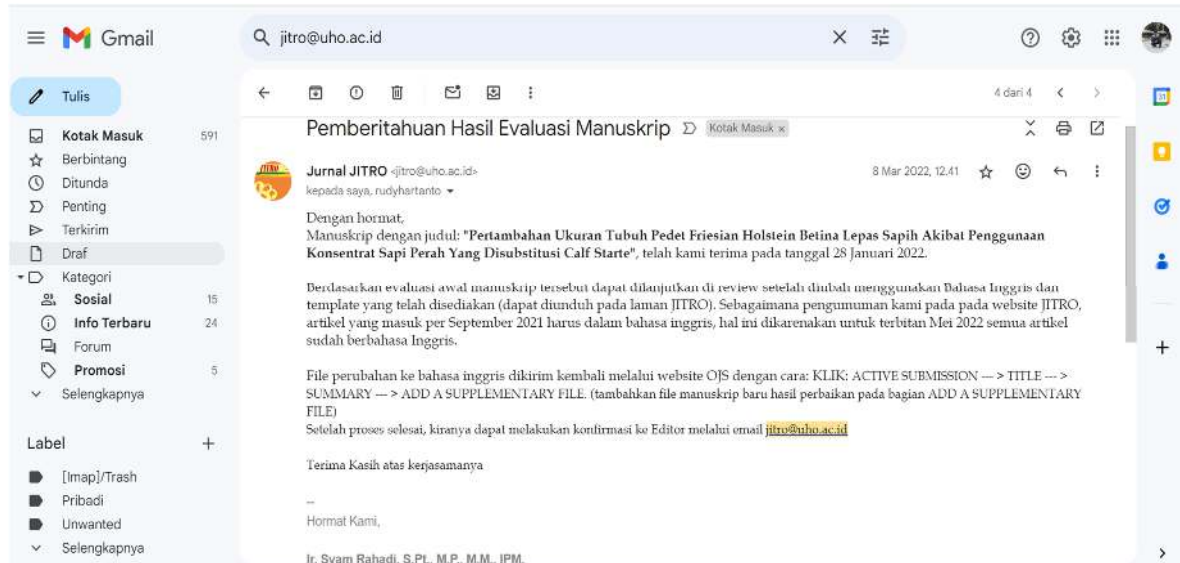
305
306 Badan Standardisasi Nasional (BSN). 2017. SNI 3148.1:2017, Pakan Konsentrat – Bagian 1 :
307 Sapi Perah. Badan Standardisasi Nasional. Jakarta
308
309
310 Imran, S. P. S. Budhi, N. Ngadiyono & Dahlanuddin. 2012. Pertumbuhan pedet sapi Bali
311 lepas sapih yang diberi rumput lapangan dan disuplementasi daun turi (*Sesbania*
312 *grandiflora*). Agrinimal Jurnal Ilmu Ternak dan Tanaman 2(2): 55 – 60.
313
314 Hardiono, R., T. Saili & L. O. Nafiu. 2016. Respon pertumbuhan dan mortalitas pedet sapi
315 bali dari induk yang diberi pakan tambahan dan obat cacing. JITRO 3(2): 39-47.
316
317 Kargar, S., M. Kanani, M. Albenzio & M. Caroprese. 2019. Substituting corn silage with
318 reconstituted forage or nonforage fiber sources in the starter diets of Holstein calves:
319 effects on performance, ruminal fermentation, and blood metabolites. Journal of
320 Animal Science 97(7): 3046 – 3055.
321
322 Kusumawati, E.D., S. Rahadi, J. Peso & A.T. N. Krisnaningsih. 2018. Pengaruh umur lepas
323 sapih dan umur induk terhadap produksi susu sapi perah Peranakan *Friesian Holstein*
324 (PFH). JITRO 5(1): 62-68.
325
326 Lardy, R., A. de Boyer des Roches , J. Capdeville, R. Bastien³, L. Mounier &
327 I. Veissier. 2020. New recommendations for self-locking barriers to reduce skin injuries
328 in dairy cows. Animal 14(8):745-1756.
329
330 Maluhima, R. J., J. H. Manopo, A. Lomboan & S. H. Turangan. 2019. Rekondisi beberapa
331 ukuran tubuh ternak sapi perah Friesian Holland di Balai Pengembangan Bibit dan Pakan
332 Ternak Tampusu. Zootec 39(1): 165 – 170.
333
334 Manthey, A. K., J. L. Anderson & G. A. Perry. 2016. Feeding distillers dried grains in
335 replacement of forage in limit-fed dairy heifer rations: Effects on growth performance,
336 rumen fermentation, and total-tract digestibility of nutrients. Journal of Dairy
337 Science 99(9): 7206 – 7215.
338
339 Manthey, A. K. & J. L. Anderson. 2018. Growth performance, rumen fermentation, nutrient
340 utilization, and metabolic profile of dairy heifers limit-fed distillers dried grains with ad
341 libitum forage. Journal of Dairy Science 101(1): 365 – 375.
342
343 McCurdy, D. E., K. R. Wilkins, R. L. Hiltz, S. Moreland, K. Klanderman & A. H. Laarman.
344 2019. Effects of supplemental butyrate and weaning on rumen fermentation in Holstein
345 calves. Journal of Dairy Science 102(10): 8874 – 8882.
346
347 Mukodiningsih, S., S. S. Budhi, A. Agus & A. Astuti. 2012. Pemanfaatan susu bubuk
348 kadaluwarsa dalam complete *calf starter* dan pengaruhnya terhadap konsentrasi VFA
349 dan gula sapih. Jurnal Sains dan Matematika 20(4): 109 – 113.
350
351 National Research Council (NRC). 2001. Nutrient Requirement of Dairy Cattle. 7th Revised
352 Edition. National Academy Press. Washington D. C.
353

- 354 Nemati, M., H. Amanlou, M. Khorvash, M. Mirzaei, B. Moshiri & M. H. Ghaffari. 2016.
355 Effect of different alfalfa hay levels on growth performance, rumen fermentation, and
356 structural growth of Holstein dairy calves. *Journal of Animal Science* 94(3): 1141-1148.
357
- 358 Nugraha, H. Y., I. P. Sampurna & I. K. Suatha. 2016. Pengaruh pemberian pakan tambahan
359 pada induk sapi bali terhadap ukuran dimensi panjang pedet. *Buletin Veteriner Udayana*
360 8(2): 159 – 165.
361
- 362 Parsons, S. D., M. A. Steele, K. E. Leslie, D. L. Renaud & T. J. DeVries. 2020. Investigation
363 of weaning strategy and solid feed location for dairy calves individually fed with an
364 automated milk feeding system. *Journal of Dairy Science* 103(7): 6533 – 6556.
365
- 366 Place, S. E. & F. M. Mitloehner. 2010. Invited review: Contemporary environmental issues: A
367 review of the dairy industry's role in climate change and air quality and the potential of
368 mitigation through improved production efficiency. *Journal of Dairy Science* 93(8):
369 3407 – 3416.
370
- 371 Pramita, I. D. A. D. P., I. N. K. Besung & I. P. Sampurna. 2016. Jumlah non coliform dan
372 total bakteri pada Sapi Bali di dataran tinggi dan dataran rendah di Bali pasca
373 pemberian mineral. *Buletin Veteriner Udayana* 8(1): 52 – 58.
374
- 375 Prihantoro, I., D. Evvyernie, Suryani, L. Abdullah1, N. S. Yunitasari, A. P. Sari, D.
376 Khairunisa, A. Haziq, N. Rahayu & T. Toharmat. 2012. Potensi bakteri pencernaan serat
377 asal rumen kerbau yang diinokulasikan pada pedet Friesian Holstein selama periode
378 prasapih. *J. Ilmu Ternak dan Veteriner* 17(4): 297 – 309.
379
- 380 Purwadi. 2017. Pengaruh pembedaan kualitas konsentrat pada tampilan ukuran-ukuran tubuh
381 dan kosumsi pakan pedet FH betina lepas sapih. *Tropical Animal Science* 1(1): 1 – 5.
382
- 383 Putra, W. P. B. & N. Z. Fajrina. 2020. Model kurva pertumbuhan berat badan pada sapi
384 Turkish Holstein jantan. *Jurnal Peternakan Lingkungan Tropis* 3(1): 23 – 30.
385
- 386 Ratnasari, D., A. Atabany, B. P. Purwanto & L. B. Salman. 2019. Model pertumbuhan sapi
387 perah Friesian Holstein (FH) dari lahir sampai beranak pertama di BBPTU-HPT sapi
388 perah Baturraden menggunakan model matematik logistic. *Jurnal Ilmu Produksi dan*
389 *Teknologi Hasil Peternakan* 7(1): 18 – 21.
390
- 391 Rotondo, V., V. R. Osborne, M. Paibomesai, K. M. Wood & S. Jantzi. 2021. PSX-A-21 Late-
392 Breaking: Predicting live weight using linear body measurements in growing dairy
393 calves. *Journal of Animal Science*. 99(Issue suppl 3): 371-372.
394
- 395 Senevirathne, N. D., J. L. Anderson, W. R. Gibbons & J. A. Clapper. 2016. Growth
396 performance of calves fed microbially enhanced soy protein in pelleted starters. *Journal*
397 *of Dairy Science* 100(1): 199 – 212.
398
- 399 Stefańska, B., M. Gąsiorek & W. Nowak. 2021. Short-and long-term effects of initial serum
400 total protein, average starter feed intake during the last week of the preweaning period,
401 and rearing body gain on primiparous dairy heifers' performance. *Journal of Dairy*
402 *Science* 104(2): 1645 – 1659.
403

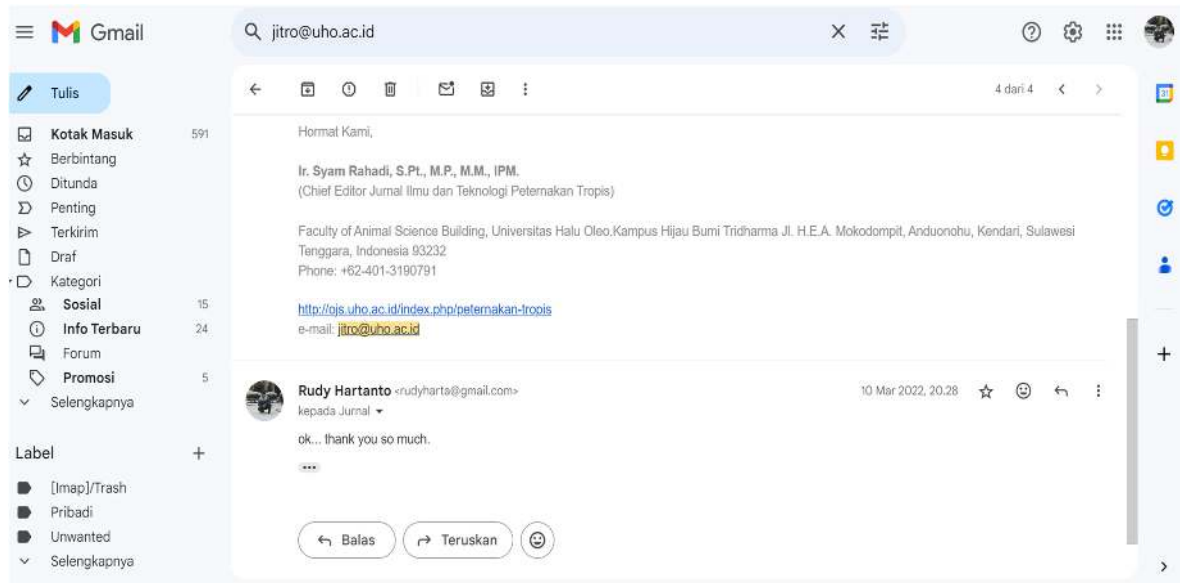
- 404 Sulistyowati, E., E. Kuswadi, L. Sutarno & G. Tampubolon. 2009. Penampilan reproduksi
405 sapi perah FH (Friesian Holland) dan pertumbuhan pedetnya pada umur 1- 3 bulan (studi
406 kasus di Desa Air Duku dan Desa Air Putih Kali Bandung, Selupu Rejang, Rejang
407 Lebong, Bengkulu). *Jurnal Sain Peternakan Indonesia* 4(1): 21-26.
408
- 409 Syaiful, F. L., Khasrad & S. Maulida. 2020. Identifikasi ukuran tubuh sapi Bali dan Simbal
410 (Simmental-Bali) di Kecamatan Luhak Nan Duo Kabupaten Pasaman Barat. *Jurnal Sain
411 Peternakan Indonesia* 15(2): 219 – 226.
412
- 413 Turiello, P., E. Martinez, M. Auil, A. Bogni & O. Queiroz. 2016. Effects of a milk balancer
414 protein supplement on growth and performance of dairy calves. *Journal of Animal
415 Science* 94(Issue suppl 5): 370.
416
- 417 Vavrišínová, K., K. Hozáková, O. Bučko, P. Haščík & P. Juhás. 2019. The effect of the
418 slaughter weight on carcass composition, body measurements and veal quality of
419 holstein calves. *Acta Universitatis Agriculturae et Silviculturae Mendelianae
420 Brunensis* 67(5): 1235 – 1243.
421
- 422 Wang, H. R., Q. Chen, L. M. Chen, R. F. Ge, M. Z. Wang, L. H. Yu & J. Zhang. 2017.
423 Effects of dietary physically effective neutral detergent fiber content on the feeding
424 behavior, digestibility, and growth of 8-to 10-month-old Holstein replacement
425 heifers. *Journal Dairy Science* 100(2): 1161 – 1169.
426
- 427 Welboren, A.C., L. N. Leal, M. A. Steele, M. A. Khan & J. Martín-Tereso. 2018.
428 Performance of ad libitum fed dairy calves weaned using fixed and individual methods.
429 *Animal* 13(9): 1891-1898.
430
- 431 Winarti, E. & A. Widyastuti. 2016. The effect of *calf starter* ration for pre-weaning ongole
432 grade (PO) calves on body weight gain. *Journal of the Indonesian Tropical Animal
433 Agriculture* 41(4): 209 – 215.
434
- 435 Xiao, J. X., G. M. Alugongo, R. Chung, S. Z. Dong, S. L. Li, I. Yoon, Z. H. Wu & Z. J. Cao.
436 2016. Effects of *Saccharomyces cerevisiae* fermentation products on dairy calves:
437 Ruminant fermentation, gastrointestinal morphology, and microbial community. *Journal
438 of Dairy Science* 99(7): 5401-5412.
439
- 440 Yanuartono, A. Nururrozi, S. Indarjulianto & H. Purnamaningsih. 2019. Peran protozoa pada
441 pencernaan ruminansia dan dampak terhadap lingkungan. *Ternak Tropika* 20(1): 16-28.
442

Korespondensi selanjutnya Via Email

Review Ke-1 : Permintaan Merubah dari Bahasa Indonesia ke Bahasa Inggris



The screenshot shows a Gmail interface with a search bar containing "jitro@uho.ac.id". The left sidebar lists folders like "Kotak Masuk" (591), "Sosial", "Info Terbaru" (24), and "Promosi" (5). The main content area displays an email from "Jurnal JITRO" dated "8 Mar 2022, 12.41". The email subject is "Pemberitahuan Hasil Evaluasi Manuskrip". The body text reads: "Dengan hormat, Manuskrip dengan judul: 'Pertambahan Ukuran Tubuh Pedet Friesian Holstein Betina Lepas Sapih Akibat Penggunaan Konsentrat Sapi Perah Yang Disubstitusi Calf Starter', telah kami terima pada tanggal 28 Januari 2022. Berdasarkan evaluasi awal manuskrip tersebut dapat dilanjutkan di review setelah diubah menggunakan Bahasa Inggris dan template yang telah disediakan (dapat diunduh pada laman JITRO). Sebagaimana pengumuman kami pada pada website JITRO, artikel yang masuk per September 2021 harus dalam bahasa inggris, hal ini dikarenakan untuk terbitan Mei 2022 semua artikel sudah berbahasa Inggris. File perubahan ke bahasa inggris dikirim kembali melalui website OJS dengan cara: KLIK: ACTIVE SUBMISSION --> TITLE --> SUMMARY --> ADD A SUPPLEMENTARY FILE. (tambahkan file manuskrip baru hasil perbaikan pada bagian ADD A SUPPLEMENTARY FILE) Setelah proses selesai, kiranya dapat melakukan konfirmasi ke Editor melalui email jitro@uho.ac.id Terima Kasih atas kerjasamanya" followed by "Hormat Kami, Ir. Syam Rahadi, S.Pt., M.P., M.M., IPM."



The screenshot shows a Gmail interface with a search bar containing "jitro@uho.ac.id". The left sidebar lists folders like "Kotak Masuk" (591), "Sosial", "Info Terbaru" (24), and "Promosi" (5). The main content area displays a reply email from "Rudy Hartanto" dated "10 Mar 2022, 20.28". The email body text reads: "Hormat Kami, Ir. Syam Rahadi, S.Pt., M.P., M.M., IPM. (Chief Editor Jurnal Ilmu dan Teknologi Peternakan Tropis) Faculty of Animal Science Building, Universitas Halu Oleo, Kampus Hijau Bumi Tridharma Jl. H.E.A. Mokodompit, Anduonohu, Kendari, Sulawesi Tenggara, Indonesia 93232 Phone: +62-401-3190791 <http://ojs.uho.ac.id/index.php/peternakan-tropis> e-mail: jitro@uho.ac.id" followed by "ok... thank you so much." and a "Balas" button.

Pertambahan Ukuran Tubuh Pedet *Friesian Holstein* Betina Lepas Sapih Akibat Penggunaan Konsentrat Sapi Perah Yang Disubstitusi *Calf Starter*

Commented [U1]: Rubah dalam bahasa inggris dan perbaiki sesuai saran

Increase in Body Measurements of Post-Weaning Female Holstein Friesian Calves Due to the Use of Concentrated Dairy Cows Substituted by Calf Starter

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ABSTRAK

Penelitian bertujuan untuk menganalisis pertambahan ukuran tubuh pedet *Friesian Holstein* (FH) betina lepas sapih yang diberi konsentrat sapi perah dengan substitusi *calf starter* yang berbeda level. Materi adalah 4 ekor pedet FH betina lepas sapih umur 4 – 5 bulan, BB rata-rata $101,38 \pm 14,21$ kg. Pakan berupa rumput gajah, *calf starter* serta konsentrat sapi laktasi. Penelitian menggunakan rancangan bujur sangkar latin (RBSL), dengan 4 perlakuan konsentrat yaitu P1 (75% *calf starter* dan 25% konsentrat sapi laktasi), P2 (50% *calf starter* dan 50% konsentrat sapi laktasi), P3 (25% *calf starter* dan 75% konsentrat sapi laktasi), P4 (100% konsentrat sapi laktasi); dan 4 ulangan dalam 4 periode (setiap periode berlangsung 1 bulan). Konsentrat diberikan 1% BB dalam bahan kering; rumput gajah serta air minum diberikan secara *ad libitum* terukur. Parameter penelitian adalah pertambahan ukuran tubuh (lingkar dada (LD), panjang badan (PB), tinggi pundak (TP)). Data dianalisis menggunakan Anova. Hasil menunjukkan perlakuan tidak berpengaruh nyata ($P > 0,05$) terhadap pertambahan ukuran tubuh pedet FH betina lepas sapih. Pertambahan ukuran tubuh pada P1 (LD = 2,30 cm/bulan, PB = 4,75 cm/bulan, TP = 1,95 cm/bulan), P2 (LD = 4,20 cm/bulan, PB = 4,38 cm/bulan, TP = 2,23 cm/bulan), P3 (LD = 4,60 cm/bulan, PB = 4,38 cm/bulan, TP = 2,35 cm/bulan), P4 (LD = 4,10 cm/bulan, PB = 3,48 cm/bulan, TP = 2,18 cm/bulan). Disimpulkan bahwa dengan pakan hijauan berkualitas dalam jumlah cukup, pemberian 100% konsentrat sapi laktasi pada pedet FH betina lepas sapih dapat menghasilkan pertambahan ukuran tubuh yang relatif sama dengan pemberian substitusi *calf starter* (25-75%) pada konsentrat sapi perah sebagai pakan konsentratnya.

Commented [U2]: Tujuan penelitian di abstrak dan pendahuluan harus sama

Kata Kunci : pedet FH betina lepas sapih, ukuran tubuh, *calf starter*, konsentrat

ABSTRACT

The aim of the study was to analyze the increase in body measurements of post-weaning female Holstein Friesian (HF) calves fed with dairy cow concentrate with different levels of *calf starter* substitution. The material was 4 post-weaning female HF calves aged 4-5 months, with an average weight of 101.38 ± 14.21 kg. The feed consisted of elephant grass,

50 calf starter and lactating cow concentrate. The study used a Latin square design (RBSL), with
51 4 concentrate treatments, namely P1 (75% calf starter and 25% lactating cow concentrate), P2
52 (50% calf starter and 50% lactating cow concentrate), P3 (25% calf starter and 75% lactating
53 cow concentrate), P4 (100% lactating cow concentrate); and 4 replications in 4 periods (each
54 period in 1 month). Concentrate is given 1% BW in dry matter; elephant grass and drinking
55 water were provided in a measurable ad libitum. The research parameters were the increase in
56 body measurements (heart girth (HG), body length (BL) and shoulder height (SH)). Data were
57 analyzed using ANOVA. The results showed that the treatment had no significant effect
58 ($P>0.05$) on the increase in body size of post-weaning female HF calves. Increase in body
59 measurements at P1 (HG = 2.30 cm/month, BL = 4.75 cm/month, SH = 1.95 cm/month), P2
60 (HG = 4.20 cm/month, BL = 4.38 cm/month, SH = 2.23 cm/month), P3 (HG = 4.60
61 cm/month, BL = 4.38 cm/month, SH = 2.35 cm/month), P4 (HG = 4,10 cm/month, BL = 3.48
62 cm/month, SH = 2.18 cm/month). It was concluded that with sufficient quality forage feed,
63 giving 100% lactating cow concentrate to post-weaning female HF calves could result in an
64 increase in body measurements that was relatively the same as the substitution of calf starter
65 (25-75%) in lactating cow concentrate as concentrate feed.

66
67 **Keywords:** post-weaning female HF calves, body measurements, calf starter, concentrate

68

69

PENDAHULUAN

70

71 Pemberian pakan dan minum serta kesehatan pedet merupakan faktor penting yang
72 perlu diperhatikan guna mendapatkan pertumbuhan pedet yang baik, dimasa pra sapih
73 maupun lepas sapih. Pedet yang sudah lepas sapih tidak mendapatkan susu dari induknya dan
74 memenuhi kebutuhan nutrisinya secara penuh dari hijauan dan konsentrat (Kusumawati *et al.*,
75 2018; Atabany *et al.*, 2020). Pedet mulai dapat disapih saat berumur 8 minggu, yaitu setelah
76 mampu mengkonsumsi pakan starter 0,5 – 0,68 kg /hari, tetapi penyapihan di umur ini
77 memiliki resiko kematian pedet yang tinggi sehingga pedet pada umumnya disapih saat umur 3
78 bulan (NRC, 2001; Prihantoro *et al.*, 2012). Saat lepas sapih, pedet memasuki fase awal
79 pertumbuhan, sehingga sebagian besar nutrisi yang dikonsumsi akan digunakan untuk
80 pertumbuhan seperti pembesaran kerangka tubuhnya (Imran *et al.*, 2012; Welboren *et al.*,
81 2018).

82 Pembentukan ukuran tubuh pedet betina saat lepas sapih sangat perlu diperhatikan
83 karena pedet betina yang dari awal sudah mempunyai ukuran tubuh ideal, akan menjadi

Commented [U3]: perjelas dengan fungsi lainnya juga

84 indukan yang ideal pula. Selain penambahan bobot badan, penambahan ukuran tubuh
85 (lingkar dada, tinggi pundak, panjang tubuh) pada pedet lepas sapih juga merupakan ukuran
86 tampilan atau performans pedet (Hardiono *et al.*, 2016; Rotondo *et al.*, 2021). Pedet saat lepas
87 sapih sebaiknya memiliki ukuran lingkar dada 96 cm dan tinggi badan 75 cm, supaya
88 nantinya dapat memenuhi target lingkar dada 155 cm dan tinggi badan 115 cm pada saat
89 masuk usia 15 bulan untuk IB pertama kali (Alim dan Hidaka, 2002). Pembentukan ukuran
90 tubuh ini dipengaruhi oleh kecukupan akan kebutuhan nutriennya. Pedet lepas sapih biasanya
91 diberi pakan hijauan berkualitas tinggi dan konsentrat yang diformulasikan untuk memenuhi
92 kebutuhan nutrisi serta meningkatkan bobot badannya (American Society of Animal Science,
93 2020).

94 Namun pada praktik di lapangan, pemberian pakan untuk pedet lepas sapih belum
95 diperhatikan dengan baik oleh para peternak kecil. Umumnya peternakan rakyat memberikan
96 konsentrat sapi laktasi pada pedet dengan pertimbangan harga konsentrat yang lebih murah.
97 Konsentrat sapi laktasi minimal memiliki kandungan PK sebesar 14% dan TDN 68%,
98 sedangkan pada *calf starter* kadungan PK 16-21% dan TDN 70-80% (BSN, 2017). Padahal
99 kebutuhan nutrisi pedet mulai dari lepas sapih hingga dara berbeda dengan kebutuhan sapi
100 dewasa, sehingga pedet perlu diberikan pakan yang berbeda pula dengan sapi dewasa.

101 Substitusi *calf starter* pada konsentrat sapi laktasi dilakukan dengan tujuan untuk
102 meningkatkan kualitas nutrien pada pakan konsentrat yang diberikan pada pedet lepas sapih.
103 *Calf starter* berbeda dengan konsentrat sapi laktasi baik secara fisik maupun kualitasnya
104 (Mukodiningsih *et al.*, 2012). Pedet lepas sapih yang mendapatkan pakan yang lebih
105 berkualitas akan menghasilkan performen dalam ukuran tubuh yang lebih baik juga. Bobot
106 badan dan ukuran tubuh yang lebih besar pada umur yang sama menunjukkan adanya
107 pertumbuhan yang lebih baik (Turiello *et al.*, 2016; Nemati *et al.*, 2016).

108 Penelitian ini bertujuan untuk mengetahui dan mengkaji tentang penambahan ukuran
109 tubuh pedet FH betina lepas sapih yang diberi konsentrat sapi perah dengan substitusi *calf*
110 *starter* yang berbeda level.

Commented [U4]: samakan dengan yang di abstrak

111 112 MATERI DAN METODE

113 114 Materi

115 Materi yang digunakan yaitu 4 ekor pedet FH betina lepas sapih umur 4 – 5 bulan
116 dengan BB rata-rata $101,38 \pm 14,21$ kg. Pedet dipelihara dalam kandang metabolik selama
117 penelitian berlangsung. Pita ukur merek 300 cm dengan keakuratan 0,1 cm dan tongkat ukur
118 dari *stainless steel* 1,5 m dengan kepekaan 0,1 cm untuk mengukur dimensi tubuh ternak.
119 Pakan yang digunakan yaitu rumput gajah, konsentrat sapi laktasi (KSL), dan *calf starter*
120 (CS) produksi Teaching Farm FPP Undip.

122 123 Metode

124 Pakan yang diberikan berupa hijauan dan konsentrat perlakuan yang disesuaikan
125 dengan kebutuhan BK ternak. Konsentrat perlakuan (dalam BK) diberikan sebanyak 1% BB
126 dalam dua kali pemberian, yaitu pagi pukul 06.00 dan sore pukul 15.00. Hijauan dan air
127 minum diberikan secara *ad libitum* terukur. Konsentrat perlakuan terdiri atas P1 (75% CS dan
128 25% KSL), P2 (50% CS dan 50% KSL), P3 (25% CS dan 75% KSL), dan P4 (100% KSL).
129 Kandungan nutrisi pakan yang diberikan terlihat pada tabel 1. Rancangan penelitian yang
130 digunakan yaitu rancangan bujur sangkar latin (RBSL) dengan 4 perlakuan dan 4 periode.

Commented [U5]: Apakah ada pengaturan / jeda waktu dalam pemberian hijauan dan konsentrat?

132 Pemberian dan sisa dari pakan serta air minum pada ternak dicatat di buku catatan
133 secara rutin. Penelitian dilakukan dalam 4 periode, setiap periode dilakukan selama 30 hari
134 pengamatan. Parameter yang diukur yaitu lingkaran dada (LD), panjang badan (PB), tinggi

135 pundak (TP). Pengukuran ukuran tubuh dilakukan pada awal dan akhir periode, dilanjutkan
136 istirahat selama 5 hari, dan dilanjutkan ke periode berikutnya.

Commented [U6]: Apakah 5 hari ini sudah cukup dalam menghilangkan efek perlakuan sebelumnya? Harus ada pustaka pendukungnya!

137
138 Tabel 1. Kandungan Nutrien Pakan

	Air	Abu	TDN	PK	LK	SK	Ca	P
	----- % -----							
Konsentrat Sapi Laktasi	9,42	9,90	64,91	16,40	6,42	26,87	0,51	0,56
<i>Calf starter</i>	11,17	12,32	76,13	19,70	5,25	8,74	0,08	0,50
Rumput Gajah	7,73	13,31	58,5	12,13	2,17	28,64	0,30	0,27
Konsentrat P1	10,73	11,71	73,32	18,87	5,54	13,27	0,18	0,51
Konsentrat P2	10,29	11,11	70,52	18,05	5,83	17,80	0,29	0,53
Konsentrat P3	9,86	10,50	67,71	17,25	6,13	22,33	0,40	0,54
Konsentrat P4	9,42	9,90	64,91	16,40	6,42	26,87	0,51	0,56

139
140
141 **Analisis Data**

142
143 Semua data dianalisis menggunakan analisis ragam (ANOVA). Jika terdapat pengaruh
144 perlakuan maka dilanjutkan uji Duncan.

Commented [U7]: Jelaskan fungsi uji duncan!

145
146 **HASIL DAN PEMBAHASAN**

147
148 Hasil penelitian pengaruh pemberian substitusi *calf starter* pada konsentrat sapi laktasi
149 terhadap pertambahan ukuran tubuh pedet FH betina lepas sapih disajikan pada Tabel 2.
150 Perlakuan substitusi *calf starter* pada konsentrat sapi laktasi (P1, P2, P3, dan P4) tidak
151 berpengaruh nyata ($P>0,05$) terhadap rata-rata ukuran tubuh di akhir penelitian dan
152 pertambahan ukuran tubuh ternak yang meliputi lingkaran dada, panjang badan, dan tinggi
153 pundak. Hasil ini memiliki fenomena yang sama dengan penelitian Purwadi (2017) bahwa
154 pemberian konsentrat dengan kandungan protein yang berbeda, yaitu 10,23% dan 13,79%
155 pada pedet betina lepas sapih usia 3,5 bulan memberikan pengaruh yang tidak nyata terhadap

156 pertambahan ukuran tubuh pedet FH betina lepas sapih.

157

158 Tabel 2. Rataan Ukuran Tubuh Pedet FH Betina Lepas Sapih

Parameter	Perlakuan			
	P1	P2	P3	P4
	------(cm)-----			
Awal				
Lingkar Dada	116,92±8,45	115,25 ±13,58	114,55 ±9,84	115,40 ±6,30
Panjang Badan	96,33 ±8,68	97,27 ±10,82	98,95 ±7,93	99,25 ±3,30
Tinggi Pundak	70,40 ±4,62	70,92 ±4,83	71,50 ±3,76	71,20 ±2,48
Akhir				
Lingkar Dada	119,23 ±7,82	119,48 ±12,25	119,15 ±7,46	119,50 ±6,46
Panjang Badan	101,08 ±7,89	101,65 ±9,72	103,33 ±7,67	102,73 ±4,22
Tinggi Pundak	72,35 ±3,92	73,15 ±3,67	73,85 ±3,23	73,38 ±1,60
Pertambahan Ukuran Tubuh (cm/bulan)				
Lingkar Dada	2,31 ±1,36	4,23 ±1,85	4,60 ±2,81	4,10 ±1,13
Panjang Badan	4,75 ±3,10	4,38 ±1,80	4,38 ±1,41	3,48 ±1,83
Tinggi Pundak	1,95 ±1,08	2,23 ±1,58	2,35 ±2,16	2,18 ±1,48

159

160 Pertambahan ukuran tubuh yang tidak berbeda antar perlakuan dapat disebabkan oleh
161 jumlah konsumsi harian yang relatif sama sehingga nutrisi yang dicerna oleh pedet juga sama.
162 Rataan konsumsi BK juga tidak berbeda nyata, yaitu P1 3,43 kg/hari, P2 3,54 kg/hari, P3 3,58
163 kg/hari dan P4 3,34 kg/hari. Substitusi *calf starter* ditujukan untuk membuat kandungan
164 nutrisi pada pakan konsentrat untuk pedet lepas sapih di peternakan rakyat menjadi lebih baik
165 jika dibandingkan dengan pakan dari konsentrat sapi laktasi saja. Pakan hijauan diberikan
166 secara *ad libitum* terukur dengan tujuan pedet dapat memenuhi kekurangan nutrisi dari
167 konsumsi konsentrat dengan cara mendapatkannya dari konsumsi hijauan. Namun pemberian

168 konsentrat yang 1% dari BB atau dengan imbangan H : K sebesar 70 : 30 ini maka diduga jika
169 konsumsi BK relatif sama akan diikuti konsumsi nutrisi lain yang relatif sama juga. Nutrien
170 dari proses pencernaan pakan yang berupa energi, protein, lemak, mineral, dan sebagainya
171 akan digunakan pedet untuk memenuhi kebutuhan nutrisi untuk pertumbuhan pedet. Imran *et*
172 *al.* (2012) menyatakan bahwa nutrisi yang dicerna oleh pedet akan digunakan untuk
173 memenuhi kebutuhan dalam mendukung pertumbuhan pedet sesuai dengan genetiknya.
174 Penelitian Kargar *et al.* (2019) juga menunjukkan ukuran tubuh pedet lepas sapih yang tidak
175 berbeda karena jumlah konsumsi bahan kering dan kandungan nutrisi yang dikonsumsi relatif
176 sama. Menurut Winarti dan Widyastuti (2016) jika konsumsi BK yang hampir sama akan
177 menghasilkan pertumbuhan pedet antar perlakuan tidak memiliki perbedaan karena konsumsi
178 zat gizinya hampir sama, baik dari konsumsi protein kasar, lemak kasar, serta serat kasar.

179 **Pertumbuhan pedet lepas sapih ditunjukkan oleh pertambahan ukuran tubuhnya.** Hasil
180 penelitian ini menunjukkan bahwa pertambahan ukuran tubuh pedet lepas sapih antar
181 perlakuan relatif sama. Hal ini diduga karena saat lepas sapih kondisi dan fungsi rumen sudah
182 berkembang sempurna, sehingga hasil pencernaan pakan secara fermentatif dalam rumen
183 yang dapat dimanfaatkan untuk pertumbuhan pedet lepas sapih pada setiap perlakuan relatif
184 sama, sehingga menghasilkan ukuran tubuh yang relatif sama walaupun *calf starter* memiliki
185 kualitas yang lebih baik dibanding konsentrat sapi perah laktasi. Hal tersebut dapat
186 disebabkan oleh kondisi rumen pada pedet lepas sapih yang sudah siap untuk mencerna pakan
187 padat. McCurdy *et al.* (2019) menyatakan bahwa ketika pedet sudah lepas sapih maka rumen
188 pedet sudah siap untuk mencerna pakan padat dan rumen menjadi jauh lebih peka terhadap
189 fermentabilitas makanan. Mikroba rumen diduga sudah mampu untuk memfermentasi
190 konsentrat dan hijauan dengan baik, sehingga sudah tersedia protein mikroba yang cukup
191 untuk pedet lepas sapih baik pada P1, P2, P3 maupun P4. Pramita *et al.* (2016) menyatakan
192 bahwa mikroba rumen merupakan sumber protein utama bagi induk semang, selain itu

Commented [U8]: Ukuran tubuh pedet dipengaruhi apa saja?
Diperjelas!

193 mikroba rumen berperan penting dalam mencerna pakan karena dapat menghasilkan enzim
194 yang dapat mencerna serat pada pakan berkualitas rendah.

195 Rumen pedet lepas sapih memiliki mikroorganisme yang sudah cukup lengkap. Dengan
196 kondisi rumen yang sudah siap, pedet lepas sapih mampu untuk memanfaatkan hijauan dan
197 konsentrat dengan baik untuk memenuhi kebutuhan nutrisinya. Hal tersebut mengakibatkan
198 pemberian konsentrat sapi laktasi dengan kandungan PK 16,40% dan TDN 64,91% (P4)
199 sudah memberikan hasil pertambahan ukuran tubuh yang relatif sama dengan konsentrat yang
200 disubstitusi *calf starter* (P1, P2, P3), jika diiringi dengan pemberian hijauan yang optimal.

Commented [U9]: Diperjelas, apa saja mikroorganismenya!

201 **Pertambahan Lingkar Dada**

203 Pertambahan ukuran lingkar dada pedet yang diberi perlakuan substitusi *calf starter*
204 pada konsentrat sapi laktasi (P1, P2, P3, dan P4) masing-masing yaitu 2,31 ±1,36 cm/bulan,
205 4,23 ±1,85 cm/bulan, 4,60 ±2,81 cm/bulan, dan 4,10 ±1,13 cm/bulan. Hasil tersebut lebih
206 rendah dari hasil penelitian Manthey *et al.* (2016) dengan perlakuan penambahan DDGS pada
207 konsentrat dengan konsentrasi yang berbeda pada pedet Holstein yaitu rata-rata 5,22
208 cm/bulan, juga hasil penelitian Wang *et al.* (2017) yang melakukan pemberian konsentrat
209 dengan kandungan *physically effective neutral detergent fiber* (peNDF) yang berbeda pada
210 pedet Holstein yaitu 5,36 cm/bulan. Hal tersebut sesuai pernyataan Ratnasari *et al.* (2019)
211 bahwa perbedaan pertumbuhan pada ternak dapat disebabkan oleh iklim, kemampuan genetik
212 masing-masing ternak, manajemen pemeliharaan dan pakan.

Commented [U10]: perbedaan hasil ini dikarenakan faktor apa?

214 Pemberian substitusi *calf starter* pada konsentrat sapi laktasi tidak berpengaruh
215 terhadap pertambahan ukuran lingkar dada pedet FH betina lepas sapih ($P>0,05$). Kondisi
216 tersebut mungkin terjadi karena nutrisi dari pakan yang dikonsumsi pedet telah digunakan
217 untuk pertumbuhan tulang, pertumbuhan organ, dan pertumbuhan dagingnya. Hal tersebut
218 sesuai dengan pendapat Parsons *et al.* (2020) yang menyatakan bahwa ukuran tubuh berkaitan

219 erat dengan bobot badan yang dipengaruhi oleh pertumbuhan tulang kemudian deposisi
220 lemak. Pertumbuhan daging dan tulang mempengaruhi ukuran lingkaran dada, lebar dada,
221 lingkaran perut dan bobot badan ternak, sedangkan pertumbuhan tulang berpengaruh terhadap
222 panjang badan, tinggi badan, serta bobot badan ternak. Pertambahan ukuran lingkaran dada
223 terjadi karena lingkaran dada berkaitan erat dengan bobot badan ternak, sehingga ketika bobot
224 ternak naik maka lingkaran dada akan semakin besar, termasuk pada pedet sapi FH
225 (Sulistiyowati *et al.*, 2009; Hardiono *et al.*, 2016; Rotondo *et al.*, 2021). Syaiful *et al.* (2020)
226 menyatakan bahwa semakin besar lingkaran dada maka semakin besar pula organ-organ yang
227 berada di dalam rongga dada seperti jantung dan paru-paru, oleh sebab itu lingkaran dada dapat
228 digunakan sebagai indikator kapasitas tubuh pedet.

229 230 **Pertambahan Panjang Badan**

231 Pemberian substitusi *calf starter* pada konsentrat sapi laktasi tidak berpengaruh
232 terhadap pertambahan ukuran panjang badan pedet FH betina lepas sapih ($P > 0,05$). Hasil dari
233 masing-masing perlakuan yaitu $4,75 \pm 3,10$ cm/bulan, $4,38 \pm 1,80$ cm/bulan, $4,38 \pm 1,41$
234 cm/bulan, dan $3,48 \pm 1,83$ cm/bulan. Hasil tersebut lebih tinggi dari hasil penelitian Anderson
235 *et al.* (2015) dengan perlakuan pemberian konsentrat dari biji-bijian dengan kandungan lemak
236 dan protein yang berbeda pada pedet Holstein yaitu rata-rata $3,93$ cm/bulan, namun lebih
237 rendah dari hasil rata-rata penelitian Wang *et al.* (2017) dengan perlakuan konsentrat dengan
238 kandungan *physically effective neutral detergent fiber* (peNDF) yang berbeda pada pedet
239 Holstein yaitu $6,15$ cm/bulan. Hasil penelitian tersebut berbeda karena disebabkan oleh
240 beberapa faktor, yaitu umur ternak, genetik, kualitas pakan, dan manajemen pemeliharaan.
241 Hal tersebut sesuai dengan pendapat Vavrisinova *et al.* (2019) yang menyatakan bahwa model
242 pertumbuhan pada pedet dipengaruhi oleh umur, genetik, pemberian pakan dan manajemen
243 yang berbeda.

245 Ukuran panjang tubuh pedet yang tidak berbeda, akibat dari perlakuan pemberian
246 substitusi *calf starter* pada konsentrat sapi laktasi, dapat disebabkan oleh pengaruh genetik
247 dan umur yang hampir sama. Hal tersebut sesuai dengan hasil penelitian Senevirathne *et al.*
248 (2016) bahwa tidak adanya perbedaan antar perlakuan terhadap ukuran tubuh pedet
249 menunjukkan bahwa pedet berada di periode yang sama sehingga tingkat pertumbuhan
250 kerangka tubuhnya tidak berbeda. Pada saat penelitian dilaksanakan, pedet berada di fase
251 percepatan pertumbuhan sehingga pakan yang dikonsumsi pedet akan digunakan maksimal
252 untuk pertumbuhan kerangka tubuhnya. Putra dan Fajrina (2020) menyatakan bahwa laju
253 pertumbuhan maksimal terjadi pada saat pedet berumur 4 – 8 bulan.

Commented [U11]: bagaimana kaitan pertumbuhan pedet dengan pakan yang diberikan?

254 **Pertambahan Tinggi Pundak**

256 Pemberian substitusi *calf starter* pada konsentrat sapi laktasi tidak memiliki pengaruh
257 yang berbeda terhadap pertambahan ukuran tinggi pundak pedet FH betina lepas sapih
258 ($P > 0,05$). Pemberian konsentrat perlakuan memberikan pertambahan ukuran tinggi pundak
259 masing-masing sebanyak $1,95 \pm 1,08$ cm/bulan pada P1; $2,23 \pm 1,58$ cm/bulan pada P2; $2,35$
260 $\pm 2,16$ cm/bulan pada P3 dan $2,18 \pm 1,48$ cm/bulan pada P4. Hasil tersebut lebih rendah dari
261 hasil penelitian Manthey dan Anderson (2018) dengan pemberian konsentrat berbasis jagung
262 dan kedelai (dengan pemberian hijauan *ad libitum*) pada pedet Holstein memiliki hasil rata-
263 rata pertambahan tinggi gumba sebesar $3,03$ cm/bulan. Perbedaan hasil penelitian ini dapat
264 dipengaruhi oleh faktor umur ternak, iklim lingkungan, pakan yang diberikan, serta
265 manajemen pemeliharaan. Hal tersebut sesuai pendapat Place dan Mitloehner (2010) bahwa
266 iklim, umur, manajemen pakan dan manajemen pemeliharaan merupakan faktor-faktor yang
267 berpengaruh terhadap pertumbuhan ternak.

269 Hasil pertambahan tinggi pundak yang tidak berbeda dari semua perlakuan pemberian
270 substitusi *calf starter* pada konsentrat sapi laktasi juga dikarenakan oleh umur pedet yang

271 sedang dalam masa awal pertumbuhan sehingga nutrisi dari pakan yang dikonsumsi
272 digunakan untuk pertumbuhan tulangnya. Hal tersebut sesuai dengan pendapat Syaiful *et al.*
273 (2020) yang menyatakan bahwa bahwa pada umur 0 – 6 bulan pedet mengalami pertumbuhan
274 yang lebih cepat pada kaki depannya karena kaki depan digunakan untuk aktif bergerak pada
275 saat pedet menyusu pada induknya, selain itu kaki depan digunakan untuk menopang berat
276 tubuh pedet. Pertambahan tinggi pundak berkaitan erat dengan pertumbuhan tulang kerangka
277 tubuh pedet. Hal tersebut sesuai dengan pendapat Maluhima *et al.* (2019) yang menyatakan
278 bahwa tinggi pundak dipengaruhi oleh beberapa faktor, diantaranya adalah karena manajemen
279 pemberian pakan, genetik, kondisi ternak itu sendiri, serta mempunyai kaitan erat dengan
280 ukuran kerangka pedet.

Commented [U12]: Dierjas kaitannya tinggi pundak dengan pertumbuhan tulang kaki depan!

281
282

KESIMPULAN

283
284 Substitusi *calf starter* pada pakan konsentrat sapi laktasi tidak memberikan pengaruh
285 yang berbeda terhadap pertambahan ukuran tubuh (lingkar dada, panjang tubuh, tinggi
286 pundak) pedet FH betina lepas sapih. Pemberian pakan konsentrat sapi laktasi dengan PK
287 16,40% dan TDN 64,91% serta diikuti hijauan yang berkualitas baik dalam jumlah cukup,
288 sudah mampu mencukupi kebutuhan nutrisi pada pedet lepas sapih.

Commented [U13]: Dilihat dari apa kecukupan tersebut!

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290

DAFTAR PUSTAKA

291 Alim, A. F. & T. Hidaka. 2002. Pakan dan Tatalaksana Sapi Perah. Dairy Technology
292 Improvement Project in Indonesia. Bandung.
293
294 American Society of Animal Science. 2020. The Guide for the
295 Care and Use of Agricultural Animals in Research and Teaching. 4th ed. American
296 Society of Animal Science. Champaign, IL.
297
298 Anderson, J. L., K. F. Kalscheur, A. D. Garcia & D. J. Schingoethe. 2015. Feeding fat from
299 distillers dried grains with solubles to dairy heifers: I. Effects on growth performance
300 and total-tract digestibility of nutrients. *Journal of Dairy Science* 98(8): 5699 – 5708.
301
302 Atabany, A., B. P. Purwanto, A. Yani, L. Cyrilla, I. Komala, S. Prabowo, W. A. Zahra, D.
303 Permadi, T. Suprijatna & Surajudin. 2020. *Budidaya Sapi Perah*. IPB Press. Bogor.
304

305
306 Badan Standardisasi Nasional (BSN). 2017. SNI 3148.1:2017, Pakan Konsentrat – Bagian 1 :
307 Sapi Perah. Badan Standardisasi Nasional. Jakarta
308
309
310 Imran, S. P. S. Budhi, N. Ngadiyono & Dahlanuddin. 2012. Pertumbuhan pedet sapi Bali
311 lepas sapih yang diberi rumput lapangan dan disuplementasi daun turi (*Sesbania*
312 *grandiflora*). Agrinimal Jurnal Ilmu Ternak dan Tanaman 2(2): 55 – 60.
313
314 Hardiono, R., T. Saili & L. O. Nafiu. 2016. Respon pertumbuhan dan mortalitas pedet sapi
315 bali dari induk yang diberi pakan tambahan dan obat cacing. JITRO 3(2): 39-47.
316
317 Kargar, S., M. Kanani, M. Albenzio & M. Caroprese. 2019. Substituting corn silage with
318 reconstituted forage or nonforage fiber sources in the starter diets of Holstein calves:
319 effects on performance, ruminal fermentation, and blood metabolites. Journal of
320 Animal Science 97(7): 3046 – 3055.
321
322 Kusumawati, E.D., S. Rahadi, J. Peso & A.T. N. Krisnaningsih. 2018. Pengaruh umur lepas
323 sapih dan umur induk terhadap produksi susu sapi perah Peranakan *Friesian Holstein*
324 (PFH). JITRO 5(1): 62-68.
325
326 Lardy, R., A. de Boyer des Roches , J. Capdeville, R. Bastien³, L. Mounier &
327 I. Veissier. 2020. New recommendations for self-locking barriers to reduce skin injuries
328 in dairy cows. Animal 14(8):745-1756.
329
330 Maluhima, R. J., J. H. Manopo, A. Lomboan & S. H. Turangan. 2019. Rekondisi beberapa
331 ukuran tubuh ternak sapi perah Friess Holland di Balai Pengembangan Bibit dan Pakan
332 Ternak Tampusu. Zootec 39(1): 165 – 170.
333
334 Manthey, A. K., J. L. Anderson & G. A. Perry. 2016. Feeding distillers dried grains in
335 replacement of forage in limit-fed dairy heifer rations: Effects on growth performance,
336 rumen fermentation, and total-tract digestibility of nutrients. Journal of Dairy
337 Science 99(9): 7206 – 7215.
338
339 Manthey, A. K. & J. L. Anderson. 2018. Growth performance, rumen fermentation, nutrient
340 utilization, and metabolic profile of dairy heifers limit-fed distillers dried grains with ad
341 libitum forage. Journal of Dairy Science 101(1): 365 – 375.
342
343 McCurdy, D. E., K. R. Wilkins, R. L. Hiltz, S. Moreland, K. Klanderma & A. H. Laarman.
344 2019. Effects of supplemental butyrate and weaning on rumen fermentation in Holstein
345 calves. Journal of Dairy Science 102(10): 8874 – 8882.
346
347 Mukodiningsih, S., S. S. Budhi, A. Agus & A. Astuti. 2012. Pemanfaatan susu bubuk
348 kadaluwarsa dalam complete *calf starter* dan pengaruhnya terhadap konsentrasi VFA
349 dan gula sapih. Jurnal Sains dan Matematika 20(4): 109 – 113.
350
351 National Research Council (NRC). 2001. Nutrient Requirement of Dairy Cattle. 7th Revised
352 Edition. National Academy Press. Washington D. C.
353

354 Nemati, M., H. Amanlou, M. Khorvash, M. Mirzaei, B. Moshiri & M. H. Ghaffari. 2016.
355 Effect of different alfalfa hay levels on growth performance, rumen fermentation, and
356 structural growth of Holstein dairy calves. *Journal of Animal Science* 94(3): 1141-1148.
357

358 Nugraha, H. Y., I. P. Sampurna & I. K. Suatha. 2016. Pengaruh pemberian pakan tambahan
359 pada induk sapi bali terhadap ukuran dimensi panjang pedet. *Buletin Veteriner Udayana*
360 8(2): 159 – 165.
361

362 Parsons, S. D., M. A. Steele, K. E. Leslie, D. L. Renaud & T. J. DeVries. 2020. Investigation
363 of weaning strategy and solid feed location for dairy calves individually fed with an
364 automated milk feeding system. *Journal of Dairy Science* 103(7): 6533 – 6556.
365

366 Place, S. E. & F. M. Mitloehner. 2010. Invited review: Contemporary environmental issues: A
367 review of the dairy industry's role in climate change and air quality and the potential of
368 mitigation through improved production efficiency. *Journal of Dairy Science* 93(8):
369 3407 – 3416.
370

371 Pramita, I. D. A. D. P., I. N. K. Besung & I. P. Sampurna. 2016. Jumlah non coliform dan
372 total bakteri pada Sapi Bali di dataran tinggi dan dataran rendah di Bali pasca
373 pemberian mineral. *Buletin Veteriner Udayana* 8(1): 52 – 58.
374

375 Prihantoro, I., D. Evvyernie, Suryani, L. Abdullah1, N. S. Yunitasari, A. P. Sari, D.
376 Khairunisa, A. Haziq, N. Rahayu & T. Toharmat. 2012. Potensi bakteri pencernaan serat
377 asal rumen kerbau yang diinokulasikan pada pedet Frisian Holstein selama periode
378 prasapah. *J. Ilmu Ternak dan Veteriner* 17(4): 297 – 309.
379

380 Purwadi. 2017. Pengaruh pembedaan kualitas konsentrat pada tampilan ukuran-ukuran tubuh
381 dan kosumsi pakan pedet FH betina lepas sapih. *Tropical Animal Science* 1(1): 1 – 5.
382

383 Putra, W. P. B. & N. Z. Fajrina. 2020. Model kurva pertumbuhan berat badan pada sapi
384 Turkish Holstein jantan. *Jurnal Peternakan Lingkungan Tropis* 3(1): 23 – 30.
385

386 Ratnasari, D., A. Atabany, B. P. Purwanto & L. B. Salman. 2019. Model pertumbuhan sapi
387 perah Friesian Holstein (FH) dari lahir sampai beranak pertama di BBPTU-HPT sapi
388 perah Baturraden menggunakan model matematik logistic. *Jurnal Ilmu Produksi dan*
389 *Teknologi Hasil Peternakan* 7(1): 18 – 21.
390

391 Rotondo, V., V. R. Osborne, M. Paibomesai, K. M. Wood & S. Jantzi. 2021. PSX-A-21 Late-
392 Breaking: Predicting live weight using linear body measurements in growing dairy
393 calves. *Journal of Animal Science*. 99(Issue suppl 3): 371-372.
394

395 Senevirathne, N. D., J. L. Anderson, W. R. Gibbons & J. A. Clapper. 2016. Growth
396 performance of calves fed microbially enhanced soy protein in pelleted starters. *Journal*
397 *of Dairy Science* 100(1): 199 – 212.
398

399 Stefańska, B., M. Gąsiorek & W. Nowak. 2021. Short-and long-term effects of initial serum
400 total protein, average starter feed intake during the last week of the preweaning period,
401 and rearing body gain on primiparous dairy heifers' performance. *Journal of Dairy*
402 *Science* 104(2): 1645 – 1659.
403

- 404 Sulistyowati, E., E. Kuswadi, L. Sutarno & G. Tampubolon. 2009. Penampilan reproduksi
405 sapi perah FH (Friesian Holland) dan pertumbuhan pedetnya pada umur 1- 3 bulan (studi
406 kasus di Desa Air Duku dan Desa Air Putih Kali Bandung, Selupu Rejang, Rejang
407 Lebong, Bengkulu). *Jurnal Sain Peternakan Indonesia* 4(1): 21-26.
408
- 409 Syaiful, F. L., Khasrad & S. Maulida. 2020. Identifikasi ukuran tubuh sapi Bali dan Simbal
410 (Simmental-Bali) di Kecamatan Luhak Nan Duo Kabupaten Pasaman Barat. *Jurnal Sain
411 Peternakan Indonesia* 15(2): 219 – 226.
412
- 413 Turiello, P., E. Martinez, M. Auil, A. Bogni & O. Queiroz. 2016. Effects of a milk balancer
414 protein supplement on growth and performance of dairy calves. *Journal of Animal
415 Science* 94(Issue suppl 5): 370.
416
- 417 Vavrišínová, K., K. Hozáková, O. Bučko, P. Haščík & P. Juhás. 2019. The effect of the
418 slaughter weight on carcass composition, body measurements and veal quality of
419 holstein calves. *Acta Universitatis Agriculturae et Silviculturae Mendelianae
420 Brunensis* 67(5): 1235 – 1243.
421
- 422 Wang, H. R., Q. Chen, L. M. Chen, R. F. Ge, M. Z. Wang, L. H. Yu & J. Zhang. 2017.
423 Effects of dietary physically effective neutral detergent fiber content on the feeding
424 behavior, digestibility, and growth of 8-to 10-month-old Holstein replacement
425 heifers. *Journal Dairy Science* 100(2): 1161 – 1169.
426
- 427 Welboren, A.C., L. N. Leal, M. A. Steele, M. A. Khan & J. Martín-Tereso. 2018.
428 Performance of ad libitum fed dairy calves weaned using fixed and individual methods.
429 *Animal* 13(9): 1891-1898.
430
- 431 Winarti, E. & A. Widyastuti. 2016. The effect of *calf starter* ration for pre-weaning ongole
432 grade (PO) calves on body weight gain. *Journal of the Indonesian Tropical Animal
433 Agriculture* 41(4): 209 – 215.
434
- 435 Xiao, J. X., G. M. Alugongo, R. Chung, S. Z. Dong, S. L. Li, I. Yoon, Z. H. Wu & Z. J. Cao.
436 2016. Effects of *Saccharomyces cerevisiae* fermentation products on dairy calves:
437 Ruminal fermentation, gastrointestinal morphology, and microbial community. *Journal
438 of Dairy Science* 99(7): 5401-5412.
439
- 440 Yanuartono, A. Nururrozi, S. Indarjulianto & H. Purnamaningsih. 2019. Peran protozoa pada
441 pencernaan ruminansia dan dampak terhadap lingkungan. *Ternak Tropika* 20(1): 16-28.
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Commented [U14]: kata latin ditulis miring!

Hasil Perbaikan Review Ke-1

Perbaikan Manuskrip Kotak Masuk

Rudy Hartanto <rudyharta@gmail.com>
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Kepada Yth. Chief Editor JITRO (Ir. Syam Rahadi, S.Pt., M.P.,M.M.,IPM.)

Dengan hormat,

Kami menginformasikan jika telah mengirim perbaikan manuskrip dengan judul "**Pertambahan Ukuran Tubuh Pedet Friesian Holstein Betina Lepas Sapih Akibat Penggunaan Konsentrat Sapi Perah Yang Disubstitusi Calf Starter**", yang submit pada tanggal 28 Januari 2022.

Yaitu Pada tanggal 16 Maret 2022 ini sudah kami tambahkan di bagian ADD A SUPPLEMENTARY FILE , manuskrip bahasa inggrisnya dengan judul "**Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to the Use of Lactation Cow Concentrate by Calf Starter Substitution**".

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Kami sangat berharan manuskrip kami ini bisa diterima dan diterbitkan di JITRO.

Terimakasih.

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Kami perlu sampaikan bahwa artikel dalam proses review. semoga kami dapat informasikan dalam waktu dekat. Rencana kami akan terbitkan pada edisi Mei 2022 ini.

Terima kasih

...

..

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(Chief Editor Jurnal Ilmu dan Teknologi Peternakan Tropis)

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Baik Pak, Terimakasih Banyak.
Kami tunggu informasi selanjutnya.

Hormat Kami

Ir. Rudy Hartanto, S.Pt., M.P., Ph.D., IPM , et al.

1 **Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to**
2 **the Use of Lactation Cow Concentrate by Calf Starter Substitution**

3
4
5 **Rudy Hartanto***, Nida Fariha, Dian Wahyu Harjanti, Edi Prayitno, Fajar Wahyono

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13
14
15 **ABSTRACT**

16
17 The aim of the study was to analyze the increase in body dimensions of post-weaning
18 female Holstein Friesian (HF) calves fed with lactation cow concentrate with different levels
19 of calf starter substitution. The material was 4 post-weaning female HF calves aged 4-5
20 months, with an average weight of 101.38 ± 14.21 kg. The feed consisted of elephant grass,
21 calf starter (CS) and lactation cow concentrate (LCC). The study used a Latin square design,
22 with 4 concentrate treatments, i.e. P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC),
23 P3 (25% CS and 75% LCC), P4 (100% LCC); and 4 replications in 4 periods (each period in
24 1 month). Concentrate was given 1% BW in dry matter; elephant grass and drinking water
25 were provided in a measurable ad libitum. The research parameters were the increase in body
26 dimensions (heart girth (HG), body length (BL) and withers height (WH)). The treatments
27 had no significant effect ($P>0.05$) on the increase in body dimensions, were P1 (HG = 2.31
28 cm/month, BL = 4.75 cm/month, WH = 1.95 cm/month), P2 (HG = 4.23 cm/month, BL =
29 4.38 cm/month, WH = 2.23 cm/month), P3 (HG = 4.60 cm/month, BL = 4.38 cm/month, WH
30 = 2.35 cm/month), P4 (HG = 4.10 cm/month, BL = 3.48 cm/month, WH = 2.18 cm/month). It
31 was concluded that with sufficient quality forage feed, giving 100% LCC to post-weaning
32 female HF calves could result in an increase in body dimensions that was relatively the same
33 as the substitution of CS (25-75%) in LCC as concentrate feed.

34
35 **Keywords:** post-weaning female HF calves, body dimensions, calf starter, lactation cow
36 concentrate

37
38 **INTRODUCTION**

39
40 Feeding and drinking as well as calf health are important factors that need to be
41 considered in order to get good calf growth, both pre-weaning and after-weaning. Calves that
42 have been weaned do not get milk and fulfill their nutritional needs in full from forages and
43 concentrates (Kusumawati *et al.*, 2018; Atabany *et al.*, 2020). Calves can be weaned when

44 they are 8 weeks old, i.e. after they are able to consume calf starter 0.5 – 0.68 kg/day, but at
45 this age weaning has a high risk of calf death so that calves are generally weaned at 3 months
46 of age (NRC, 2001; Prihantoro *et al.*, 2012). When weaning, the calf enters the initial phase of
47 growth, so most of the nutrients consumed will be used for growth such as enlargement of the
48 body skeleton (Imran *et al.*, 2012; Welboren *et al.*, 2019).

49 The body dimensions of the female calf when weaning is very important because the
50 female calf which from the start already has the ideal body dimensions, will also be an ideal
51 breeder. In addition to body weight gain, the increase in body dimensions (heart girth, withers
52 height, body length) in weaning calves is also a measure of the calf's appearance or
53 performance (Hardiono *et al.*, 2016; Rotondo *et al.*, 2021). The calf when post-weaning
54 should have heart girth of 96 cm and withers height of 75 cm, so that later it can meet the target
55 of a heart girth of 155 cm and withers height of 115 cm at the time of entering the age of 15
56 months for first mating (Alim and Hidaka, 2002). The formation of body dimensions is
57 influenced by the adequacy of nutrient needs. Weaning calves are usually fed high-quality
58 forage and concentrates formulated to meet nutritional needs and increase body weight
59 (American Society of Animal Science, 2020).

60 However, in practice in the field, the provision of feed for post-weaning female calves
61 has not been well considered by small farmers. Generally, smallholder farms provide lactation
62 cow concentrates to calves with the consideration of cheaper concentrate prices. At least
63 lactation cow concentrate has crude protein CP content is 16-21% and TDN 70-80% (BSN,
64 2017). Whereas the nutritional needs of female calves from post-weaning to heifers are
65 different from those of adult cattle, so calves need to be given different feeds from adult cows.

66 The substitution of calf starter in lactation cow concentrate was carried out with the aim
67 of improving the nutritional quality of the concentrate feed given to weaning calves. Calf
68 starter is different from lactation cow concentrate both physically and in quality

69 (Mukodiningsih *et al.*, 2012). Post-Weaning calves that receive higher quality feed will
70 produce better performance in body dimensions as well. Larger body weight and body
71 dimensions at the same age indicate better growth (Turiello *et al.*, 2016; Nemati *et al.*, 2016).

72 This study aimed to analyze the increase in body dimensions of post-weaned female
73 Holstein Friesian (HF) calves fed with dairy cow concentrate with different levels of
74 substitution of calf starter.

75
76

MATERIALS AND METHODS

77

Materials

78

79 The materials used were 4 post-weaning female Holstein Friesian (HF) calves aged 4-
80 5 months with an average weight of 101.38 ± 14.21 kg. The calves were kept in metabolic
81 cages for the duration of the study. 300 cm long measuring tape with 0.1 cm accuracy and 1.5
82 m stainless steel measuring stick with 0.1 cm accuracy were used to measure the body
83 dimensions of livestock. The feed used were elephant grass (*Pennisetum purpureum*),
84 lactation cow concentrate (LCC) and calf starter (CS) produced by Teaching Farm FPP
85 Undip.
86

87

Methods

88

89 The feed provided were forage and concentrate treatment which was adjusted to the
90 dry matter (DM) needs of the calves. Treatment concentrate (in DM) was given as much as
91 1% body weight (BW) in two doses, i.e. in the morning at 06.00 and in the afternoon at 15.00.
92 Forage and drinking water are provided on a measured ad libitum basis. The forage was given
93 one hour after the concentrate was given. The treatment concentrates consisted of P1 (75%
94 CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), and P4 (100%
95

96 LCC). The nutritional content of the feed given is shown in Table 1. The research design used
 97 was the Latin Square Design (LSD) with 4 treatments and 4 periods.

98 Feeding and residues of feed and drinking water to livestock were recorded in a
 99 logbook on a regular basis. The study was conducted in 4 periods, each period was carried out
 100 for 30 days of observation. The parameters measured were heart girth (HG), body length
 101 (BL), withers height (WH). Measurement of body dimensions were carried out at the
 102 beginning and end of the period based on Welboren *et al.* (2019) and Lardy *et al.* (2020),
 103 followed by a break for 5 days and continued to the next period.

104
 105 Table 1. Nutrient Content of Feed

Feed	Water	Ash	EE	CF	CP	NFE	TDN
	--(%)--		-----(% DM)-----				
Lactation Cow Concentrate (LCC)	9,42	9,90	6,42	26,87	16,40	40,41	64,91
Calf Starter (CS)	11,17	12,32	5,25	8,74	19,70	53,99	76,13
Elephant Grass	78,08	13,31	2,17	28,64	12,13	43,75	58,5
P1	10,73	11,71	5,54	13,27	18,87	50,61	73,32
P2	10,29	11,11	5,83	17,80	18,05	47,21	70,52
P3	9,86	10,50	6,13	22,33	17,25	43,79	67,71
P4	9,42	9,90	6,42	26,87	16,40	40,41	64,91

106 EE: ether extract, CF: crude fiber, CP: crude protein, NFE: nitrogen free extract, TDN: total digestible nutrients,
 107 DM: dry matter

108
 109
 110 **Statistical Analyses**

111
 112
 113 All data were analyzed using analysis of variance (ANOVA) based on Latin Square
 114 Design. If there was a treatment effect, then Duncan's test was continued to determine the
 115 difference between treatments.

116
 117 **RESULTS AND DISCUSSION**

118
 119 The results of the study on the effect of substitution of calf starter on lactating cow

120 concentrate on body dimensions increase in post-weaning HF female calves are presented in
 121 Table 2. Treatment of calf starter substitution on lactating cow concentrate (P1, P2, P3, and
 122 P4) had no significant effect ($P > 0.05$) to the average body size at the end of the study and
 123 the increase in body dimensions of livestock which includes heart girth, body length, and
 124 withers height. These results have the same phenomenon as research of Purwadi (2017) that
 125 giving concentrates with different protein content, i.e. 10.23% and 13.79% in post-weaning
 126 female calves aged 3.5 months gave no significant effect on body dimensions increase.

127
 128 Table 2. Average Body Dimensions of Post-Weaning Female HF Calves

Variables	Treatments			
	P1	P2	P3	P4
Initial Body Dimensions (cm)				
Heart Girth	116,92±8,45	115,25 ±13,58	114,55 ±9,84	115,40 ±6,30
Body Length	96,33 ±8,68	97,27 ±10,82	98,95 ±7,93	99,25 ±3,30
Withers Height	70,40 ±4,62	70,92 ±4,83	71,50 ±3,76	71,20 ±2,48
Final Body Dimensions (cm)				
Heart Girth	119,23 ±7,82	119,48 ±12,25	119,15 ±7,46	119,50 ±6,46
Body Length	101,08 ±7,89	101,65 ±9,72	103,33 ±7,67	102,73 ±4,22
Withers Height	72,35 ±3,92	73,15 ±3,67	73,85 ±3,23	73,38 ±1,60
Increase in Body Dimensions (cm/month)				
Heart Girth	2,31 ±1,36	4,23 ±1,85	4,60 ±2,81	4,10 ±1,13
Body Length	4,75 ±3,10	4,38 ±1,80	4,38 ±1,41	3,48 ±1,83
Withers Height	1,95 ±1,08	2,23 ±1,58	2,35 ±2,16	2,18 ±1,48

129
 130 The increase in body size that did not differ between treatments could be caused by the
 131 relatively same amount of daily consumption so that the nutrients digested by the calves were
 132 also the same. The average DM consumption was also not significantly different, i.e. P1 3.43

133 kg/day, P2 3.54 kg/day, P3 3.58 kg/day and P4 3.34 kg/day. The substitution of calf starter
134 was intended to make the nutritional content of concentrate feed for post-weaning calves
135 better at smallholder farms when compared to feed from lactation cow concentrate alone.
136 Forage feed was given in a measurable ad libitum with the aim of the calves being able to
137 meet the nutritional deficiencies from consumption of concentrates by obtaining them from
138 forage consumption. However, giving a concentrate that was 1% of body weight or with an
139 forage : concentrate balance of 70 : 30 in this study, it was assumed that if the consumption of
140 DM was relatively the same, the consumption of other nutrients was relatively the same as
141 well. Nutrients from the feed digestion process in the form of energy, protein, fat, minerals,
142 and so on will be used by the calf to meet the nutritional needs for calf growth. Imran *et al.*
143 (2012) stated that the nutrients digested by the calf will be used to meet the needs to support
144 the growth of the calf according to its genetics. Research by Kargar *et al.* (2019) also shows
145 the body dimensions of post-weaning calves that were not different because the amount of
146 DM consumption and the nutritional content consumed were relatively the same. According
147 to Winarti and Widyastuti (2016), almost the same DM consumption will result in calf growth
148 between treatments, there was no difference because the consumption of nutrients was almost
149 the same, both from consumption of crude protein, crude fat (ether extract) and crude fiber.

150 The growth of the post-weaning calves is indicated by the increase in body dimensions.
151 Calf body dimensions were strongly influenced by feeding, feed consumption and
152 digestibility. The results of this study showed that the increase in body dimensions of post-
153 weaning calves between treatments was relatively the same. This was presumably because
154 during post-weaning the rumen conditions and functions have developed perfectly, so that the
155 results of fermentative digestion of feed in the rumen that can be used for the growth of the
156 post-weaning calves in each treatment were relatively the same, resulting in relatively the
157 same body dimensions even though the calf starter has the better quality than lactation dairy

158 cow concentrate. This can be caused by the condition of the rumen in post-weaning calves
159 that are ready to digest solid feed. McCurdy *et al.* (2019) stated that when the calf has been
160 weaned, the calf rumen is ready to digest solid feed and the rumen becomes much more
161 sensitive to food fermentability. Rumen microbes were thought to have been able to ferment
162 concentrates and forage well, so that sufficient microbial protein was available for post-
163 weaning calves at P1, P2, P3 and P4. Pramita *et al.* (2016) stated that rumen microbes are the
164 main source of protein for the host, besides that rumen microbe play an important role in
165 digesting feed because they can produce enzymes that can digest fiber in low-quality feed.

166 The rumen of the post-weaning calves had a fairly complete set of microorganisms.
167 Xiao *et al.* (2016) stated that in the rumen of the calf there are fungi, protozoa, and bacteria
168 which include fiber-digesting bacteria such as *Fibrobacter succinogenes*, *Ruminococcus*
169 *albus*, and *Ruminococcus flavefaciens*, as well as other bacteria such as *Prevotella*,
170 *Butyrivibrio fibrisolvens*, *Shuttleworthia* and *Desulfovibrio*. In addition, there are two groups
171 of protozoa that are abundant in the rumen, i.e. entodiniomorphid (oligotrich) and holotrich
172 (Yanuartono *et al.*, 2019). With a ready-made rumen condition, post-weaning calves are able
173 to properly utilize forage and concentrates to meet their nutritional needs. This resulted in the
174 administration of lactation cow concentrate with a CP content of 16.40% and TDN 64.91%
175 (P4), which resulted in an increase in body dimensions which was relatively the same as the
176 concentrate substituted of calf starter (P1, P2, P3), if accompanied by the administration of
177 optimal forage. In this study, post-weaning female HF calves received concentrate as much as
178 1% of BW and forage given ad libitum.

179

180 **Increase in Heart Girth (HG)**

181

182 The increase in heart girth of calves treated with calf starter substitution on lactation
183 cow concentrates were 2.31 ± 1.36 cm/month (P1), 4.23 ± 1.85 cm/month (P2), 4.60 ± 2.81

184 cm/month (P3), and 4.10 ± 1.13 cm/month (P4). These results were lower than the study results
185 of Manthey *et al.* (2016) with the addition of DDGS treatment in concentrates with different
186 concentrations in Holstein calves, i.e. an average of 5.22 cm/month, also the results of
187 research by Wang *et al.* (2017) who gave a concentrate with a different physically effective
188 neutral detergent fiber (peNDF) content in Holstein calves, i.e. 5.36 cm/month. Differences in
189 the results of these studies can be caused by genetic influences, environmental climate, feed
190 given, and maintenance management. This is in accordance with the statement of Ratnasari *et*
191 *al.* (2019) that differences in growth in livestock can be caused by climate, genetic
192 capabilities of each animal, maintenance and feed management.

193 Giving calf starter substitution in lactation cow concentrate had no effect on the increase
194 in heart girth of post-weaning female HF calves ($P > 0.05$). This condition may occur because
195 the nutrition from the feed consumed by the calf has been used for bone growth, organ
196 growth, and meat growth. This was in accordance with the opinion of Parsons *et al.* (2020)
197 which stated that body size is closely related to body weight which is influenced by bone
198 growth and then fat deposition. The growth of meat and bones affects the size of the heart
199 girth, chest width, abdominal girth and body weight of livestock, while bone growth affects
200 body length, withers height, and body weight of livestock. The increase in the size of the heart
201 girth occurs because the heart girth is closely related to the body weight of the cattle, so that
202 when the weight of the cattle increases, the heart girth will be even bigger, including in HF
203 calves (Sulistiyowati *et al.*, 2009; Hardiono *et al.*, 2016; Rotondo *et al.*, 2021). Syaiful *et al.*
204 (2020) stated that the bigger the heart girth, the bigger the organs in the chest cavity such as
205 the heart and lungs, therefore heart girth can be used as an indicator of the calf body capacity.

206

207 **Increase in Body Length (BL)**

208

209 Giving calf starter substitution to lactation cow concentrate had no effect on the increase

210 in body length for post-weaning female HF calves ($P>0.05$). The results of each treatment
211 were 4.75 ± 3.10 cm/month (P1), 4.38 ± 1.80 cm/month (P2), 4.38 ± 1.41 cm/month (P3) and
212 3.48 ± 1.83 cm/month (P4). This result was higher than the average result of Anderson *et al.*
213 (2015) in the treatment of concentrates from grains with different fat and protein content in
214 Holstein calves, which was an average of 3.93 cm/month, but lower than the average results
215 of Wang *et al.* (2017) on concentrate treatment with different physically effective neutral
216 detergent fiber (peNDF) content in Holstein calves, i.e. 6.15 cm/month. The results of these
217 studies differ because they are caused by several factors, i.e. livestock age, genetics, feed
218 quality, and maintenance management (Vavrisinova *et al.*, 2019).

219 The size of the calf body length that did not differ, this was as a result of the treatment
220 with calf starter substitution on lactation cow concentrate, could be due to genetic influences
221 and almost the same age. This is in accordance with the research results of Senevirathne *et al.*
222 (2016) that there was no difference between treatments for calf body dimensions, indicating
223 that calves were in the same period so that the growth rate of their body skeletons did not
224 differ. At the time the research was carried out, the calf was in the growth acceleration phase
225 so that the feed consumed by the calf would be used maximally for the growth of its body
226 frame. Putra and Fajrina (2020) stated that the maximum growth rate occurs when the calf is
227 4-8 months old. This was reinforced by the opinion of Nugraha *et al.* (2016) which stated that
228 livestock growth is influenced by the feed given, if the feed provided is of good quality and in
229 sufficient quantity, and then livestock growth will also be good.

230

231 **Increase in Withers Height (WH)**

232

233 Giving calf starter substitution to lactation cow concentrate did not have a different
234 effect on the increase in withers height of post-weaning female HF calves ($P>0.05$). The
235 treatment concentrate gave an increase in the size of the withers height by 1.95 ± 1.08

236 cm/month (P1); 2.23±1.58 cm/month (P2); 2.35±2.16 cm/month (P3) and 2.18±1.48
237 cm/month (P4). This result was lower than the results of the study by Manthey and Anderson
238 (2018) by giving corn and soybean-based concentrates (with ad libitum forage) to Holstein
239 calves which resulted in an average increase in withers height of 3.03 cm/month. Differences
240 in the results of this study can be influenced by factors such as age of livestock,
241 environmental climate, feed given, and maintenance management (Place and Mitloehner,
242 2010).

243 The results of the increase in withers height which did not differ from all treatments
244 with calf starter substitution in lactation cow concentrate were also due to the age of the calf
245 which was in the early stages of growth so that the nutrients from the feed consumed were
246 used for bone growth, including the forefoot bones that greatly affect the value of withers
247 height. This was in accordance with the opinion of Syaiful *et al.* (2020) which stated that at
248 the age of 0-6 months the calf experiences faster growth in its forelegs because the forelegs
249 are used to actively move when the calf is suckle on its mother, in addition the forelegs are
250 used to support the calf body weight. The increase in withers height is closely related to the
251 growth of the calf skeletal bones. This was in accordance with the opinion of Maluhima *et al.*
252 (2019) which stated that withers height is influenced by several factors, including feeding
253 management, genetics, the condition of the livestock itself, and having a close relationship
254 with the size of the calf frame.

255
256

CONCLUSION

257
258 The substitution of calf starter on lactation cow concentrate did not have a different
259 effect on the increase in body dimensions (heart girth, body length, withers height) of post-
260 weaning female HF calves. Lactation cow concentrate with PK 16.40% and TDN 64.91%

261 followed by good quality forage in sufficient quantities was able to meet the nutritional needs
262 of weaning calves seen from the performance of increasing body dimensions.

263
264
265
266
267

CONFLICT OF INTEREST

268 There is no conflict of interest with financial, personal, or other relationship with other
269 people or organizations associated with material discussed in the manuscript.

269
270
271

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REFERENCES

276
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291
292
293
294
295
296
297
298
299
300
301
302

- Alim, A. F. & T. Hidaka. 2002. Pakan dan Tatalaksana Sapi Perah. Dairy Technology Improvement Project in Indonesia. Bandung. [Indonesian].
- American Society of Animal Science. 2020. The Guide for the Care and Use of Agricultural Animals in Research and Teaching. 4th ed. American Society of Animal Science. Champaign, IL.
- Anderson, J. L., K. F. Kalscheur, A. D. Garcia & D. J. Schingoethe. 2015. Feeding fat from distillers dried grains with solubles to dairy heifers: I. Effects on growth performance and total-tract digestibility of nutrients. *Journal of Dairy Science* 98(8): 5699 – 5708.
- Atabany, A., B. P. Purwanto, A. Yani, L. Cyrilla, I. Komala, S. Prabowo, W. A. Zahra, D. Permadi, T. Suprijatna & Surajudin. 2020. Budidaya Sapi Perah. IPB Press. Bogor. [Indonesian].
- Badan Standardisasi Nasional (BSN). 2017. SNI 3148.1:2017, Pakan Konsentrat – Bagian 1 : Sapi Perah. Badan Standardisasi Nasional. Jakarta. [Indonesian].
- Hardiono, R., T. Saili & L. O. Nafiu. 2016. Respon pertumbuhan dan mortalitas pedet sapi bali dari induk yang diberi pakan tambahan dan obat cacing. *JITRO* 3(2): 39-47. [Indonesian].
- Imran, S. P. S. Budhi, N. Ngadiyono & Dahlanuddin. 2012. Pertumbuhan pedet sapi Bali lepas sapih yang diberi rumput lapangan dan disuplementasi daun turi (*Sesbania grandiflora*). *Agrinimal Jurnal Ilmu Ternak dan Tanaman* 2(2): 55 – 60. [Indonesian].

- 303 Kargar, S., M. Kanani, M. Albenzio & M. Caroprese. 2019. Substituting corn silage with
304 reconstituted forage or nonforage fiber sources in the starter diets of Holstein calves:
305 effects on performance, ruminal fermentation, and blood metabolites. *Journal of Animal*
306 *Science* 97(7): 3046 – 3055.
- 307
- 308 Kusumawati, E.D., S. Rahadi, J. Peso & A.T. N. Krisnaningsih. 2018. Pengaruh umur lepas
309 sapih dan umur induk terhadap produksi susu sapi perah Peranakan *Friesian Holstein*
310 (PFH). *JITRO* 5(1): 62-68. [Indonesian].
- 311
- 312 Lardy, R., A. de Boyer des Roches, J. Capdeville, R. Bastien, L. Mounier &
313 I. Veissier. 2020. New recommendations for self-locking barriers to reduce skin injuries
314 in dairy cows. *Animal* 14(8):745-1756.
- 315
- 316 Maluhima, R. J., J. H. Manopo, A. Lomboan & S. H. Turangan. 2019. Rekondisi beberapa
317 ukuran tubuh ternak sapi perah Friess Holland di Balai Pengembangan Bibit dan Pakan
318 Ternak Tampusu. *Zootec* 39(1): 165 – 170. [Indonesian].
- 319
- 320 Manthey, A. K., J. L. Anderson & G. A. Perry. 2016. Feeding distillers dried grains in
321 replacement of forage in limit-fed dairy heifer rations: Effects on growth performance,
322 rumen fermentation, and total-tract digestibility of nutrients. *Journal of Dairy*
323 *Science* 99(9): 7206 – 7215.
- 324
- 325 Manthey, A. K. & J. L. Anderson. 2018. Growth performance, rumen fermentation, nutrient
326 utilization, and metabolic profile of dairy heifers limit-fed distillers dried grains with ad
327 libitum forage. *Journal of Dairy Science* 101(1): 365 – 375.
- 328
- 329 McCurdy, D. E., K. R. Wilkins, R. L. Hiltz, S. Moreland, K. Klanderman & A. H. Laarman.
330 2019. Effects of supplemental butyrate and weaning on rumen fermentation in Holstein
331 calves. *Journal of Dairy Science* 102(10): 8874 – 8882.
- 332
- 333 Mukodiningsih, S., S. S. Budhi, A. Agus & A. Astuti. 2012. Pemanfaatan susu bubuk
334 kadaluwarsa dalam complete *calf starter* dan pengaruhnya terhadap konsentrasi VFA
335 dan gula sapih. *Jurnal Sains dan Matematika* 20(4): 109 – 113. [Indonesian].
- 336
- 337 National Research Council (NRC). 2001. Nutrient Requirement of Dairy Cattle. 7th Revised
338 Edition. National Academy Press. Washington D. C.
- 339
- 340 Nemati, M., H. Amanlou, M. Khorvash, M. Mirzaei, B. Moshiri & M. H. Ghaffari. 2016.
341 Effect of different alfalfa hay levels on growth performance, rumen fermentation, and
342 structural growth of Holstein dairy calves. *Journal of Animal Science* 94(3): 1141-1148.
- 343
- 344 Nugraha, H. Y., I. P. Sampurna & I. K. Suatha. 2016. Pengaruh pemberian pakan tambahan
345 pada induk sapi bali terhadap ukuran dimensi panjang pedet. *Buletin Veteriner Udayana*
346 8(2): 159 – 165. [Indonesian].
- 347
- 348 Parsons, S. D., M. A. Steele, K. E. Leslie, D. L. Renaud & T. J. DeVries. 2020. Investigation
349 of weaning strategy and solid feed location for dairy calves individually fed with an
350 automated milk feeding system. *Journal of Dairy Science* 103(7): 6533 – 6556.
- 351

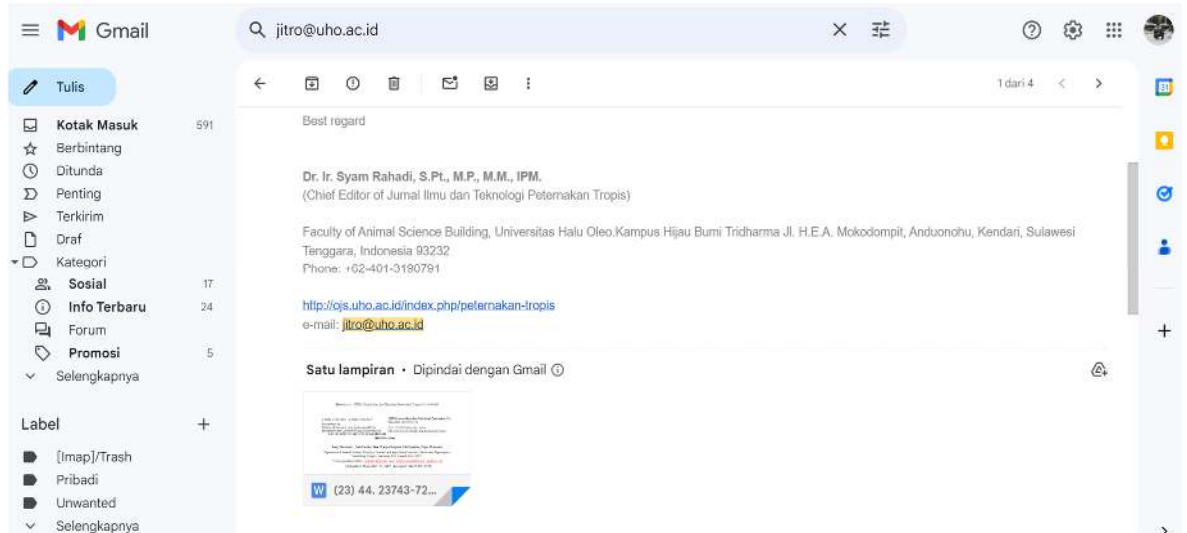
- 352 Place, S. E. & F. M. Mitloehner. 2010. Invited review: Contemporary environmental issues: A
353 review of the dairy industry's role in climate change and air quality and the potential of
354 mitigation through improved production efficiency. *Journal of Dairy Science* 93(8):
355 3407 – 3416.
356
- 357 Pramita, I. D. A. D. P., I. N. K. Besung & I. P. Sampurna. 2016. Jumlah non coliform dan
358 total bakteri pada Sapi Bali di dataran tinggi dan dataran rendah di Bali pasca
359 pemberian mineral. *Buletin Veteriner Udayana* 8(1): 52 – 58. [Indonesian].
360
- 361 Prihantoro, I., D. Evvyernie, Suryani, L. Abdullah1, N. S. Yunitasari, A. P. Sari, D.
362 Khairunisa, A. Haziq, N. Rahayu & T. Toharmat. 2012. Potensi bakteri pencernaan serat
363 asal rumen kerbau yang diinokulasikan pada pedet Frisian Holstein selama periode
364 prasapih. *J. Ilmu Ternak dan Veteriner* 17(4): 297 – 309. [Indonesian].
365
- 366 Purwadi. 2017. Pengaruh perbedaan kualitas konsentrat pada tampilan ukuran-ukuran tubuh
367 dan konsumsi pakan pedet FH betina lepas sapih. *Tropical Animal Science* 1(1): 1 – 5.
368 [Indonesian].
369
- 370 Putra, W. P. B. & N. Z. Fajrina. 2020. Model kurva pertumbuhan berat badan pada sapi
371 Turkish Holstein jantan. *Jurnal Peternakan Lingkungan Tropis* 3(1): 23 – 30.
372 [Indonesian].
373
- 374 Ratnasari, D., A. Atabany, B. P. Purwanto & L. B. Salman. 2019. Model pertumbuhan sapi
375 perah Friesian Holstein (FH) dari lahir sampai beranak pertama di BBPTU-HPT sapi
376 perah Baturraden menggunakan model matematik logistic. *Jurnal Ilmu Produksi dan*
377 *Teknologi Hasil Peternakan* 7(1): 18 – 21. [Indonesian].
378
- 379 Rotondo, V., V. R. Osborne, M. Paibomesai, K. M. Wood & S. Jantzi. 2021. PSX-A-21 Late-
380 Breaking: Predicting live weight using linear body measurements in growing dairy
381 calves. *Journal of Animal Science*. 99(Issue suppl 3): 371-372.
382
- 383 Senevirathne, N. D., J. L. Anderson, W. R. Gibbons & J. A. Clapper. 2016. Growth
384 performance of calves fed microbially enhanced soy protein in pelleted starters. *Journal*
385 *of Dairy Science* 100(1): 199 – 212.
386
- 387 Sulistyowati, E., E. Kuswadi, L. Sutarno & G. Tampubolon. 2009. Penampilan reproduksi
388 sapi perah FH (Friesian Holland) dan pertumbuhan pedetnya pada umur 1- 3 bulan (studi
389 kasus di Desa Air Duku dan Desa Air Putih Kali Bandung, Selupu Rejang, Rejang
390 Lebong, Bengkulu). *Jurnal Sain Peternakan Indonesia* 4(1): 21-26. [Indonesian].
391
- 392 Syaiful, F. L., Khasrad & S. Maulida. 2020. Identifikasi ukuran tubuh sapi Bali dan Simbal
393 (Simmental-Bali) di Kecamatan Luhak Nan Duo Kabupaten Pasaman Barat. *Jurnal Sain*
394 *Peternakan Indonesia* 15(2): 219 – 226. [Indonesian].
395
- 396 Turiello, P., E. Martinez, M. Auil, A. Bogni & O. Queiroz. 2016. Effects of a milk balancer
397 protein supplement on growth and performance of dairy calves. *Journal of Animal*
398 *Science* 94(Issue suppl 5): 370.
399
- 400 Vavrišínová, K., K. Hozáková, O. Bučko, P. Haščík & P. Juhás. 2019. The effect of the
401 slaughter weight on carcass composition, body measurements and veal quality of

- 402 holstein calves. *Acta Universitatis Agriculturae et Silviculturae Mendelianae*
403 *Brunensis* 67(5): 1235 – 1243.
404
- 405 Wang, H. R., Q. Chen, L. M. Chen, R. F. Ge, M. Z. Wang, L. H. Yu & J. Zhang. 2017.
406 Effects of dietary physically effective neutral detergent fiber content on the feeding
407 behavior, digestibility, and growth of 8-to 10-month-old Holstein replacement
408 heifers. *Journal Dairy Science* 100(2): 1161 – 1169.
409
- 410 Welboren, A.C., L. N. Leal, M. A. Steele, M. A. Khan & J. Martín-Tereso. 2019.
411 Performance of ad libitum fed dairy calves weaned using fixed and individual methods.
412 *Animal* 13(9): 1891-1898.
413
- 414 Winarti, E. & A. Widyastuti. 2016. The effect of calf starter ration for pre-weaning ongole
415 grade (PO) calves on body weight gain. *Journal of the Indonesian Tropical Animal*
416 *Agriculture* 41(4): 209 – 215.
417
- 418 [Xiao, J. X., G. M. Alugongo, R. Chung, S. Z. Dong, S. L. Li, I. Yoon, Z. H. Wu & Z. J. Cao.](#)
419 [2016. Effects of *Saccharomyces cerevisiae* fermentation products on dairy calves:](#)
420 [Ruminal fermentation, gastrointestinal morphology, and microbial community. *Journal*](#)
421 [of Dairy Science 99\(7\): 5401-5412.](#)
422
- 423 Yanuartono, A. Nururrozi, S. Indarjulianto & H. Purnamaningsih. 2019. Peran protozoa pada
424 pencernaan ruminansia dan dampak terhadap lingkungan. *Ternak Tropika* 20(1): 16-28.
425 [Indonesian].
426
427

Konfirmasi Perkembangan Review

The screenshot shows a Gmail interface with a search bar at the top containing 'jitra@uho.ac.id'. The left sidebar lists folders like 'Kotak Masuk' (591), 'Sosial' (15), 'Info Terbaru' (24), 'Forum', 'Promosi' (5), and 'Selengkapnya'. The main content area displays an email from Rudy Hartanto (rudyharta@gmail.com) dated 'Sel, 13 Sep 2022, 13:21'. The email is addressed to 'Yth. Ir. Syam Rahadi, S.PL., M.P., IPM. (Chief Editor Jurnal Ilmu dan Teknologi Peternakan Tropis)'. The subject of the email is 'monon informasi tentang makala kami yang berjudul : **Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to the Use of Lactation Cow Concentrate by Calf Starter Substitution**'. The body of the email contains the following text: 'terakhir perbaikan : 23621-72271-1-SP.DOCX 2022-03-16', 'info terakhir dari bapak (27 April 2022) akan diterbitkan bulan edisi mei 2022.', and 'mohon informasi perkembangannya njih pak...'. The email concludes with 'Terimakasih' and 'Dr. Rudy Hartanto dkk.'. At the bottom of the email, there are buttons for 'Balas' (Reply), 'Teruskan' (Forward), and an emoji icon.

Review Ke 2 : Permintaan pengecekan Kembali manuskrip



Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to the Use of Lactation Cow Concentrate by Calf Starter Substitution

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ABSTRACT

The aim of the study was to analyze the increase in body dimensions of post-weaning female Holstein Friesian (HF) calves fed with lactation cow concentrate with different levels of calf starter substitution. The material was 4 post-weaning female HF calves aged 4-5 months, with an average weight of 101.38 ± 14.21 kg. The feed consisted of elephant grass, calf starter (CS), and lactation cow concentrate (LCC). The study used a Latin square design, with 4 concentrate treatments, i.e. P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), P4 (100% LCC); and 4 replications in 4 periods (each period in 1 month). The concentrate was given 1% BW in the dry matter; elephant grass and drinking water were provided in a measurable ad libitum. The research parameters were the increase in body dimensions (heart girth (HG), body length (BL), and withers height (WH)). The treatments had no significant effect ($p > 0.05$) on the increase in body dimensions, were P1 (HG = 2.31 cm/month, BL = 4.75 cm/month, WH = 1.95 cm/month), P2 (HG = 4.23 cm/month, BL = 4.38 cm/month, WH = 2.23 cm/month), P3 (HG = 4.60 cm/month, BL = 4.38 cm/month, WH = 2.35 cm/month), P4 (HG = 4.10 cm/month, BL = 3.48 cm/month, WH = 2.18 cm/month). It was concluded that with sufficient quality forage feed, giving 100% LCC to post-weaning female HF calves could result in an increase in body dimensions that was relatively the same as the substitution of CS (25-75%) in LCC as concentrate feed.

Keywords: post-weaning female HF calves, body dimensions, calf starter, lactation cow concentrate

INTRODUCTION

Feeding and drinking as well as calf health are important factors that need to be considered in order to get good calf growth, both pre-weaning and after-weaning. Calves that have been weaned do not get milk and fulfill their nutritional needs in full from forages and concentrates (Kusumawati et al., 2018; Atabany et al., 2020). Calves can be weaned when they are 8 weeks old, i.e. after they are able to consume calf starter 0.5-0.68 kg/day, but at this age weaning has a high risk of calf death so that calves are generally weaned at 3 months of age (NRC, 2001; Prihantoro et al., 2012). When weaning, the calf enters the initial phase of growth, so most of the nutrients consumed will be used for growth such as enlargement of the body skeleton (Imran et al., 2012; Welboren et al., 2019).

The body dimensions of the female calf when weaning are very important because the female calf which from the start already has the ideal body dimensions, will also be an ideal breeder. In addition to body weight gain, the increase in body dimensions (heart girth, withers height, body length) in weaning calves is also a measure of the calf's appearance or performance (Hardiono et al., 2016; Rotondo et al., 2021). The calf when post-weaning should have a heart girth of 96 cm and a withers height of 75 cm so that later it can meet the target of a heart girth of 155 cm and withers height of 115 cm at the time of entering the age of 15 months for first mating (Alim and Hidaka, 2002). The formation of body dimensions is influenced by the adequacy of nutrient needs. Weaning calves are usually fed high-quality forage and concentrates formulated to meet nutritional needs and increase body weight (ASAS, 2020).

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However, in practice in the field, the provision of feed for post-weaning female calves has not been well considered by small farmers. Generally, smallholder farms provide lactation cow concentrates to calves with the consideration of cheaper concentrate prices. At least lactation cow concentrate has a crude protein CP content is 16-21% and TDN of 70-80% (BSN, 2017). Whereas the nutritional needs of female calves from post-weaning to heifers are different from those of adult cattle, so calves need to be given different feeds from adult cows.

The substitution of calf starter in lactation cow concentrate was carried out with the aim of improving the nutritional quality of the concentrate feed given to weaning calves. Calf starter is different from lactation cow concentrate both physically and in quality (Mukodiningsih et al., 2012). Post-Weaning calves that receive higher-quality feed will produce better performance in body dimensions as well. Larger body weight and body dimensions at the same age indicate better growth (Turiello et al., 2016; Nemati et al., 2016).

This study aimed to analyze the increase in body dimensions of post-weaned female Holstein Friesian (HF) calves fed with dairy cow concentrate with different levels of substitution of calf starter.

MATERIAL AND METHOD

Materials

The materials used were 4 post-weaning female Holstein Friesian (HF) calves aged 4-5 months with an average weight of 101.38±14.21 kg. The calves were kept in metabolic cages for the duration of the study. 300 cm long measuring tape with 0.1 cm accuracy and a 1.5 m stainless steel measuring stick with 0.1 cm accuracy were used to measure the body dimensions of livestock.

Table 1. Nutrient content of feed

Feed	Water	Ash	EE	CF	CP	NFE	TDN
	--(%)--			----- (% DM) -----			
Lactation Cow Concentrate (LCC)	9,42	9,90	6,42	26,87	16,40	40,41	64,91
Calf Starter (CS)	11,17	12,32	5,25	8,74	19,70	53,99	76,13
Elephant Grass	78,08	13,31	2,17	28,64	12,13	43,75	58,5
P1	10,73	11,71	5,54	13,27	18,87	50,61	73,32
P2	10,29	11,11	5,83	17,80	18,05	47,21	70,52
P3	9,86	10,50	6,13	22,33	17,25	43,79	67,71
P4	9,42	9,90	6,42	26,87	16,40	40,41	64,91

Note: EE = ether extract, CF = crude fiber, CP = crude protein, NFE = nitrogen free extract, TDN = total digestible nutrients, DM = dry matter

The feed used was elephant grass (*Pennisetum purpureum*), lactation cow concentrate (LCC), and calf starter (CS) produced by Teaching Farm FPP Undip.

Methods

The feed provided was forage and concentrate treatment which was adjusted to the dry matter (DM) needs of the calves. Treatment concentrate (in DM) was given as much as 1% body weight (BW) in two doses, i.e. in the morning at 06.00 and in the afternoon at 15.00. Forage and drinking water are provided on a measured ad libitum basis. The forage was given one hour after the concentrate was given. The treatment concentrates consisted of P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), and P4 (100% LCC). The nutritional content of the feed given is shown in Table 1. The research design used was the Latin Square Design (LSD) with 4 treatments and 4 periods.

Feeding and residues of feed and drinking water to livestock were recorded in a logbook on a regular basis. The study was conducted in 4 periods, each period was carried out for 30 days of observation. The parameters measured were heart girth (HG), body length (BL), and withers height (WH). Measurement of body dimensions was carried out at the beginning and end of the period based on Welboren et al. (2019) and Lardy et al. (2020), followed by a break for 5 days and continued to the next period.

Statistical Analyses

All data were analyzed using analysis of variance (ANOVA) based on the Latin Square Design. If there was a treatment effect, then Duncan's test was continued to determine the difference between treatments.

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RESULTS AND DISCUSSION

The results of the study on the effect of substitution of calf starter on lactating cow concentrate on body dimensions increase in post-weaning HF female calves are presented in Table 2. Treatment of calf starter substitution on lactating cow concentrate (P1, P2, P3, and P4) had no significant effect ($p > 0.05$) on the average body size at the end of the study and the increase in body dimensions of livestock which includes heart girth, body length, and withers height. These results have the same phenomenon as the research of Purwadi (2017) that giving concentrates with different protein content, i.e. 10.23% and 13.79% in post-weaning female calves aged 3.5 months gave no significant effect on body dimensions increase.

The increase in body size that did not differ between treatments could be caused by the relatively same amount of daily consumption so that the nutrients digested by the calves were also the same. The average DM consumption was also not significantly different, i.e. P1 3.43 kg/day, P2 3.54 kg/day, P3 3.58 kg/day and P4 3.34 kg/day. The substitution of calf starter was intended to make the nutritional content of concentrate feed for post-weaning calves better at smallholder farms when compared to feed from lactation cow concentrate alone. Forage feed was given in a measurable ad libitum with the aim of the calves being able to meet the nutritional deficiencies from the consumption of concentrates by obtaining them from forage consumption. However, giving a concentrate that was 1% of body weight or with a forage: concentrate balance of 70:30 in this study, it was assumed that if the consumption of DM was relatively the same, the consumption of other nutrients was relatively the same as well. Nutrients from the feed digestion process in the form of energy, protein, fat, minerals, and so on will be used by the calf to meet the nutritional needs for calf growth. Imran et al. (2012) stated that the nutrients digested by the calf will be used to meet the needs to support the growth of the calf according to its genetics. Research by Kargar et al. (2019) also shows the body dimensions of post-weaning calves that were not different because the amount of DM consumption and the nutritional content consumed were relatively the same. According to Winarti and Widyastuti (2016), almost the same DM consumption will result in calf growth between treatments, there was no difference because the consumption of nutrients

was almost the same, both from consumption of crude protein, crude fat (ether extract) and crude fiber.

The growth of the post-weaning calves is indicated by the increase in body dimensions. Calf body dimensions were strongly influenced by feeding, feed consumption and digestibility. The results of this study showed that the increase in body dimensions of post-weaning calves between treatments was relatively the same. This was presumably because during post-weaning the rumen conditions and functions have developed perfectly, so that the results of fermentative digestion of feed in the rumen that can be used for the growth of the post-weaning calves in each treatment were relatively the same, resulting in relatively the same body dimensions even though the calf starter has the better quality than lactation dairy cow concentrate. This can be caused by the condition of the rumen in post-weaning calves that are ready to digest solid feed. McCurdy et al. (2019) stated that when the calf has been weaned, the calf rumen is ready to digest solid feed and the rumen becomes much more sensitive to food fermentability. Rumen microbes were thought to have been able to ferment concentrates and forage well, so that sufficient microbial protein was available for post-weaning calves at P1, P2, P3 and P4. Pramita et al. (2016) stated that rumen microbes are the main source of protein for the host, besides that rumen microbes play an important role in digesting feed because they can produce enzymes that can digest fiber in low-quality feed.

The rumen of the post-weaning calves had a fairly complete set of microorganisms. Xiao et al. (2016) stated that in the rumen of the calf there are fungi, protozoa, and bacteria which include fiber-digesting bacteria such as *Fibrobacter succinogenes*, *Ruminococcus albus*, and *Ruminococcus flavefaciens*, as well as other bacteria such as *Prevotella*, *Butyrivibrio fibrisolvens*, *Shuttleworthia*, and *Desulfovibrio*. In addition, there are two groups of protozoa that are abundant in the rumen, i.e. entodiniomorphid (oligotrich) and holotrich (Yanuartono et al., 2019). With a ready-made rumen condition, post-weaning calves are able to properly utilize forage and concentrates to meet their nutritional needs. This resulted in the administration of lactation cow concentrate with a CP content of 16.40% and TDN of 64.91% (P4), which resulted in an increase in body dimensions that was relatively the same as the concentrate substituted of calf starter (P1, P2, P3) if accompanied by the

administration of optimal forage. In this study, post-weaning female HF calves received concentrate as much as 1% of BW and forage given ad libitum.

Table 2. Average body dimensions of post-weaning female HF calves

Variables	Treatments			
	P1	P2	P3	P4
Initial Body Dimensions (cm)				
Heart Girth	116,92±8,45	115,25 ±13,58	114,55 ±9,84	115,40 ±6,30
Body Length	96,33 ±8,68	97,27 ±10,82	98,95 ±7,93	99,25 ±3,30
Withers Height	70,40 ±4,62	70,92 ±4,83	71,50 ±3,76	71,20 ±2,48
Final Body Dimensions (cm)				
Heart Girth	119,23 ±7,82	119,48 ±12,25	119,15 ±7,46	119,50 ±6,46
Body Length	101,08 ±7,89	101,65 ±9,72	103,33 ±7,67	102,73 ±4,22
Withers Height	72,35 ±3,92	73,15 ±3,67	73,85 ±3,23	73,38 ±1,60
Increase in Body Dimensions (cm/month)				
Heart Girth	2,31 ±1,36	4,23 ±1,85	4,60 ±2,81	4,10 ±1,13
Body Length	4,75 ±3,10	4,38 ±1,80	4,38 ±1,41	3,48 ±1,83
Withers Height	1,95 ±1,08	2,23 ±1,58	2,35 ±2,16	2,18 ±1,48

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Increase in Heart Girth (HG)

The increase in heart girth of calves treated with calf starter substitution on lactation cow concentrates was 2.31±1.36 cm/month (P1), 4.23±1.85 cm/month (P2), 4.60±2.81 cm/month (P3), and 4.10±1.13 cm/month (P4). These results were lower than the study results of Manthey et al. (2016) with the addition of DDGS treatment in concentrates with different concentrations in Holstein’s calves, i.e. an average of 5.22 cm/month, also the results of research by Wang et al. (2017) who gave a concentrate with a different physically effective neutral detergent fiber (peNDF) content in Holstein’s calves, i.e. 5.36 cm/month. Differences in the results of these studies can be caused by genetic influences, environmental climate, feed given, and maintenance management. This is in accordance with the statement of Ratnasari et al. (2019) that differences in growth in livestock can be caused by climate, the genetic capabilities of each animal, maintenance, and feed management.

Giving calf starter substitution in lactation cow concentrate had no effect on the increase in heart girth of post-weaning female HF calves (p>0.05). This condition may occur because the nutrition from the feed consumed by the calf has been used for bone growth, organ growth, and meat growth. This was in accordance with the opinion of Parsons et al. (2020) who stated that body size is closely related to body weight which is influenced by bone growth and then fat deposition. The growth of meat and bones affects the size of the heart girth, chest width, abdominal girth, and body weight of livestock, while bone growth affects body length, withers height, and

body weight of livestock. The increase in the size of the heart girth occurs because the heart girth is closely related to the body weight of the cattle, so when the weight of the cattle increases, the heart girth will be even bigger, including in HF calves (Sulistiyowati et al., 2009; Hardiono et al., 2016; Rotondo et al., 2021). Syaiful et al. (2020) stated that the bigger the heart girth, the bigger the organs in the chest cavity such as the heart and lungs, therefore heart girth can be used as an indicator of the calf body capacity.

Increase in Body Length (BL)

Giving calf starter substitution to lactation cow concentrate had no effect on the increase in body length for post-weaning female HF calves (p>0.05). The results of each treatment were 4.75±3.10 cm/month (P1), 4.38±1.80 cm/month (P2), 4.38±1.41 cm/month (P3) and 3.48±1.83 cm/month (P4). This result was higher than the average result of Anderson et al. (2015) in the treatment of concentrates from grains with different fat and protein content in Holstein calves, which was an average of 3.93 cm/month, but lower than the average results of Wang et al. (2017) on concentrate treatment with different physically effective neutral detergent fiber (peNDF) content in Holstein’s calves, i.e. 6.15 cm/month. The results of these studies differ because they are caused by several factors, i.e. livestock age, genetics, feed quality, and maintenance management (Vavrisinova et al., 2019).

The size of the calf’s body length did not differ, this was a result of the treatment with calf starter substitution on lactation cow concentrate,

which could be due to genetic influences and almost the same age. This is in accordance with the research results of Senevirathne et al. (2016) that there was no difference between treatments for calf body dimensions, indicating that calves were in the same period so that the growth rate of their body skeletons did not differ. At the time the research was carried out, the calf was in the growth acceleration phase so that the feed consumed by the calf would be used maximally for the growth of its body frame. Putra and Fajrina (2020) stated that the maximum growth rate occurs when the calf is 4-8 months old. This was reinforced by the opinion of Nugraha et al. (2016) who stated that livestock growth is influenced by the feed given, if the feed provided is of good quality and in sufficient quantity, then livestock growth will also be good.

Increase in Withers Height (WH)

Giving calf starter substitution to lactation cow concentrate did not have a different effect on the increase in withers height of post-weaning female HF calves ($p>0.05$). The treatment concentrate gave an increase in the size of the wither's height by 1.95 ± 1.08 cm/month (P1); 2.23 ± 1.58 cm/month (P2); 2.35 ± 2.16 cm/month (P3) and 2.18 ± 1.48 cm/month (P4). This result was lower than the results of the study by Manthey and Anderson (2018) by giving corn and soybean-based concentrates (with ad libitum forage) to Holstein's calves which resulted in an average increase in withers height of 3.03 cm/month. Differences in the results of this study can be influenced by factors such as the age of livestock, environmental climate, feed given, and maintenance management (Place & Mitloehner, 2010).

The results of the increase in wither height which did not differ from all treatments with calf starter substitution in lactation cow concentrate were also due to the age of the calf which was in the early stages of growth so that the nutrients from the feed consumed were used for bone growth, including the forefoot bones that greatly affect the value of withers height. This was in accordance with the opinion of Syaiful et al. (2020) which stated that at the age of 0-6 months the calf experiences faster growth in its forelegs because the forelegs are used to actively move when the calf is suckling on its mother, in addition, the forelegs are used to support the calf body weight. The increase in wither height is closely related to the growth of the calf's skeletal bones. This was in accordance with the opinion of

Maluhima et al. (2019) who stated that withers height is influenced by several factors, including feeding management, genetics, the condition of the livestock itself, and having a close relationship with the size of the calf frame.

CONCLUSION

The substitution of calf starter on lactation cow concentrate did not have a different effect on the increase in body dimensions (heart girth, body length, withers height) of post-weaning female HF calves. Lactation cow concentrate with PK 16.40% and TDN 64.91% followed by good quality forage in sufficient quantities was able to meet the nutritional needs of weaning calves seen from the performance of increasing body dimensions.

CONFLICT OF INTEREST

There is no conflict of interest with financial, personal, or other relationship with other people or organizations associated with material discussed in the manuscript.

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REFERENCES

- Alim, A.F. & T. Hidaka. 2002. Pakan dan Tatalaksana Sapi Perah. Dairy Technology Improvement Project in Indonesia. Bandung. [Indonesian].
- [ASAS] American Society of Animal Science. 2020. The Guide for the Care and Use of Agricultural Animals in Research and Teaching. 4th ed. American Society of Animal Science. Champaign, IL.
- Anderson, J.L., K.F. Kalscheur, A.D. Garcia, & D.J. Schingoethe. 2015. Feeding fat from distillers dried grains with solubles to dairy heifers: I. Effects on growth performance and total-tract digestibility of nutrients. *Journal of Dairy Science* 98(8): 5699 – 5708.
- Atabany, A., B.P. Purwanto, A. Yani, L. Cyrilla, I. Komala, S. Prabowo, W.A. Zahra, D. Permadi, T. Suprijatna, & Surajudin. 2020. *Budidaya Sapi Perah*. IPB Press. Bogor. [Indonesian].

- [BSN] Badan Standardisasi Nasional. 2017. SNI 3148.1:2017, Pakan Konsentrat-Bagian 1: Sapi Perah. Badan Standardisasi Nasional. Jakarta. [Indonesian].
- Hardiono, R., T. Saili & L.O. Nafiu. 2016. Respon pertumbuhan dan mortalitas pedet sapi bali lepas sapih yang diberi pakan tambahan dan obat cacing. *JITRO* 3(2): 39-47. [Indonesian].
- Imran, S.P.S. Budhi, N. Ngadiyono, & Dahlanuddin. 2012. Pertumbuhan pedet sapi bali lepas sapih yang diberi rumput lapangan dan disuplementasi daun turi (*Sesbania grandiflora*). *Agrinimal Jurnal Ilmu Ternak dan Tanaman* 2(2):55-60. [Indonesian].
- Kargar, S., M. Kanani, M. Albenzio, & M. Caroprese. 2019. Substituting corn silage with reconstituted forage or nonforage fiber sources in the starter diets of Holstein calves: effects on performance, ruminal fermentation, and blood metabolites. *Journal of Animal Science* 97(7):3046-3055.
- Kusumawati, E.D., S. Rahadi, J. Peso, & A.T.N. Krisnaningsih. 2018. Pengaruh umur lepas sapih dan umur induk terhadap produksi susu sapi perah Peranakan *Friesian Holstein* (PFH). *JITRO* 5(1):62-68. [Indonesian].
- Lardy, R., A. de Boyer des Roches, J. Capdeville, R. Bastien, L. Mounier, & I. Veissier. 2020. New recommendations for self-locking barriers to reduce skin injuries in dairy cows. *Animal* 14(8):745-1756.
- Maluhima, R.J., J.H. Manopo, A. Lomboan & S. H. Turangan. 2019. Rekondisi beberapa ukuran tubuh ternak sapi perah Friess Holland di Balai Pengembangan Bibit dan Pakan Ternak Tampusu. *Zootec* 39(1):165-170. [Indonesian].
- Manthey, A. K., J. L. Anderson & G. A. Perry. 2016. Feeding distillers dried grains in replacement of forage in limit-fed dairy heifer rations: Effects on growth performance, rumen fermentation, and total-tract digestibility of nutrients. *Journal of Dairy Science* 99(9):7206-7215.
- Manthey, A.K. & J.L. Anderson. 2018. Growth performance, rumen fermentation, nutrient utilization, and metabolic profile of dairy heifers limit-fed distillers dried grains with ad libitum forage. *Journal of Dairy Science* 101(1):365-375.
- McCurdy, D.E., K.R. Wilkins, R.L. Hiltz, S. Moreland, K. Klanderman & A.H. Laarman. 2019. Effects of supplemental butyrate and weaning on rumen fermentation in Holstein calves. *Journal of Dairy Science* 102(10):8874-8882.
- Mukodiningsih, S., S.S. Budhi, A. Agus & A. Astuti. 2012. Pemanfaatan susu bubuk kadaluwarsa dalam complete *calf starter* dan pengaruhnya terhadap konsentrasi VFA dan gula sapih. *Jurnal Sains dan Matematika* 20(4):109-113. [Indonesian].
- [NRC] National Research Council. 2001. *Nutrient Requirement of Dairy Cattle*. 7th Revised Edition. National Academy Press. Washington D.C.
- Nemati, M., H. Amanlou, M. Khorvash, M. Mirzaei, B. Moshiri, & M. H. Ghaffari. 2016. Effect of different alfalfa hay levels on growth performance, rumen fermentation, and structural growth of Holstein dairy calves. *Journal of Animal Science* 94(3):1141-1148.
- Nugraha, H.Y., I.P. Sampurna & I.K. Suatha. 2016. Pengaruh pemberian pakan tambahan pada induk sapi bali terhadap ukuran dimensi panjang pedet. *Buletin Veteriner Udayana* 8(2):159-165. [Indonesian].
- Parsons, S.D., M.A. Steele, K.E. Leslie, D.L. Renaud, & T.J. DeVries. 2020. Investigation of weaning strategy and solid feed location for dairy calves individually fed with an automated milk feeding system. *Journal of Dairy Science* 103(7):6533-6556.
- Place, S. E. & F. M. Mitloehner. 2010. Invited review: Contemporary environmental issues: A review of the dairy industry's role in climate change and air quality and the potential of mitigation through improved production efficiency. *Journal of Dairy Science* 93(8):3407-3416.
- Pramita, I.D.A.D.P., I.N.K. Besung & I.P. Sampurna. 2016. Jumlah non coliform dan total bakteri pada sapi bali di dataran tinggi dan dataran rendah di Bali pasca

- pemberian mineral. Buletin Veteriner Udayana 8(1):52-58. [Indonesian].
- Prihantoro, I., D. Evvyernie, Suryani, L. Abdullah1, N.S. Yunitasari, A.P. Sari, D. Khairunisa, A. Haziq, N. Rahayu, & T. Toharmat. 2012. Potensi bakteri pencernaan serat asal rumen kerbau yang diinokulasikan pada pedet Frisian Holstein selama periode prasapah. J. Ilmu Ternak dan Veteriner 17(4):297-309. [Indonesian].
- Purwadi. 2017. Pengaruh perbedaan kualitas konsentrat pada tampilan ukuran-ukuran tubuh dan konsumsi pakan pedet FH betina lepas sapah. Tropical Animal Science 1(1): 1-5. [Indonesian].
- Putra, W. P. B. & N. Z. Fajrina. 2020. Model kurva pertumbuhan berat badan pada sapi Turkish Holstein jantan. Jurnal Peternakan Lingkungan Tropis 3(1):23-30. [Indonesian].
- Ratnasari, D., A. Atabany, B. P. Purwanto & L. B. Salman. 2019. Model pertumbuhan sapi perah Friesian Holstein (FH) dari lahir sampai beranak pertama di BBPTU-HPT sapi perah Baturren menggunakan model matematik logistic. Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan 7(1):18-21. [Indonesian].
- Rotondo, V., V.R. Osborne, M. Paibomesai, K. M. Wood, & S. Jantzi. 2021. PSX-A-21 Late-Breaking: Predicting live weight using linear body measurements in growing dairy calves. Journal of Animal Science. 99(Issue suppl 3):371-372.
- Senevirathne, N.D., J.L. Anderson, W.R. Gibbons, & J.A. Clapper. 2016. Growth performance of calves fed microbially enhanced soy protein in pelleted starters. Journal of Dairy Science 100(1):199-212.
- Sulistiyowati, E., E. Kuswadi, L. Sutarno, & G. Tampubolon. 2009. Penampilan reproduksi sapi perah FH (Friesian Holland) dan pertumbuhan pedetnya pada umur 1- 3 bulan (studi kasus di Desa Air Duku dan Desa Air Putih Kali Bandung, Selupu Rejang, Rejang Lebong, Bengkulu). Jurnal Sain Peternakan Indonesia 4(1):21-26. [Indonesian].
- Syaiful, F.L., Khasrad, & S. Maulida. 2020. Identifikasi ukuran tubuh sapi bali dan simbal (simmental-bali) di Kecamatan Luhak Nan Duo Kabupaten Pasaman Barat. Jurnal Sain Peternakan Indonesia 15(2):219-226. [Indonesian].
- Turiello, P., E. Martinez, M. Auil, A. Bogni & O. Queiroz. 2016. Effects of a milk balancer protein supplement on growth and performance of dairy calves. Journal of Animal Science 94(Issue suppl 5): 370.
- Vavrišínová, K., K. Hozáková, O. Bučko, P. Haščík, & P. Juhás. 2019. The effect of the slaughter weight on carcass composition, body measurements and veal quality of holstein calves. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis 67(5): 1235-1243.
- Wang, H.R., Q. Chen, L.M. Chen, R.F. Ge, M.Z. Wang, L.H. Yu, & J. Zhang. 2017. Effects of dietary physically effective neutral detergent fiber content on the feeding behavior, digestibility, and growth of 8-to 10-month-old Holstein replacement heifers. Journal Dairy Science 100(2): 1161-1169.
- Welboren, A.C., L.N. Leal, M.A. Steele, M.A. Khan, & J. Martín-Tereso. 2019. Performance of ad libitum fed dairy calves weaned using fixed and individual methods. Animal 13(9):1891-1898.
- Winarti, E. & A. Widyastuti. 2016. The effect of calf starter ration for pre-weaning ongole grade (PO) calves on body weight gain. Journal of the Indonesian Tropical Animal Agriculture 41(4):209-215.
- Xiao, J.X., G.M. Alugongo, R. Chung, S.Z. Dong, S.L. Li, I. Yoon, Z.H. Wu, & Z. J. Cao. 2016. Effects of *Saccharomyces cerevisiae* fermentation products on dairy calves: Ruminal fermentation, gastrointestinal morphology, and microbial community. Journal of Dairy Science 99(7):5401-5412.
- Yanuartono, A. Nururrozi, S. Indarjulianto, & H. Purnamaningsih. 2019. Peran protozoa pada pencernaan ruminansia dan dampak terhadap lingkungan. Ternak Tropika 20(1):16-28. [Indonesian].

Hasil Perbaikan Review Ke-2

The screenshot shows a Gmail interface with a search bar at the top containing "jitra@uho.ac.id". The left sidebar lists various folders: "Kotak Masuk" (591), "Berbintang", "Ditunda", "Penting", "Terkirir", "Draf", "Kategori", "Sosial" (17), "Info Terbaru" (24), "Forum", "Promosi" (5), and "Selengkapnya". Below these are labels: "[imap]/Trash", "Pribadi", "Unwanted", and "Selengkapnya".

The main email content is from Rudy Hartanto (rudyharta@gmail.com) to Dr. Ir. Syam Rahadi, S.Pt., M.P., M.M., IPM, dated 18 Okt 2022, 14.03. The email text reads:

Kepada YTh.
Dr. Ir. Syam Rahadi, S.Pt., M.P., M.M., IPM.
(Chief Editor of Jurnal Ilmu dan Teknologi Peternakan Tropis)

Dengan hormat,

Kami sudah lakukan perbaikan dan pengecekan kembali masukrip sebagaimana terlampir.
Mohon bisa dilanjutkan ke proses penerbitan.

Terimakasih
Dr. Rudy Hartanto

2 Lampiran • Dipindai dengan Gmail

At the bottom, there are two attachments: a Word document titled "(23) 44, 23743-72..." and a PDF document titled "23_44, 23743-72...".

Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to the Use of Lactation Cow Concentrate by Calf Starter Substitution

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ABSTRACT

The aim of the study was to analyze the increase in body dimensions of post-weaning female Holstein Friesian (HF) calves fed with lactation cow concentrate with different levels of calf starter substitution. The material was 4 post-weaning female HF calves aged 4-5 months, with an average weight of 101.38 ± 14.21 kg. The feed consisted of elephant grass, calf starter (CS), and lactation cow concentrate (LCC). The study used a Latin square design, with 4 concentrate treatments, i.e. P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), P4 (100% LCC); and 4 replications in 4 periods (each period in 1 month). The concentrate was given 1% BW in the dry matter; elephant grass and drinking water were provided in a measurable ad libitum. The research parameters were the increase in body dimensions (heart girth (HG), body length (BL), and withers height (WH)). The treatments had no significant effect ($p > 0.05$) on the increase in body dimensions, were P1 (HG = 2.31 cm/month, BL = 4.75 cm/month, WH = 1.95 cm/month), P2 (HG = 4.23 cm/month, BL = 4.38 cm/month, WH = 2.23 cm/month), P3 (HG = 4.60 cm/month, BL = 4.38 cm/month, WH = 2.35 cm/month), P4 (HG = 4.10 cm/month, BL = 3.48 cm/month, WH = 2.18 cm/month). It was concluded that with sufficient quality forage feed, giving 100% LCC to post-weaning female HF calves could result in an increase in body dimensions that was relatively the same as the substitution of CS (25-75%) in LCC as concentrate feed.

Keywords: post-weaning female HF calves, body dimensions, calf starter, lactation cow concentrate

INTRODUCTION

Feeding and drinking as well as calf health are important factors that need to be considered in order to get good calf growth, both pre-weaning and after-weaning. Calves that have been weaned do not get milk and fulfill their nutritional needs in full from forages and concentrates (Kusumawati et al., 2018; Atabany et al., 2020). Calves can be weaned when they are 8 weeks old, i.e. after they are able to consume calf starter 0.5-0.68 kg/day, but at this age weaning has a high risk of calf death so that calves are generally weaned at 3 months of age (NRC, 2001; Prihantoro et al., 2012). When weaning, the calf enters the initial phase of growth, so most of the nutrients consumed will be used for growth such as enlargement of the body skeleton (Imran et al., 2012; Welboren et al., 2019).

The body dimensions of the female calf when weaning are very important because the female calf which from the start already has the ideal body dimensions, will also be an ideal breeder. In addition to body weight gain, the increase in body dimensions (heart girth, withers height, body length) in weaning calves is also a measure of the calf's appearance or performance (Hardiono et al., 2016; Rotondo et al., 2021). The calf when post-weaning should have a heart girth of 96 cm and a withers height of 75 cm so that later it can meet the target of a heart girth of 155 cm and withers height of 115 cm at the time of entering the age of 15 months for first mating (Alim and Hidaka, 2002). The formation of body dimensions is influenced by the adequacy of nutrient needs. Weaning calves are usually fed high-quality forage and concentrates formulated to meet nutritional needs and increase body weight (ASAS, 2020).



However, in practice in the field, the provision of feed for post-weaning female calves has not been well considered by small farmers. Generally, smallholder farms provide lactation cow concentrates to calves with the consideration of cheaper concentrate prices. At least lactation cow concentrate has a crude protein CP content is 16-21% and TDN of 70-80% (BSN, 2017). Whereas the nutritional needs of female calves from post-weaning to heifers are different from those of adult cattle, so calves need to be given different feeds from adult cows.

The substitution of calf starter in lactation cow concentrate was carried out with the aim of improving the nutritional quality of the concentrate feed given to weaning calves. Calf starter is different from lactation cow concentrate both physically and in quality (Mukodiningsih et al., 2012). Post-Weaning calves that receive higher-quality feed will produce better performance in body dimensions as well. Larger body weight and body dimensions at the same age indicate better growth (Turiello et al., 2016; Nemati et al., 2016).

This study aimed to analyze the increase in body dimensions of post-weaned female Holstein Friesian (HF) calves fed with dairy cow concentrate with different levels of substitution of calf starter.

MATERIAL AND METHOD

Materials

The materials used were 4 post-weaning female Holstein Friesian (HF) calves aged 4-5 months with an average weight of 101.38±14.21 kg. The calves were kept in metabolic cages for the duration of the study. 300 cm long measuring tape with 0.1 cm accuracy and a 1.5 m stainless steel measuring stick with 0.1 cm accuracy were used to measure the body dimensions of livestock.

The feed used was elephant grass (*Pennisetum purpureum*), lactation cow concentrate (LCC), and calf starter (CS) produced by Teaching Farm FPP Undip.

Methods

The feed provided was forage and concentrate treatment which was adjusted to the dry matter (DM) needs of the calves. Treatment concentrate (in DM) was given as much as 1% body weight (BW) in two doses, i.e. in the morning at 06.00 and in the afternoon at 15.00. Forage and drinking water are provided on a measured ad libitum basis. The forage was given one hour after the concentrate was given. The treatment concentrates consisted of P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), and P4 (100% LCC). The nutritional content of the feed given is shown in Table 1. The research design used was the Latin Square Design (LSD) with 4 treatments and 4 periods.

Feeding and residues of feed and drinking water to livestock were recorded in a logbook on a regular basis. The study was conducted in 4 periods, each period was carried out for 30 days of observation. The parameters measured were heart girth (HG), body length (BL), and withers height (WH). Measurement of body dimensions was carried out at the beginning and end of the period based on Welboren et al. (2019) and Lardy et al. (2020), followed by a break for 5 days and continued to the next period.

Statistical Analyses

All data were analyzed using analysis of variance (ANOVA) based on the Latin Square Design. If there was a treatment effect, then Duncan's test was continued to determine the difference between treatments.

Table 1. Nutrient content of feed

Feed	Water	Ash	EE	CF	CP	NFE	TDN
	--(%)--			----- (% DM) -----			
Lactation Cow Concentrate (LCC)	9.42	9.90	6.42	26.87	16.40	40.41	64.91
Calf Starter (CS)	11.17	12.32	5.25	8.74	19.70	53.99	76.13
Elephant Grass	78.08	13.31	2.17	28.64	12.13	43.75	58.5
P1	10.73	11.71	5.54	13.27	18.87	50.61	73.32
P2	10.29	11.11	5.83	17.80	18.05	47.21	70.52
P3	9.86	10.50	6.13	22.33	17.25	43.79	67.71
P4	9.42	9.90	6.42	26.87	16.40	40.41	64.91

Note: EE = ether extract, CF = crude fiber, CP = crude protein, NFE = nitrogen free extract, TDN = total digestible nutrients, DM = dry matter

RESULTS AND DISCUSSION

The results of the study on the effect of substitution of calf starter on lactating cow concentrate on body dimensions increase in post-weaning HF female calves are presented in Table 2. Treatment of calf starter substitution on lactating cow concentrate (P1, P2, P3, and P4) had no significant effect ($p > 0.05$) on the average body size at the end of the study and the increase in body dimensions of livestock which includes heart girth, body length, and withers height. These results have the same phenomenon as the research of Purwadi (2017) that giving concentrates with different protein content, i.e. 10.23% and 13.79% in post-weaning female calves aged 3.5 months gave no significant effect on body dimensions increase.

The increase in body size that did not differ between treatments could be caused by the relatively same amount of daily consumption so that the nutrients digested by the calves were also not the same. The average DM consumption was also not significantly different, i.e. P1 3.43 kg/day, P2 3.54 kg/day, P3 3.58 kg/day and P4 3.34 kg/day. The substitution of calf starter was intended to make the nutritional content of concentrate feed for post-weaning calves better at smallholder farms when compared to feed from lactation cow concentrate alone. Forage feed was given in a measurable ad libitum with the aim of the calves being able to meet the nutritional deficiencies from the consumption of concentrates by obtaining them from forage consumption. However, giving a concentrate that was 1% of body weight or with a forage: concentrate balance of 70:30 in this study, it was assumed that if the consumption of DM was relatively the same, the consumption of other nutrients was relatively the same as well. Nutrients from the feed digestion process in the form of energy, protein, fat, minerals, and so on will be used by the calf to meet the nutritional needs for calf growth. Imran et al. (2012) stated that the nutrients digested by the calf will be used to meet the needs to support the growth of the calf according to its genetics. Research by Kargar et al. (2019) also shows the body dimensions of post-weaning calves that were not different because the amount of DM consumption and the nutritional content consumed were relatively the same. According to Winarti and Widyastuti (2016), almost the same DM consumption will result in calf growth between treatments, there was no difference because the consumption of nutrients

was almost the same, both from consumption of crude protein, crude fat (ether extract) and crude fiber.

The growth of the post-weaning calves is indicated by the increase in body dimensions. Calf body dimensions were strongly influenced by feeding, feed consumption and digestibility. The results of this study showed that the increase in body dimensions of post-weaning calves between treatments was relatively the same. This was presumably because during post-weaning the rumen conditions and functions have developed perfectly, so that the results of fermentative digestion of feed in the rumen that can be used for the growth of the post-weaning calves in each treatment were relatively the same, resulting in relatively the same body dimensions even though the calf starter has the better quality than lactation dairy cow concentrate. This can be caused by the condition of the rumen in post-weaning calves that are ready to digest solid feed. McCurdy et al. (2019) stated that when the calf has been weaned, the calf rumen is ready to digest solid feed and the rumen becomes much more sensitive to food fermentability. Rumen microbes were thought to have been able to ferment concentrates and forage well, so that sufficient microbial protein was available for post-weaning calves at P1, P2, P3 and P4. Pramita et al. (2016) stated that rumen microbes are the main source of protein for the host, besides that rumen microbes play an important role in digesting feed because they can produce enzymes that can digest fiber in low-quality feed.

The rumen of the post-weaning calves had a fairly complete set of microorganisms. Xiao et al. (2016) stated that in the rumen of the calf there are fungi, protozoa, and bacteria which include fiber-digesting bacteria such as *Fibrobacter succinogenes*, *Ruminococcus albus*, and *Ruminococcus flavefaciens*, as well as other bacteria such as *Prevotella*, *Butyrivibrio fibrisolvens*, *Shuttleworthia*, and *Desulfovibrio*. In addition, there are two groups of protozoa that are abundant in the rumen, i.e. entodiniomorphid (oligotrich) and holotrich (Yanuartono et al., 2019). With a ready-made rumen condition, post-weaning calves are able to properly utilize forage and concentrates to meet their nutritional needs. This resulted in the administration of lactation cow concentrate with a CP content of 16.40% and TDN of 64.91% (P4), which resulted in an increase in body dimensions that was relatively the same as the concentrate substituted of calf starter (P1, P2, P3) if accompanied by the

administration of optimal forage. In this study, post-weaning female HF calves received concentrate as much as 1% of BW and forage given ad libitum.

Table 2. Average body dimensions of post-weaning female HF calves

Variables	Treatments			
	P1	P2	P3	P4
Initial Body Dimensions (cm)				
Heart Girth	116.92±8.45	115.25 ±13.58	114.55 ±9.84	115.40 ±6.30
Body Length	96.33 ±8.68	97.27 ±10.82	98.95 ±7.93	99.25 ±3.30
Withers Height	70.40 ±4.62	70.92 ±4.83	71.50 ±3.76	71.20 ±2.48
Final Body Dimensions (cm)				
Heart Girth	119.23 ±7.82	119.48 ±12.25	119.15 ±7.46	119.50 ±6.46
Body Length	101.08 ±7.89	101.65 ±9.72	103.33 ±7.67	102.73 ±4.22
Withers Height	72.35 ±3.92	73.15 ±3.67	73.85 ±3.23	73.38 ±1.60
Increase in Body Dimensions (cm/month)				
Heart Girth	2.31 ±1.36	4.23 ±1.85	4.60 ±2.81	4.10 ±1.13
Body Length	4.75 ±3.10	4.38 ±1.80	4.38 ±1.41	3.48 ±1.83
Withers Height	1.95 ±1.08	2.23 ±1.58	2.35 ±2.16	2.18 ±1.48

Increase in Heart Girth (HG)

The increase in heart girth of calves treated with calf starter substitution on lactation cow concentrates was 2.31±1.36 cm/month (P1), 4.23±1.85 cm/month (P2), 4.60±2.81 cm/month (P3), and 4.10±1.13 cm/month (P4). These results were lower than the study results of Manthey et al. (2016) with the addition of DDGS treatment in concentrates with different concentrations in Holstein's calves, i.e. an average of 5.22 cm/month, also the results of research by Wang et al. (2017) who gave a concentrate with a different physically effective neutral detergent fiber (peNDF) content in Holstein's calves, i.e. 5.36 cm/month. Differences in the results of these studies can be caused by genetic influences, environmental climate, feed given, and maintenance management. This is in accordance with the statement of Ratnasari et al. (2019) that differences in growth in livestock can be caused by climate, the genetic capabilities of each animal, maintenance, and feed management.

Giving calf starter substitution in lactation cow concentrate had no effect on the increase in heart girth of post-weaning female HF calves ($p>0.05$). This condition may occur because the nutrition from the feed consumed by the calf has been used for bone growth, organ growth, and meat growth. This was in accordance with the opinion of Parsons et al. (2020) who stated that body size is closely related to body weight which is influenced by bone growth and then fat deposition. The growth of meat and bones affects the size of the heart girth, chest width, abdominal girth, and body weight of livestock, while bone growth affects body length, withers height, and

body weight of livestock. The increase in the size of the heart girth occurs because the heart girth is closely related to the body weight of the cattle, so when the weight of the cattle increases, the heart girth will be even bigger, including in HF calves (Sulistiyowati et al., 2009; Hardiono et al., 2016; Rotondo et al., 2021). Syaiful et al. (2020) stated that the bigger the heart girth, the bigger the organs in the chest cavity such as the heart and lungs, therefore heart girth can be used as an indicator of the calf body capacity.

Increase in Body Length (BL)

Giving calf starter substitution to lactation cow concentrate had no effect on the increase in body length for post-weaning female HF calves ($p>0.05$). The results of each treatment were 4.75±3.10 cm/month (P1), 4.38±1.80 cm/month (P2), 4.38±1.41 cm/month (P3) and 3.48±1.83 cm/month (P4). This result was higher than the average result of Anderson et al. (2015) in the treatment of concentrates from grains with different fat and protein content in Holstein calves, which was an average of 3.93 cm/month, but lower than the average results of Wang et al. (2017) on concentrate treatment with different physically effective neutral detergent fiber (peNDF) content in Holstein's calves, i.e. 6.15 cm/month. The results of these studies differ because they are caused by several factors, i.e. livestock age, genetics, feed quality, and maintenance management (Vavrisinova et al., 2019).

The size of the calf's body length did not differ, this was a result of the treatment with calf starter substitution on lactation cow concentrate,

which could be due to genetic influences and almost the same age. This is in accordance with the research results of Senevirathne et al. (2016) that there was no difference between treatments for calf body dimensions, indicating that calves were in the same period so that the growth rate of their body skeletons did not differ. At the time the research was carried out, the calf was in the growth acceleration phase so that the feed consumed by the calf would be used maximally for the growth of its body frame. Putra and Fajrina (2020) stated that the maximum growth rate occurs when the calf is 4-8 months old. This was reinforced by the opinion of Nugraha et al. (2016) who stated that livestock growth is influenced by the feed given, if the feed provided is of good quality and in sufficient quantity, then livestock growth will also be good.

Increase in Withers Height (WH)

Giving calf starter substitution to lactation cow concentrate did not have a different effect on the increase in withers height of post-weaning female HF calves ($p>0.05$). The treatment concentrate gave an increase in the size of the wither's height by 1.95 ± 1.08 cm/month (P1); 2.23 ± 1.58 cm/month (P2); 2.35 ± 2.16 cm/month (P3) and 2.18 ± 1.48 cm/month (P4). This result was lower than the results of the study by Manthey and Anderson (2018) by giving corn and soybean-based concentrates (with ad libitum forage) to Holstein's calves which resulted in an average increase in withers height of 3.03 cm/month. Differences in the results of this study can be influenced by factors such as the age of livestock, environmental climate, feed given, and maintenance management (Place & Mitloehner, 2010).

The results of the increase in wither height which did not differ from all treatments with calf starter substitution in lactation cow concentrate were also due to the age of the calf which was in the early stages of growth so that the nutrients from the feed consumed were used for bone growth, including the forefoot bones that greatly affect the value of withers height. This was in accordance with the opinion of Syaiful et al. (2020) which stated that at the age of 0-6 months the calf experiences faster growth in its forelegs because the forelegs are used to actively move when the calf is suckling on its mother, in addition, the forelegs are used to support the calf body weight. The increase in wither height is closely related to the growth of the calf's skeletal bones. This was in accordance with the opinion of

Maluhima et al. (2019) who stated that withers height is influenced by several factors, including feeding management, genetics, the condition of the livestock itself, and having a close relationship with the size of the calf frame.

CONCLUSION

The substitution of calf starter on lactation cow concentrate did not have a different effect on the increase in body dimensions (heart girth, body length, withers height) of post-weaning female HF calves. Lactation cow concentrate with PK 16.40% and TDN 64.91% followed by good quality forage in sufficient quantities was able to meet the nutritional needs of weaning calves seen from the performance of increasing body dimensions.

CONFLICT OF INTEREST

There is no conflict of interest with financial, personal, or other relationship with other people or organizations associated with material discussed in the manuscript.

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REFERENCES

- Alim, A.F. & T. Hidaka. 2002. Pakan dan Tatalaksana Sapi Perah. Dairy Technology Improvement Project in Indonesia. Bandung. [Indonesian].
- [ASAS] American Society of Animal Science. 2020. The Guide for the Care and Use of Agricultural Animals in Research and Teaching. 4th ed. American Society of Animal Science. Champaign, IL.
- Anderson, J.L., K.F. Kalscheur, A.D. Garcia, & D.J. Schingoethe. 2015. Feeding fat from distillers dried grains with solubles to dairy heifers: I. Effects on growth performance and total-tract digestibility of nutrients. *Journal of Dairy Science* 98(8): 5699 – 5708.
- Atabany, A., B.P. Purwanto, A. Yani, L. Cyrilla, I. Komala, S. Prabowo, W.A. Zahra, D. Permadi, T. Suprijatna, & Surajudin. 2020. *Budidaya Sapi Perah*. IPB Press. Bogor. [Indonesian].

- [BSN] Badan Standardisasi Nasional. 2017. SNI 3148.1:2017, Pakan Konsentrat-Bagian 1: Sapi Perah. Badan Standardisasi Nasional. Jakarta. [Indonesian].
- Hardiono, R., T. Saili & L.O. Nafiu. 2016. Respon pertumbuhan dan mortalitas pedet sapi bali dari induk yang diberi pakan tambahan dan obat cacing. JITRO 3(2): 39-47. [Indonesian].
- Imran, S.P.S. Budhi, N. Ngadiyono, & Dahlanuddin. 2012. Pertumbuhan pedet sapi bali lepas sapih yang diberi rumput lapangan dan disuplementasi daun turi (*Sesbania grandiflora*). Agrinimal Jurnal Ilmu Ternak dan Tanaman 2(2):55-60. [Indonesian].
- Kargar, S., M. Kanani, M. Albenzio, & M. Caroprese. 2019. Substituting corn silage with reconstituted forage or nonforage fiber sources in the starter diets of Holstein calves: effects on performance, ruminal fermentation, and blood metabolites. Journal of Animal Science 97(7):3046- 3055.
- Kusumawati, E.D., S. Rahadi, J. Peso, & A.T.N. Krisnaningsih. 2018. Pengaruh umur lepas sapih dan umur induk terhadap produksi susu sapi perah Peranakan *Friesian Holstein* (PFH). JITRO 5(1):62-68. [Indonesian].
- Lardy, R., A. de Boyer des Roches, J. Capdeville, R. Bastien, L. Mounier, & I. Veissier. 2020. New recommendations for self-locking barriers to reduce skin injuries in dairy cows. Animal 14(8):745-1756.
- Maluhima, R.J., J.H. Manopo, A. Lomboan & S. H. Turangan. 2019. Rekondisi beberapa ukuran tubuh ternak sapi perah Friess Holland di Balai Pengembangan Bibit dan Pakan Ternak Tampusu. Zootec 39(1):165-170. [Indonesian].
- Manthey, A. K., J. L. Anderson & G. A. Perry. 2016. Feeding distillers dried grains in replacement of forage in limit-fed dairy heifer rations: Effects on growth performance, rumen fermentation, and total-tract digestibility of nutrients. Journal of Dairy Science 99(9):7206-7215.
- Manthey, A.K. & J.L. Anderson. 2018. Growth performance, rumen fermentation, nutrient utilization, and metabolic profile of dairy heifers limit-fed distillers dried grains with ad libitum forage. Journal of Dairy Science 101(1):365-375.
- McCurdy, D.E., K.R. Wilkins, R.L. Hiltz, S. Moreland, K. Klanderma & A.H. Laarman. 2019. Effects of supplemental butyrate and weaning on rumen fermentation in Holstein calves. Journal of Dairy Science 102(10):8874-8882.
- Mukodiningsih, S., S.S. Budhi, A. Agus & A. Astuti. 2012. Pemanfaatan susu bubuk kadaluwarsa dalam complete *calv starter* dan pengaruhnya terhadap konsentrasi VFA dan gula sapih. Jurnal Sains dan Matematika 20(4):109-113. [Indonesian].
- [NRC] National Research Council. 2001. Nutrient Requirement of Dairy Cattle. 7th Revised Edition. National Academy Press. Washington D.C.
- Nemati, M., H. Amanlou, M. Khorvash, M. Mirzaei, B. Moshiri, & M. H. Ghaffari. 2016. Effect of different alfalfa hay levels on growth performance, rumen fermentation, and structural growth of Holstein dairy calves. Journal of Animal Science 94(3):1141-1148.
- Nugraha, H.Y., I.P. Sampurna & I.K. Suatha. 2016. Pengaruh pemberian pakan tambahan pada induk sapi bali terhadap ukuran dimensi panjang pedet. Buletin Veteriner Udayana 8(2):159-165. [Indonesian].
- Parsons, S.D., M.A. Steele, K.E. Leslie, D.L. Renaud, & T.J. DeVries. 2020. Investigation of weaning strategy and solid feed location for dairy calves individually fed with an automated milk feeding system. Journal of Dairy Science 103(7):6533-6556.
- Place, S. E. & F. M. Mitloehner. 2010. Invited review: Contemporary environmental issues: A review of the dairy industry's role in climate change and air quality and the potential of mitigation through improved production efficiency. Journal of Dairy Science 93(8):3407-3416.
- Pramita, I.D.A.D.P., I.N.K. Besung & I.P. Sampurna. 2016. Jumlah non coliform dan total bakteri pada sapi bali di dataran tinggi dan dataran rendah di Bali pasca

- pemberian mineral. Buletin Veteriner Udayana 8(1):52-58. [Indonesian].
- Prihantoro, I., D. Evvyernie, Suryani, L. Abdullah1, N.S. Yunitasari, A.P. Sari, D. Khairunisa, A. Haziq, N. Rahayu, & T. Toharmat. 2012. Potensi bakteri pencernaan serat asal rumen kerbau yang diinokulasikan pada pedet Frisian Holstein selama periode prasapih. J. Ilmu Ternak dan Veteriner 17(4):297-309. [Indonesian].
- Purwadi. 2017. Pengaruh perbedaan kualitas konsentrat pada tampilan ukuran-ukuran tubuh dan konsumsi pakan pedet FH betina lepas sapih. Tropical Animal Science 1(1): 1-5. [Indonesian].
- Putra, W. P. B. & N. Z. Fajrina. 2020. Model kurva pertumbuhan berat badan pada sapi Turkish Holstein jantan. Jurnal Peternakan Lingkungan Tropis 3(1):23-30. [Indonesian].
- Ratnasari, D., A. Atabany, B. P. Purwanto & L. B. Salman. 2019. Model pertumbuhan sapi perah Friesian Holstein (FH) dari lahir sampai beranak pertama di BBPTU-HPT sapi perah Baturraden menggunakan model matematik logistic. Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan 7(1):18-21. [Indonesian].
- Rotondo, V., V.R. Osborne, M. Paibomesai, K. M. Wood, & S. Jantzi. 2021. PSX-A-21 Late-Breaking: Predicting live weight using linear body measurements in growing dairy calves. Journal of Animal Science. 99(Issue suppl 3):371-372.
- Senevirathne, N.D., J.L. Anderson, W.R. Gibbons, & J.A. Clapper. 2016. Growth performance of calves fed microbially enhanced soy protein in pelleted starters. Journal of Dairy Science 100(1):199-212.
- Sulistiyowati, E., E. Kuswadi, L. Sutarno, & G. Tampubolon. 2009. Penampilan reproduksi sapi perah FH (Friesian Holland) dan pertumbuhan pedetnya pada umur 1- 3 bulan (studi kasus di Desa Air Duku dan Desa Air Putih Kali Bandung, Selupu Rejang, Rejang Lebong, Bengkulu). Jurnal Sain Peternakan Indonesia 4(1):21-26. [Indonesian].
- Syaiful, F.L., Khasrad, & S. Maulida. 2020. Identifikasi ukuran tubuh sapi bali dan simbal (simmental-bali) di Kecamatan Luhak Nan Duo Kabupaten Pasaman Barat. Jurnal Sain Peternakan Indonesia 15(2):219-226. [Indonesian].
- Turiello, P., E. Martinez, M. Auil, A. Bogni & O. Queiroz. 2016. Effects of a milk balancer protein supplement on growth and performance of dairy calves. Journal of Animal Science 94(Issue suppl 5): 370.
- Vavrišínová, K., K. Hozáková, O. Bučko, P. Haščík, & P. Juhás. 2019. The effect of the slaughter weight on carcass composition, body measurements and veal quality of holstein calves. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis 67(5): 1235-1243.
- Wang, H.R., Q. Chen, L.M. Chen, R.F. Ge, M.Z. Wang, L.H. Yu, & J. Zhang. 2017. Effects of dietary physically effective neutral detergent fiber content on the feeding behavior, digestibility, and growth of 8-to 10-month-old Holstein replacement heifers. Journal Dairy Science 100(2): 1161-1169.
- Welboren, A.C., L.N. Leal, M.A. Steele, M.A. Khan, & J. Martín-Tereso. 2019. Performance of ad libitum fed dairy calves weaned using fixed and individual methods. Animal 13(9):1891-1898.
- Winarti, E. & A. Widyastuti. 2016. The effect of calf starter ration for pre-weaning ongole grade (PO) calves on body weight gain. Journal of the Indonesian Tropical Animal Agriculture 41(4):209-215.
- Xiao, J.X., G.M. Alugongo, R. Chung, S.Z. Dong, S.L. Li, I. Yoon, Z.H. Wu, & Z. J. Cao. 2016. Effects of *Saccharomyces cerevisiae* fermentation products on dairy calves: Ruminal fermentation, gastrointestinal morphology, and microbial community. Journal of Dairy Science 99(7):5401-5412.
- Yanuartono, A. Nururrozi, S. Indarjulianto, & H. Purnamaningsih. 2019. Peran protozoa pada pencernaan ruminansia dan dampak terhadap lingkungan. Ternak Tropika 20(1):16-28. [Indonesian].

HASIL UJI SIMILIARITY

Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to the Use of Lactation Cow Concentrate by Calf Starter Substitution

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Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to the Use of Lactation Cow Concentrate by Calf Starter Substitution

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ABSTRACT

The aim of the study was to analyze the increase in body dimensions of post-weaning female Holstein Friesian (HF) calves fed with lactation cow concentrate with different levels of calf starter substitution. The material was 4 post-weaning female HF calves aged 4-5 months, with an average weight of 101.38 ± 14.21 kg. The feed consisted of elephant grass, calf starter (CS), and lactation cow concentrate (LCC). The study used a Latin square design, with 4 concentrate treatments, i.e. P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), P4 (100% LCC); and 4 replications in 4 periods (each period in 1 month). The concentrate was given 1% BW in the dry matter; elephant grass and drinking water were provided in a measurable ad libitum. The research parameters were the increase in body dimensions (heart girth (HG), body length (BL), and withers height (WH)). The treatments had no significant effect ($p > 0.05$) on the increase in body dimensions, were P1 (HG = 2.31 cm/month, BL = 4.75 cm/month, WH = 1.95 cm/month), P2 (HG = 4.23 cm/month, BL = 4.38 cm/month, WH = 2.23 cm/month), P3 (HG = 4.60 cm/month, BL = 4.38 cm/month, WH = 2.35 cm/month), P4 (HG = 4.10 cm/month, BL = 3.48 cm/month, WH = 2.18 cm/month). It was concluded that with sufficient quality forage feed, giving 100% LCC to post-weaning female HF calves could result in an increase in body dimensions that was relatively the same as the substitution of CS (25-75%) in LCC as concentrate feed.

Keywords: post-weaning female HF calves, body dimensions, calf starter, lactation cow concentrate

INTRODUCTION

Feeding and drinking as well as calf health are important factors that need to be considered in order to get good calf growth, both pre-weaning and after-weaning. Calves that have been weaned do not get milk and fulfill their nutritional needs in full from forages and concentrates (Kusumawati et al., 2018; Atabany et al., 2020). Calves can be weaned when they are 8 weeks old, i.e. after they are able to consume calf starter 0.5-0.68 kg/day, but at this age weaning has a high risk of calf death so that calves are generally weaned at 3 months of age (NRC, 2001; Prihantoro et al., 2012). When weaning, the calf enters the initial phase of growth, so most of the nutrients consumed will be used for growth such as enlargement of the body skeleton (Imran et al., 2012; Welboren et al., 2019).

The body dimensions of the female calf when weaning are very important because the female calf which from the start already has the ideal body dimensions, will also be an ideal breeder. In addition to body weight gain, the increase in body dimensions (heart girth, withers height, body length) in weaning calves is also a measure of the calf's appearance or performance (Hardiono et al., 2016; Rotondo et al., 2021). The calf when post-weaning should have a heart girth of 96 cm and a withers height of 75 cm so that later it can meet the target of a heart girth of 155 cm and withers height of 115 cm at the time of entering the age of 15 months for first mating (Alim and Hidaka, 2002). The formation of body dimensions is influenced by the adequacy of nutrient needs. Weaning calves are usually fed high-quality forage and concentrates formulated to meet nutritional needs and increase body weight (ASAS, 2020).



However, in practice in the field, the provision of feed for post-weaning female calves has not been well considered by small farmers. Generally, smallholder farms provide lactation cow concentrates to calves with the consideration of cheaper concentrate prices. At least lactation cow concentrate has a crude protein CP content is 16-21% and TDN of 70-80% (BSN, 2017). Whereas the nutritional needs of female calves from post-weaning to heifers are different from those of adult cattle, so calves need to be given different feeds from adult cows.

The substitution of calf starter in lactation cow concentrate was carried out with the aim of improving the nutritional quality of the concentrate feed given to weaning calves. Calf starter is different from lactation cow concentrate both physically and in quality (Mukodiningsih *et al.*, 2012). Post-Weaning calves that receive higher-quality feed will produce better performance in body dimensions as well. Larger body weight and body dimensions at the same age indicate better growth (Turiello *et al.*, 2016; Nemati *et al.*, 2016).

This study aimed to determine and examine the increase in body dimensions of post-weaned female Holstein Friesian (HF) calves fed with dairy cow concentrate with different levels of substitution of calf starter.

MATERIAL AND METHOD

Materials

The materials used were 4 post-weaning female Holstein Friesian (HF) calves aged 4-5 months with an average weight of 101.38±14.21 kg. The calves were kept in metabolic cages for the duration of the study. 300 cm long measuring tape with 0.1 cm accuracy and a 1.5 m stainless steel measuring stick with 0.1 cm accuracy were used to measure the body dimensions of livestock. The feed

used was elephant grass (*Pennisetum purpureum*), lactation cow concentrate (LCC), and calf starter (CS) produced by Teaching Farm FPP Undip.

Methods

The feed provided was forage and concentrate treatment which was adjusted to the dry matter (DM) needs of the calves. Treatment concentrate (in DM) was given as much as 1% body weight (BW) in two doses, i.e. in the morning at 06.00 and in the afternoon at 15.00. Forage and drinking water are provided on a measured ad libitum basis. The forage was given one hour after the concentrate was given. The treatment concentrates consisted of P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), and P4 (100% LCC). The nutritional content of the feed given is shown in Table 1. The research design used was the Latin Square Design (LSD) with 4 treatments and 4 periods.

Feeding and residues of feed and drinking water to livestock were recorded in a logbook on a regular basis. The study was conducted in 4 periods, each period was carried out for 30 days of observation. The parameters measured were heart girth (HG), body length (BL), and withers height (WH). Measurement of body dimensions was carried out at the beginning and end of the period based on Welboren *et al.* (2019) and Lardy *et al.* (2020), followed by a break for 5 days and continued to the next period.

Statistical Analyses

All data were analyzed using analysis of variance (ANOVA) based on the Latin Square Design. If there was a treatment effect, then Duncan's test was continued to determine the difference between treatments.

Table 1. Nutrient content of feed

Feed	Water	Ash	EE	CF	CP	NFE	TDN
	--(%)--			-----(% DM)-----			
Lactation Cow Concentrate (LCC)	9,42	9,90	6,42	26,87	16,40	40,41	64,91
Calf Starter (CS)	11,17	12,32	5,25	8,74	19,70	53,99	76,13
Elephant Grass	78,08	13,31	2,17	28,64	12,13	43,75	58,5
P1	10,73	11,71	5,54	13,27	18,87	50,61	73,32
P2	10,29	11,11	5,83	17,80	18,05	47,21	70,52
P3	9,86	10,50	6,13	22,33	17,25	43,79	67,71
P4	9,42	9,90	6,42	26,87	16,40	40,41	64,91

Note: EE = ether extract, CF = crude fiber, CP = crude protein, NFE = nitrogen free extract, TDN = total digestible nutrients, DM = dry matter, P1 (75% calf starter and 25% LCC), P2 (50% calf starter and 50% lactation cow concentrate), P3 (25% calf starter and 75% lactation cow concentrate), and P4 (100% lactation cow concentrate)

RESULTS AND DISCUSSION

The results of the study on the effect of substitution of calf starter on lactating cow concentrate on body dimensions increase in post-weaning HF female calves are presented in Table 2. Treatment of calf starter substitution on lactating cow concentrate (P1, P2, P3, and P4) had no significant effect ($p > 0.05$) on the average body size at the end of the study and the increase in body dimensions of livestock which includes heart girth, body length, and withers height. These results have the same phenomenon as the research of Purwadi (2017) that giving concentrates with different protein content, i.e. 10.23% and 13.79% in post-weaning female calves aged 3.5 months gave no significant effect on body dimensions increase. The increase in body size that did not differ between treatments could be caused by the relatively same amount of daily consumption so that the nutrients digested by the calves were also the same. The average DM consumption was also not significantly different, i.e. P1 3.43 kg/day, P2 3.54 kg/day, P3 3.58 kg/day and P4 3.34 kg/day. The substitution of calf starter was intended to make the nutritional content of concentrate feed for post-weaning calves better at smallholder farms when compared to feed from lactation cow concentrate alone. Forage feed was given in a measurable ad libitum with the aim of the calves being able to meet the nutritional deficiencies from the consumption of concentrates by obtaining them from forage consumption. However, giving a concentrate that was 1% of body weight or with a forage: concentrate balance of 70:30 in this study, it was assumed that if the consumption of DM was relatively the same, the consumption of other nutrients was relatively the same as well. Nutrients from the feed digestion process in the form of energy, protein, fat, minerals, and so on will be used by the calf to meet the nutritional needs for calf growth. Imran et al. (2012) stated that the nutrients digested by the calf will be used to meet the needs to support the growth of the calf according to its genetics. Research by Kargar et al. (2019) also shows the body dimensions of post-weaning calves that were not different because the amount of DM consumption and the nutritional content consumed were relatively the same. According to Winarti and Widyastuti (2016), almost the same DM consumption will result in calf growth between treatments, there was no difference because the consumption of nutrients was almost the same, both from consumption of crude protein, crude fat (ether extract) and crude fiber.

The growth of the post-weaning calves is indicated by the increase in body dimensions. Calf body dimensions were strongly influenced by feeding, feed consumption and digestibility. The results of this study showed that the increase in body dimensions of post-weaning calves between treatments was relatively the same. This was presumably because during post-weaning the rumen conditions and functions have developed perfectly, so that the results of fermentative digestion of feed in the rumen that can be used for the growth of the post-weaning calves in each treatment were relatively the same, resulting in relatively the same body dimensions even though the calf starter has the better quality than lactation dairy cow concentrate. This can be caused by the condition of the rumen in post-weaning calves that are ready to digest solid feed. McCurdy et al. (2019) stated that when the calf has been weaned, the calf rumen is ready to digest solid feed and the rumen becomes much more sensitive to food fermentability. Rumen microbes were thought to have been able to ferment concentrates and forage well, so that sufficient microbial protein was available for post-weaning calves at P1, P2, P3 and P4. Pramita et al. (2016) stated that rumen microbes are the main source of protein for the host, besides that rumen microbes play an important role in digesting feed because they can produce enzymes that can digest fiber in low-quality feed.

The rumen of the post-weaning calves had a fairly complete set of microorganisms. Xiao et al. (2016) stated that in the rumen of the calf there are fungi, protozoa, and bacteria which include fiber-digesting bacteria such as *Fibrobacter succinogenes*, *Ruminococcus albus*, and *Ruminococcus flavefaciens*, as well as other bacteria such as *Prevotella*, *Butyrivibrio fibrisolvens*, *Shuttleworthia*, and *Desulfovibrio*. In addition, there are two groups of protozoa that are abundant in the rumen, i.e. entodiniomorphid (oligotrich) and holotrich (Yanuartono et al., 2019). With a ready-made rumen condition, post-weaning calves are able to properly utilize forage and concentrates to meet their nutritional needs. This resulted in the administration of lactation cow concentrate with a CP content of 16.40% and TDN of 64.91% (P4), which resulted in an increase in body dimensions that was relatively the same as the concentrate substituted of calf starter (P1, P2, P3) if accompanied by the administration of optimal forage. In this study, post-weaning female HF calves received concentrate as much as 1% of BW and forage given ad libitum.

Table 2. Average body dimensions of post-weaning female HF calves

Variables	Treatments			
	P1	P2	P3	P4
Initial Body Dimensions (cm)				
Heart Girth	116,92±8,45	115,25 ±13,58	114,55 ±9,84	115,40 ±6,30
Body Length	96,33 ±8,68	97,27 ±10,82	98,95 ±7,93	99,25 ±3,30
Withers Height	70,40 ±4,62	70,92 ±4,83	71,50 ±3,76	71,20 ±2,48
Final Body Dimensions (cm)				
Heart Girth	119,23 ±7,82	119,48 ±12,25	119,15 ±7,46	119,50 ±6,46
Body Length	101,08 ±7,89	101,65 ±9,72	103,33 ±7,67	102,73 ±4,22
Withers Height	72,35 ±3,92	73,15 ±3,67	73,85 ±3,23	73,38 ±1,60
Increase in Body Dimensions (cm/month)				
Heart Girth	2,31 ±1,36	4,23 ±1,85	4,60 ±2,81	4,10 ±1,13
Body Length	4,75 ±3,10	4,38 ±1,80	4,38 ±1,41	3,48 ±1,83
Withers Height	1,95 ±1,08	2,23 ±1,58	2,35 ±2,16	2,18 ±1,48

Note: P1 (75% calf starter and 25% LCC), P2 (50% calf starter and 50% lactation cow concentrate), P3 (25% calf starter and 75% lactation cow concentrate), and P4 (100% lactation cow concentrate)

Increase in Heart Girth (HG)

The increase in heart girth of calves treated with calf starter substitution on lactation cow concentrates was 2.31±1.36 cm/month (P1), 4.23±1.85 cm/month (P2), 4.60±2.81 cm/month (P3), and 4.10±1.13 cm/month (P4). These results were lower than the study results of Manthey et al. (2016) with the addition of DDGS treatment in concentrates with different concentrations in Holstein's calves, i.e. an average of 5.22 cm/month, also the results of research by Wang et al. (2017) who gave a concentrate with a different physically effective neutral detergent fiber (peNDF) content in Holstein's calves, i.e. 5.36 cm/month. Differences in the results of these studies can be caused by genetic influences, environmental climate, feed given, and maintenance management. This is in accordance with the statement of Ratnasari et al. (2019) that differences in growth in livestock can be caused by climate, the genetic capabilities of each animal, maintenance, and feed management.

Giving calf starter substitution in lactation cow concentrate had no effect on the increase in heart girth of post-weaning female HF calves ($p>0.05$). This condition may occur because the nutrition from the feed consumed by the calf has been used for bone growth, organ growth, and meat growth. This was in accordance with the opinion of Parsons et al. (2020) who stated that body size is closely related to body weight which is influenced by bone growth and then fat deposition. The growth of meat and bones affects the size of the heart girth, chest width, abdominal girth, and body weight of livestock, while bone growth affects body length, withers height, and body weight of livestock. The increase in the size of the heart girth occurs because the heart girth is closely related to the body weight

of the cattle, so when the weight of the cattle increases, the heart girth will be even bigger, including HF calves (Sulistiyowati et al., 2009; Hardiono et al., 2016; Rotondo et al., 2021). Syaiful et al. (2020) stated that the bigger the heart girth, the bigger the organs in the chest cavity such as the heart and lungs, therefore heart girth can be used as an indicator of the calf body capacity.

Increase in Body Length (BL)

Giving calf starter substitution to lactation cow concentrate had no effect on the increase in body length for post-weaning female HF calves ($p>0.05$). The results of each treatment were 4.75±3.10 cm/month (P1), 4.38±1.80 cm/month (P2), 4.38±1.41 cm/month (P3) and 3.48±1.83 cm/month (P4). This result was higher than the average result of Anderson et al. (2015) in the treatment of concentrates from grains with different fat and protein content in Holstein calves, which was an average of 3.93 cm/month, but lower than the average results of Wang et al. (2017) on concentrate treatment with different physically effective neutral detergent fiber (peNDF) content in Holstein's calves, i.e. 6.15 cm/month. The results of these studies differ because they are caused by several factors, i.e. livestock age, genetics, feed quality, and maintenance management (Vavrisinova et al., 2019).

The size of the calf's body length did not differ, this was a result of the treatment with calf starter substitution on lactation cow concentrate, which could be due to genetic influences and almost the same age. This is in accordance with the research results of Senevirathne et al. (2016) that there was no difference between treatments for calf body dimensions, indicating that calves were in the

same period so that the growth rate of their body skeletons did not differ. At the time the research was carried out, the calf was in the growth acceleration phase so that the feed consumed by the calf would be used maximally for the growth of its body frame. Putra and Fajrina (2020) stated that the maximum growth rate occurs when the calf is 4-8 months old. This was reinforced by the opinion of Nugraha et al. (2016) who stated that livestock growth is influenced by the feed given, if the feed provided is of good quality and in sufficient quantity, then livestock growth will also be good.

Increase in Withers Height (WH)

Giving calf starter substitution to lactation cow concentrate did not have a different effect on the increase in withers height of post-weaning female HF calves ($p>0.05$). The treatment concentrate gave an increase in the size of the wither's height by 1.95 ± 1.08 cm/month (P1); 2.23 ± 1.58 cm/month (P2); 2.35 ± 2.16 cm/month (P3) and 2.18 ± 1.48 cm/month (P4). This result was lower than the results of the study by Manthey and Anderson (2018) by giving corn and soybean-based concentrates (with ad libitum forage) to Holstein's calves which resulted in an average increase in withers height of 3.03 cm/month. Differences in the results of this study can be influenced by factors such as the age of livestock, environmental climate, feed given, and maintenance management (Place & Mitloehner, 2010).

The results of the increase in wither height which did not differ from all treatments with calf starter substitution in lactation cow concentrate were also due to the age of the calf which was in the early stages of growth so that the nutrients from the feed consumed were used for bone growth, including the forefoot bones that greatly affect the value of withers height. This was in accordance with the opinion of Syaiful et al. (2020) which stated that at the age of 0-6 months the calf experiences faster growth in its forelegs because the forelegs are used to actively move when the calf is suckling on its mother, in addition, the forelegs are used to support the calf body weight. The increase in wither height is closely related to the growth of the calf's skeletal bones. This was in accordance with the opinion of Maluhima et al. (2019) who stated that withers height is influenced by several factors, including feeding management, genetics, the condition of the livestock itself, and having a close relationship with the size of the calf frame.

CONCLUSION

The substitution of calf starter on lactation

² cow concentrate did not have a different effect on the increase in body dimensions (heart girth, body length, withers height) of post-weaning female HF calves. Lactation cow concentrate with PK 16.40% and TDN 64.91% followed by good quality forage in sufficient quantities was able to meet the nutritional needs of weaning calves seen from the performance of increasing body dimensions.

CONFLICT OF INTEREST

There is no conflict of interest with financial, personal, or other relationship with other people or organizations associated with material discussed in the manuscript.

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REFERENCES

- Alim, A.F. & T. Hidaka. 2002. Pakan dan Tatalaksana Sapi Perah. Dairy Technology Improvement Project in Indonesia. Bandung. [Indonesian]
- [ASAS] American Society of Animal Science. 2020. The Guide for the Care and Use of Agricultural Animals in Research and Teaching. 4th ed. American Society of Animal Science. Champaign, IL.
- Anderson, J.L., K.F. Kalscheur, A.D. Garcia, & D.J. Schingoethe. 2015. Feeding fat from distillers dried grains with solubles to dairy heifers: I. Effects on growth performance and total-tract digestibility of nutrients. *Journal of Dairy Science* 98(8): 5699-5708.
- Atabany, A., B.P. Purwanto, A. Yani, L. Cyrilla, I. Komala, S. Prabowo, W.A. Zahra, D. Permadi, T. Suprijatna, & Surajudin. 2020. *Budidaya Sapi Perah*. IPB Press. Bogor. [Indonesian]
- [BSN] Badan Standardisasi Nasional. 2017. SNI 3148.1:2017, Pakan Konsentrat-Bagian 1: Sapi Perah. Badan Standardisasi Nasional. Jakarta. [Indonesian]
- Hardiono, R., T. Saili & L.O. Nafiu. 2016. Respon pertumbuhan dan mortalitas pedet sapi bali dari induk yang diberi pakan tambahan dan obat cacing. *JITRO* 3(2): 39-47. [Indonesian]

- Imran, S.P.S. Budhi, N. Ngadiyono, & Dahlanuddin. 2012. Pertumbuhan pedet sapi bali lepas sapih yang diberi rumput lapangan dan disuplementasi daun turi (*Sesbania grandiflora*). *Agrinimal Jurnal Ilmu Ternak dan Tanaman* 2(2):55-60. [Indonesian]
- Kargar, S., M. Kanani, M. Albenzio, & M. Caroprese. 2019. Substituting corn silage with reconstituted forage or nonforage fiber sources in the starter diets of Holstein calves: effects on performance, ruminal fermentation, and blood metabolites. *Journal of Animal Science* 97(7):3046-3055.
- Kusumawati, E.D., S. Rahadi, J. Peso, & A.T.N. Krisnaningsih. 2018. Pengaruh umur lepas sapih dan umur induk terhadap produksi susu sapi perah Peranakan *Friesian Holstein* (PFH). *JITRO* 5(1):62-68. [Indonesian]
- Lardy, R., A. de Boyer des Roches, J. Capdeville, R. Bastien, L. Mounier, & I. Veissier. 2020. New recommendations for self-locking barriers to reduce skin injuries in dairy cows. *Animal* 14(8):745-1756.
- Maluhima, R.J., J.H. Manopo, A. Lomboan & S. H. Turangan. 2019. Rekondisi beberapa ukuran tubuh ternak sapi perah Friess Holland di Balai Pengembangan Bibit dan Pakan Ternak Tampusu. *Zootec* 39(1):165-170. [Indonesian]
- Manthey, A. K., J. L. Anderson & G. A. Perry. 2016. Feeding distillers dried grains in replacement of forage in limit-fed dairy heifer rations: Effects on growth performance, rumen fermentation, and total-tract digestibility of nutrients. *Journal of Dairy Science* 99(9):7206-7215.
- Manthey, A.K. & J.L. Anderson. 2018. Growth performance, rumen fermentation, nutrient utilization, and metabolic profile of dairy heifers limit-fed distillers dried grains with ad libitum forage. *Journal of Dairy Science* 101(1):365-375.
- McCurdy, D.E., K.R. Wilkins, R.L. Hiltz, S. Moreland, K. Klanderman & A.H. Laarman. 2019. Effects of supplemental butyrate and weaning on rumen fermentation in Holstein calves. *Journal of Dairy Science* 102(10):8874-8882.
- Mukodiningsih, S., S.S. Budhi, A. Agus & A. Astuti. 2012. Pemanfaatan susu bubuk kadaluwarsa dalam complete *calf starter* dan pengaruhnya terhadap konsentrasi VFA dan gula sapih. *Jurnal Sains dan Matematika* 20(4):109-113. [Indonesian].
- [NRC] National Research Council. 2001. *Nutrient Requirement of Dairy Cattle*. 7th Revised Ed. National Academy Press. Washington D.C.
- Nemati, M., H. Amanlou, M. Khorvash, M. Mirzaei, B. Moshiri, & M. H. Ghaffari. 2016. Effect of different alfalfa hay levels on growth performance, rumen fermentation, and structural growth of Holstein dairy calves. *Journal of Animal Science* 94(3):1141-1148.
- Nugraha, H.Y., I.P. Sampurna & I.K. Suatha. 2016. Pengaruh pemberian pakan tambahan pada induk sapi bali terhadap ukuran dimensi panjang pedet. *Buletin Veteriner Udayana* 8(2):159-165. [Indonesian]
- Parsons, S.D., M.A. Steele, K.E. Leslie, D.L. Renaud, & T.J. DeVries. 2020. Investigation of weaning strategy and solid feed location for dairy calves individually fed with an automated milk feeding system. *Journal of Dairy Science* 103(7):6533-6556.
- Place, S. E. & F. M. Mitloehner. 2010. Invited review: Contemporary environmental issues: A review of the dairy industry's role in climate change and air quality and the potential of mitigation through improved production efficiency. *Journal of Dairy Science* 93(8):3407-3416.
- Pramita, I.D.A.D.P., I.N.K. Besung & I.P. Sampurna. 2016. Jumlah non coliform dan total bakteri pada sapi bali di dataran tinggi dan dataran rendah di Bali pasca pemberian mineral. *Buletin Veteriner Udayana* 8(1):52-58. [Indonesian]
- Prihantoro, I., D. Evvyemie, Suryani, L. Abdullah, N.S. Yunitasari, A.P. Sari, D. Khairunisa, A. Haziq, N. Rahayu, & T. Toharmat. 2012. Potensi bakteri pencernaan serat asal rumen kerbau yang diinokulasikan pada pedet Frisian Holstein selama periode prasapih. *J. Ilmu Ternak dan Veteriner* 17(4):297-309. [Indonesian]

- Purwadi. 2017. Pengaruh perbedaan kualitas konsentrat pada tampilan ukuran-ukuran tubuh dan konsumsi pakan pedet FH betina lepas sapih. *Tropical Animal Science* 1(1): 1-5. [Indonesian]
- Putra, W. P. B. & N. Z. Fajrina. 2020. Model kurva pertumbuhan berat badan pada sapi Turkish Holstein jantan. *Jurnal Peternakan Lingkungan Tropis* 3(1):23-30. [Indonesian]
- Ratnasari, D., A. Atabany, B. P. Purwanto & L. B. Salman. 2019. Model pertumbuhan sapi perah Friesian Holstein (FH) dari lahir sampai beranak pertama di BBPTU-HPT sapi perah Baturraden menggunakan model matematik logistic. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan* 7(1):18-21. [Indonesian]
- Rotondo, V., V.R. Osborne, M. Paibomesai, K. M. Wood, & S. Jantzi. 2021. PSX-A-21 Late-Breaking: Predicting live weight using linear body measurements in growing dairy calves. *Journal of Animal Science*. 99(Issue suppl 3):371-372.
- Senevirathne, N.D., J.L. Anderson, W.R. Gibbons, & J.A. Clapper. 2016. Growth performance of calves fed microbially enhanced soy protein in pelleted starters. *Journal of Dairy Science* 100(1):199-212.
- Sulistiyowati, E., E. Kuswadi, L. Sutarno, & G. Tampubolon. 2009. Penampilan reproduksi sapi perah FH (Friesian Holland) dan pertumbuhan pedetnya pada umur 1- 3 bulan (studi kasus di Desa Air Duku dan Desa Air Putih Kali Bandung, Selupu Rejang, Rejang Lebong, Bengkulu). *Jurnal Sain Peternakan Indonesia* 4(1):21-26. [Indonesian]
- Syaiful, F.L., Khasrad, & S. Maulida. 2020. Identifikasi ukuran tubuh sapi bali dan simbal (simmental-bali) di Kecamatan Luhak Nan Duo Kabupaten Pasaman Barat. *Jurnal Sain Peternakan Indonesia* 15(2):219-226. [Indonesian]
- Turiello, P., E. Martinez, M. Auil, A. Bogni & O. Queiroz. 2016. Effects of a milk balancer protein supplement on growth and performance of dairy calves. *Journal of Animal Science* 94(Issue suppl 5):370.
- Vavrišínová, K., K. Hozáková, O. Bučko, P. Haščík, & P. Juhás. 2019. The effect of the slaughter weight on carcass composition, body measurements, and veal quality of Holstein calves. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis* 67(5): 1235-1243.
- Wang, H.R., Q. Chen, L.M. Chen, R.F. Ge, M.Z. Wang, L.H. Yu, & J. Zhang. 2017. Effects of dietary physically effective neutral detergent fiber content on the feeding behavior, digestibility, and growth of 8-to 10-month-old Holstein replacement heifers. *Journal Dairy Science* 100(2): 1161-1169.
- Welboren, A.C., L.N. Leal, M.A. Steele, M.A. Khan, & J. Martín-Tereso. 2019. Performance of ad libitum fed dairy calves weaned using fixed and individual methods. *Animal* 13(9):1891-1898.
- Winarti, E. & A. Widyastuti. 2016. The effect of calf starter ration for pre-weaning ongole grade (PO) calves on body weight gain. *Journal of the Indonesian Tropical Animal Agriculture* 41(4):209-215.
- Xiao, J.X., G.M. Alugongo, R. Chung, S.Z. Dong, S.L. Li, I. Yoon, Z.H. Wu, & Z. J. Cao. 2016. Effects of *Saccharomyces cerevisiae* fermentation products on dairy calves: Ruminal fermentation, gastrointestinal morphology, and microbial community. *Journal of Dairy Science* 99(7):5401-5412.
- Yanuartono, A. Nururrozi, S. Indarjulianto, & H. Purnamaningsih. 2019. Peran protozoa pada pencernaan ruminansia dan dampak terhadap lingkungan. *Ternak Tropika* 20(1):16-28. [Indonesian]

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Increase in Body Dimensions of Post-Weaning Female Holstein Friesian Calves Due to the Use of Lactation Cow Concentrate by Calf Starter Substitution

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ABSTRACT

The aim of the study was to analyze the increase in body dimensions of post-weaning female Holstein Friesian (HF) calves fed with lactation cow concentrate with different levels of calf starter substitution. The material was 4 post-weaning female HF calves aged 4-5 months, with an average weight of 101.38 ± 14.21 kg. The feed consisted of elephant grass, calf starter (CS), and lactation cow concentrate (LCC). The study used a Latin square design, with 4 concentrate treatments, i.e. P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), P4 (100% LCC); and 4 replications in 4 periods (each period in 1 month). The concentrate was given 1% BW in the dry matter; elephant grass and drinking water were provided in a measurable ad libitum. The research parameters were the increase in body dimensions (heart girth (HG), body length (BL), and withers height (WH)). The treatments had no significant effect ($p > 0.05$) on the increase in body dimensions, were P1 (HG = 2.31 cm/month, BL = 4.75 cm/month, WH = 1.95 cm/month), P2 (HG = 4.23 cm/month, BL = 4.38 cm/month, WH = 2.23 cm/month), P3 (HG = 4.60 cm/month, BL = 4.38 cm/month, WH = 2.35 cm/month), P4 (HG = 4.10 cm/month, BL = 3.48 cm/month, WH = 2.18 cm/month). It was concluded that with sufficient quality forage feed, giving 100% LCC to post-weaning female HF calves could result in an increase in body dimensions that was relatively the same as the substitution of CS (25-75%) in LCC as concentrate feed.

Keywords: post-weaning female HF calves, body dimensions, calf starter, lactation cow concentrate

INTRODUCTION

Feeding and drinking as well as calf health are important factors that need to be considered in order to get good calf growth, both pre-weaning and after-weaning. Calves that have been weaned do not get milk and fulfill their nutritional needs in full from forages and concentrates (Kusumawati et al., 2018; Atabany et al., 2020). Calves can be weaned when they are 8 weeks old, i.e. after they are able to consume calf starter 0.5-0.68 kg/day, but at this age weaning has a high risk of calf death so that calves are generally weaned at 3 months of age (NRC, 2001; Prihantoro et al., 2012). When weaning, the calf enters the initial phase of growth, so most of the nutrients consumed will be used for growth such as enlargement of the body skeleton (Imran et al., 2012; Welboren et al., 2019).

The body dimensions of the female calf when weaning are very important because the female calf which from the start already has the ideal body dimensions, will also be an ideal breeder. In addition to body weight gain, the increase in body dimensions (heart girth, withers height, body length) in weaning calves is also a measure of the calf's appearance or performance (Hardiono et al., 2016; Rotondo et al., 2021). The calf when post-weaning should have a heart girth of 96 cm and a withers height of 75 cm so that later it can meet the target of a heart girth of 155 cm and withers height of 115 cm at the time of entering the age of 15 months for first mating (Alim and Hidaka, 2002). The formation of body dimensions is influenced by the adequacy of nutrient needs. Weaning calves are usually fed high-quality forage and concentrates formulated to meet nutritional needs and increase body weight (ASAS, 2020).



However, in practice in the field, the provision of feed for post-weaning female calves has not been well considered by small farmers. Generally, smallholder farms provide lactation cow concentrates to calves with the consideration of cheaper concentrate prices. At least lactation cow concentrate has a crude protein CP content is 16-21% and TDN of 70-80% (BSN, 2017). Whereas the nutritional needs of female calves from post-weaning to heifers are different from those of adult cattle, so calves need to be given different feeds from adult cows.

The substitution of calf starter in lactation cow concentrate was carried out with the aim of improving the nutritional quality of the concentrate feed given to weaning calves. Calf starter is different from lactation cow concentrate both physically and in quality (Mukodiningsih et al., 2012). Post-Weaning calves that receive higher-quality feed will produce better performance in body dimensions as well. Larger body weight and body dimensions at the same age indicate better growth (Turiello et al., 2016; Nemati et al., 2016).

This study aimed to determine and examine the increase in body dimensions of post-weaned female Holstein Friesian (HF) calves fed with dairy cow concentrate with different levels of substitution of calf starter.

MATERIAL AND METHOD

Materials

The materials used were 4 post-weaning female Holstein Friesian (HF) calves aged 4-5 months with an average weight of 101.38±14.21 kg. The calves were kept in metabolic cages for the duration of the study. 300 cm long measuring tape with 0.1 cm accuracy and a 1.5 m stainless steel measuring stick with 0.1 cm accuracy were used to measure the body dimensions of livestock. The feed

used was elephant grass (*Pennisetum purpureum*), lactation cow concentrate (LCC), and calf starter (CS) produced by Teaching Farm FPP Undip.

Methods

The feed provided was forage and concentrate treatment which was adjusted to the dry matter (DM) needs of the calves. Treatment concentrate (in DM) was given as much as 1% body weight (BW) in two doses, i.e. in the morning at 06.00 and in the afternoon at 15.00. Forage and drinking water are provided on a measured ad libitum basis. The forage was given one hour after the concentrate was given. The treatment concentrates consisted of P1 (75% CS and 25% LCC), P2 (50% CS and 50% LCC), P3 (25% CS and 75% LCC), and P4 (100% LCC). The nutritional content of the feed given is shown in Table 1. The research design used was the Latin Square Design (LSD) with 4 treatments and 4 periods.

Feeding and residues of feed and drinking water to livestock were recorded in a logbook on a regular basis. The study was conducted in 4 periods, each period was carried out for 30 days of observation. The parameters measured were heart girth (HG), body length (BL), and withers height (WH). Measurement of body dimensions was carried out at the beginning and end of the period based on Welboren et al. (2019) and Lardy et al. (2020), followed by a break for 5 days and continued to the next period.

Statistical Analyses

All data were analyzed using analysis of variance (ANOVA) based on the Latin Square Design. If there was a treatment effect, then Duncan's test was continued to determine the difference between treatments.

Table 1. Nutrient content of feed

Feed	Water	Ash	EE	CF	CP	NFE	TDN
	--(%)--		----- (% DM) -----				
Lactation Cow Concentrate (LCC)	9.42	9.90	6.42	26.87	16.40	40.41	64.91
Calf Starter (CS)	11.17	12.32	5.25	8.74	19.70	53.99	76.13
Elephant Grass	78.08	13.31	2.17	28.64	12.13	43.75	58.5
P1	10.73	11.71	5.54	13.27	18.87	50.61	73.32
P2	10.29	11.11	5.83	17.80	18.05	47.21	70.52
P3	9.86	10.50	6.13	22.33	17.25	43.79	67.71
P4	9.42	9.90	6.42	26.87	16.40	40.41	64.91

Note: EE = ether extract, CF = crude fiber, CP = crude protein, NFE = nitrogen free extract, TDN = total digestible nutrients, DM = dry matter

RESULTS AND DISCUSSION

The results of the study on the effect of substitution of calf starter on lactating cow concentrate on body dimensions increase in post-weaning HF female calves are presented in Table 2. Treatment of calf starter substitution on lactating cow concentrate (P1, P2, P3, and P4) had no significant effect ($p > 0.05$) on the average body size at the end of the study and the increase in body dimensions of livestock which includes heart girth, body length, and withers height. These results have the same phenomenon as the research of Purwadi (2017) that giving concentrates with different protein content, i.e. 10.23% and 13.79% in post-weaning female calves aged 3.5 months gave no significant effect on body dimensions increase. The increase in body size that did not differ between treatments could be caused by the relatively same amount of daily consumption so that the nutrients digested by the calves were also the same. The average DM consumption was also not significantly different, i.e. P1 3.43 kg/day, P2 3.54 kg/day, P3 3.58 kg/day and P4 3.34 kg/day. The substitution of calf starter was intended to make the nutritional content of concentrate feed for post-weaning calves better at smallholder farms when compared to feed from lactation cow concentrate alone. Forage feed was given in a measurable ad libitum with the aim of the calves being able to meet the nutritional deficiencies from the consumption of concentrates by obtaining them from forage consumption. However, giving a concentrate that was 1% of body weight or with a forage: concentrate balance of 70:30 in this study, it was assumed that if the consumption of DM was relatively the same, the consumption of other nutrients was relatively the same as well. Nutrients from the feed digestion process in the form of energy, protein, fat, minerals, and so on will be used by the calf to meet the nutritional needs for calf growth. Imran et al. (2012) stated that the nutrients digested by the calf will be used to meet the needs to support the growth of the calf according to its genetics. Research by Kargar et al. (2019) also shows the body dimensions of post-weaning calves that were not different because the amount of DM consumption and the nutritional content consumed were relatively the same. According to Winarti and Widyastuti (2016), almost the same DM consumption will result in calf growth between treatments, there was no difference because the consumption of nutrients was almost the same, both from consumption of crude protein, crude fat (ether extract) and crude fiber.

The growth of the post-weaning calves is indicated by the increase in body dimensions. Calf body dimensions were strongly influenced by feeding, feed consumption and digestibility. The results of this study showed that the increase in body dimensions of post-weaning calves between treatments was relatively the same. This was presumably because during post-weaning the rumen conditions and functions have developed perfectly, so that the results of fermentative digestion of feed in the rumen that can be used for the growth of the post-weaning calves in each treatment were relatively the same, resulting in relatively the same body dimensions even though the calf starter has the better quality than lactation dairy cow concentrate. This can be caused by the condition of the rumen in post-weaning calves that are ready to digest solid feed. McCurdy et al. (2019) stated that when the calf has been weaned, the calf rumen is ready to digest solid feed and the rumen becomes much more sensitive to food fermentability. Rumen microbes were thought to have been able to ferment concentrates and forage well, so that sufficient microbial protein was available for post-weaning calves at P1, P2, P3 and P4. Pramita et al. (2016) stated that rumen microbes are the main source of protein for the host, besides that rumen microbes play an important role in digesting feed because they can produce enzymes that can digest fiber in low-quality feed.

The rumen of the post-weaning calves had a fairly complete set of microorganisms. Xiao et al. (2016) stated that in the rumen of the calf there are fungi, protozoa, and bacteria which include fiber-digesting bacteria such as *Fibrobacter succinogenes*, *Ruminococcus albus*, and *Ruminococcus flavefaciens*, as well as other bacteria such as *Prevotella*, *Butyrivibrio fibrisolvens*, *Shuttleworthia*, and *Desulfovibrio*. In addition, there are two groups of protozoa that are abundant in the rumen, i.e. entodiniomorphid (oligotrich) and holotrich (Yanuartono et al., 2019). With a ready-made rumen condition, post-weaning calves are able to properly utilize forage and concentrates to meet their nutritional needs. This resulted in the administration of lactation cow concentrate with a CP content of 16.40% and TDN of 64.91% (P4), which resulted in an increase in body dimensions that was relatively the same as the concentrate substituted of calf starter (P1, P2, P3) if accompanied by the administration of optimal forage. In this study, post-weaning female HF calves received concentrate as much as 1% of BW and forage given ad libitum.

Table 2. Average body dimensions of post-weaning female HF calves

Variables	Treatments			
	P1	P2	P3	P4
Initial Body Dimensions (cm)				
Heart Girth	116.92±8.45	115.25 ±13.58	114.55 ±9.84	115.40 ±6.30
Body Length	96.33 ±8.68	97.27 ±10.82	98.95 ±7.93	99.25 ±3.30
Withers Height	70.40 ±4.62	70.92 ±4.83	71.50 ±3.76	71.20 ±2.48
Final Body Dimensions (cm)				
Heart Girth	119.23 ±7.82	119.48 ±12.25	119.15 ±7.46	119.50 ±6.46
Body Length	101.08 ±7.89	101.65 ±9.72	103.33 ±7.67	102.73 ±4.22
Withers Height	72.35 ±3.92	73.15 ±3.67	73.85 ±3.23	73.38 ±1.60
Increase in Body Dimensions (cm/month)				
Heart Girth	2.31 ±1.36	4.23 ±1.85	4.60 ±2.81	4.10 ±1.13
Body Length	4.75 ±3.10	4.38 ±1.80	4.38 ±1.41	3.48 ±1.83
Withers Height	1.95 ±1.08	2.23 ±1.58	2.35 ±2.16	2.18 ±1.48

Increase in Heart Girth (HG)

The increase in heart girth of calves treated with calf starter substitution on lactation cow concentrates was 2.31±1.36 cm/month (P1), 4.23±1.85 cm/month (P2), 4.60±2.81 cm/month (P3), and 4.10±1.13 cm/month (P4). These results were lower than the study results of Manthey et al. (2016) with the addition of DDGS treatment in concentrates with different concentrations in Holstein's calves, i.e. an average of 5.22 cm/month, also the results of research by Wang et al. (2017) who gave a concentrate with a different physically effective neutral detergent fiber (peNDF) content in Holstein's calves, i.e. 5.36 cm/month. Differences in the results of these studies can be caused by genetic influences, environmental climate, feed given, and maintenance management. This is in accordance with the statement of Ratnasari et al. (2019) that differences in growth in livestock can be caused by climate, the genetic capabilities of each animal, maintenance, and feed management.

Giving calf starter substitution in lactation cow concentrate had no effect on the increase in heart girth of post-weaning female HF calves ($p>0.05$). This condition may occur because the nutrition from the feed consumed by the calf has been used for bone growth, organ growth, and meat growth. This was in accordance with the opinion of Parsons et al. (2020) who stated that body size is closely related to body weight which is influenced by bone growth and then fat deposition. The growth of meat and bones affects the size of the heart girth, chest width, abdominal girth, and body weight of livestock, while bone growth affects body length, withers height, and body weight of livestock. The increase in the size of the heart girth occurs because the heart girth is closely related to the body weight of the cattle, so when the weight of the cattle

increases, the heart girth will be even bigger, including in HF calves (Sulistiyowati et al., 2009; Hardiono et al., 2016; Rotondo et al., 2021). Syaiful et al. (2020) stated that the bigger the heart girth, the bigger the organs in the chest cavity such as the heart and lungs, therefore heart girth can be used as an indicator of the calf body capacity.

Increase in Body Length (BL)

Giving calf starter substitution to lactation cow concentrate had no effect on the increase in body length for post-weaning female HF calves ($p>0.05$). The results of each treatment were 4.75±3.10 cm/month (P1), 4.38±1.80 cm/month (P2), 4.38±1.41 cm/month (P3) and 3.48±1.83 cm/month (P4). This result was higher than the average result of Anderson et al. (2015) in the treatment of concentrates from grains with different fat and protein content in Holstein calves, which was an average of 3.93 cm/month, but lower than the average results of Wang et al. (2017) on concentrate treatment with different physically effective neutral detergent fiber (peNDF) content in Holstein's calves, i.e. 6.15 cm/month. The results of these studies differ because they are caused by several factors, i.e. livestock age, genetics, feed quality, and maintenance management (Vavrisinova et al., 2019).

The size of the calf's body length did not differ, this was a result of the treatment with calf starter substitution on lactation cow concentrate, which could be due to genetic influences and almost the same age. This is in accordance with the research results of Senevirathne et al. (2016) that there was no difference between treatments for calf body dimensions, indicating that calves were in the same period so that the growth rate of their body skeletons did not differ. At the time the research was carried out, the calf was in the growth

acceleration phase so that the feed consumed by the calf would be used maximally for the growth of its body frame. Putra and Fajrina (2020) stated that the maximum growth rate occurs when the calf is 4-8 months old. This was reinforced by the opinion of Nugraha et al. (2016) who stated that livestock growth is influenced by the feed given, if the feed provided is of good quality and in sufficient quantity, then livestock growth will also be good.

Increase in Withers Height (WH)

Giving calf starter substitution to lactation cow concentrate did not have a different effect on the increase in withers height of post-weaning female HF calves ($p>0.05$). The treatment concentrate gave an increase in the size of the wither's height by 1.95 ± 1.08 cm/month (P1); 2.23 ± 1.58 cm/month (P2); 2.35 ± 2.16 cm/month (P3) and 2.18 ± 1.48 cm/month (P4). This result was lower than the results of the study by Manthey and Anderson (2018) by giving corn and soybean-based concentrates (with ad libitum forage) to Holstein's calves which resulted in an average increase in withers height of 3.03 cm/month. Differences in the results of this study can be influenced by factors such as the age of livestock, environmental climate, feed given, and maintenance management (Place & Mitloehner, 2010).

The results of the increase in wither height which did not differ from all treatments with calf starter substitution in lactation cow concentrate were also due to the age of the calf which was in the early stages of growth so that the nutrients from the feed consumed were used for bone growth, including the forefoot bones that greatly affect the value of withers height. This was in accordance with the opinion of Syaiful et al. (2020) which stated that at the age of 0-6 months the calf experiences faster growth in its forelegs because the forelegs are used to actively move when the calf is suckling on its mother, in addition, the forelegs are used to support the calf body weight. The increase in wither height is closely related to the growth of the calf's skeletal bones. This was in accordance with the opinion of Maluhima et al. (2019) who stated that withers height is influenced by several factors, including feeding management, genetics, the condition of the livestock itself, and having a close relationship with the size of the calf frame.

CONCLUSION

The substitution of calf starter on lactation cow concentrate did not have a different effect on the increase in body dimensions (heart girth, body length, withers height) of post-weaning female HF

calves. Lactation cow concentrate with PK 16.40% and TDN 64.91% followed by good quality forage in sufficient quantities was able to meet the nutritional needs of weaning calves seen from the performance of increasing body dimensions.

CONFLICT OF INTEREST

There is no conflict of interest with financial, personal, or other relationship with other people or organizations associated with material discussed in the manuscript.

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REFERENCES

- Alim, A.F. & T. Hidaka. 2002. Pakan dan Tatalaksana Sapi Perah. Dairy Technology Improvement Project in Indonesia. Bandung. [Indonesian].
- [ASAS] American Society of Animal Science. 2020. The Guide for the Care and Use of Agricultural Animals in Research and Teaching. 4th ed. American Society of Animal Science. Champaign, IL.
- Anderson, J.L., K.F. Kalscheur, A.D. Garcia, & D.J. Schingoethe. 2015. Feeding fat from distillers dried grains with solubles to dairy heifers: I. Effects on growth performance and total-tract digestibility of nutrients. *Journal of Dairy Science* 98(8): 5699 – 5708.
- Atabany, A., B.P. Purwanto, A. Yani, L. Cyrilla, I. Komala, S. Prabowo, W.A. Zahra, D. Permadi, T. Suprijatna, & Surajudin. 2020. *Budidaya Sapi Perah*. IPB Press. Bogor. [Indonesian].
- [BSN] Badan Standardisasi Nasional. 2017. SNI 3148.1:2017, Pakan Konsentrat-Bagian 1: Sapi Perah. Badan Standardisasi Nasional. Jakarta. [Indonesian].
- Hardiono, R., T. Saili & L.O. Nafiu. 2016. Respon pertumbuhan dan mortalitas pedet sapi bali dari induk yang diberi pakan tambahan dan obat cacing. *JITRO* 3(2): 39-47. [Indonesian].
- Imran, S.P.S. Budhi, N. Ngadiyono, & Dahlanuddin. 2012. Pertumbuhan pedet

- sapi bali lepas sapih yang diberi rumput lapangan dan disuplementasi daun turi (*Sesbania grandiflora*). Agrinimal Jurnal Ilmu Ternak dan Tanaman 2(2):55-60. [Indonesian].
- Kargar, S., M. Kanani, M. Albenzio, & M. Caroprese. 2019. Substituting corn silage with reconstituted forage or nonforage fiber sources in the starter diets of Holstein calves: effects on performance, ruminal fermentation, and blood metabolites. *Journal of Animal Science* 97(7):3046-3055.
- Kusumawati, E.D., S. Rahadi, J. Peso, & A.T.N. Krisnaningsih. 2018. Pengaruh umur lepas sapih dan umur induk terhadap produksi susu sapi perah Peranakan *Friesian Holstein* (PFH). *JITRO* 5(1):62-68. [Indonesian].
- Lardy, R., A. de Boyer des Roches, J. Capdeville, R. Bastien, L. Mounier, & I. Veissier. 2020. New recommendations for self-locking barriers to reduce skin injuries in dairy cows. *Animal* 14(8):745-1756.
- Maluhima, R.J., J.H. Manopo, A. Lomboan & S. H. Turangan. 2019. Rekondisi beberapa ukuran tubuh ternak sapi perah Friess Holland di Balai Pengembangan Bibit dan Pakan Ternak Tampusu. *Zootec* 39(1):165-170. [Indonesian].
- Manthey, A. K., J. L. Anderson & G. A. Perry. 2016. Feeding distillers dried grains in replacement of forage in limit-fed dairy heifer rations: Effects on growth performance, rumen fermentation, and total-tract digestibility of nutrients. *Journal of Dairy Science* 99(9):7206-7215.
- Manthey, A.K. & J.L. Anderson. 2018. Growth performance, rumen fermentation, nutrient utilization, and metabolic profile of dairy heifers limit-fed distillers dried grains with ad libitum forage. *Journal of Dairy Science* 101(1):365-375.
- McCurdy, D.E., K.R. Wilkins, R.L. Hiltz, S. Moreland, K. Klanderman & A.H. Laarman. 2019. Effects of supplemental butyrate and weaning on rumen fermentation in Holstein calves. *Journal of Dairy Science* 102(10):8874-8882.
- Mukodiningsih, S., S.S. Budhi, A. Agus & A. Astuti. 2012. Pemanfaatan susu bubuk kadaluwarsa dalam complete *calf starter* dan pengaruhnya terhadap konsentrasi VFA dan gula sapih. *Jurnal Sains dan Matematika* 20(4):109-113. [Indonesian].
- [NRC] National Research Council. 2001. *Nutrient Requirement of Dairy Cattle*. 7th Revised Edition. National Academy Press. Washington D.C.
- Nemati, M., H. Amanlou, M. Khorvash, M. Mirzaei, B. Moshiri, & M. H. Ghaffari. 2016. Effect of different alfalfa hay levels on growth performance, rumen fermentation, and structural growth of Holstein dairy calves. *Journal of Animal Science* 94(3):1141-1148.
- Nugraha, H.Y., I.P. Sampurna & I.K. Suatha. 2016. Pengaruh pemberian pakan tambahan pada induk sapi bali terhadap ukuran dimensi panjang pedet. *Buletin Veteriner Udayana* 8(2):159-165. [Indonesian].
- Parsons, S.D., M.A. Steele, K.E. Leslie, D.L. Renaud, & T.J. DeVries. 2020. Investigation of weaning strategy and solid feed location for dairy calves individually fed with an automated milk feeding system. *Journal of Dairy Science* 103(7):6533-6556.
- Place, S. E. & F. M. Mitloehner. 2010. Invited review: Contemporary environmental issues: A review of the dairy industry's role in climate change and air quality and the potential of mitigation through improved production efficiency. *Journal of Dairy Science* 93(8):3407-3416.
- Pramita, I.D.A.D.P., I.N.K. Besung & I.P. Sampurna. 2016. Jumlah non coliform dan total bakteri pada sapi bali di dataran tinggi dan dataran rendah di Bali pasca pemberian mineral. *Buletin Veteriner Udayana* 8(1):52-58. [Indonesian].
- Prihantoro, I., D. Evvyernie, Suryani, L. Abdullah1, N.S. Yunitasari, A.P. Sari, D. Khairunisa, A. Haziq, N. Rahayu, & T. Toharmat. 2012. Potensi bakteri pencernaan serat asal rumen kerbau yang diinokulasikan pada pedet Friesian Holstein selama periode prasapih. *J. Ilmu Ternak dan Veteriner* 17(4):297-309. [Indonesian].

- Purwadi. 2017. Pengaruh perbedaan kualitas konsentrat pada tampilan ukuran-ukuran tubuh dan konsumsi pakan pedet FH betina lepas sapih. *Tropical Animal Science* 1(1): 1-5. [Indonesian].
- Putra, W. P. B. & N. Z. Fajrina. 2020. Model kurva pertumbuhan berat badan pada sapi Turkish Holstein jantan. *Jurnal Peternakan Lingkungan Tropis* 3(1):23-30. [Indonesian].
- Ratnasari, D., A. Atabany, B. P. Purwanto & L. B. Salman. 2019. Model pertumbuhan sapi perah Friesian Holstein (FH) dari lahir sampai beranak pertama di BBPTU-HPT sapi perah Baturraden menggunakan model matematik logistic. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan* 7(1):18-21. [Indonesian].
- Rotondo, V., V.R. Osborne, M. Paibomesai, K. M. Wood, & S. Jantzi. 2021. PSX-A-21 Late-Breaking: Predicting live weight using linear body measurements in growing dairy calves. *Journal of Animal Science*. 99(Issue suppl 3):371-372.
- Senevirathne, N.D., J.L. Anderson, W.R. Gibbons, & J.A. Clapper. 2016. Growth performance of calves fed microbially enhanced soy protein in pelleted starters. *Journal of Dairy Science* 100(1):199-212.
- Sulistiyowati, E., E. Kuswadi, L. Sutarno, & G. Tampubolon. 2009. Penampilan reproduksi sapi perah FH (Friesian Holland) dan pertumbuhan pedetnya pada umur 1-3 bulan (studi kasus di Desa Air Duku dan Desa Air Putih Kali Bandung, Selupu Rejang, Rejang Lebong, Bengkulu). *Jurnal Sain Peternakan Indonesia* 4(1):21-26. [Indonesian].
- Syaiful, F.L., Khasrad, & S. Maulida. 2020. Identifikasi ukuran tubuh sapi bali dan simbal (simmental-bali) di Kecamatan Luhak Nan Duo Kabupaten Pasaman Barat. *Jurnal Sain Peternakan Indonesia* 15(2):219-226. [Indonesian].
- Turiello, P., E. Martinez, M. Auil, A. Bogni & O. Queiroz. 2016. Effects of a milk balancer protein supplement on growth and performance of dairy calves. *Journal of Animal Science* 94(Issue suppl 5): 370.
- Vavrišínová, K., K. Hozáková, O. Bučko, P. Haščík, & P. Juhás. 2019. The effect of the slaughter weight on carcass composition, body measurements and veal quality of holstein calves. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis* 67(5): 1235-1243.
- Wang, H.R., Q. Chen, L.M. Chen, R.F. Ge, M.Z. Wang, L.H. Yu, & J. Zhang. 2017. Effects of dietary physically effective neutral detergent fiber content on the feeding behavior, digestibility, and growth of 8-to 10-month-old Holstein replacement heifers. *Journal Dairy Science* 100(2): 1161-1169.
- Welboren, A.C., L.N. Leal, M.A. Steele, M.A. Khan, & J. Martín-Tereso. 2019. Performance of ad libitum fed dairy calves weaned using fixed and individual methods. *Animal* 13(9):1891-1898.
- Winarti, E. & A. Widyastuti. 2016. The effect of calf starter ration for pre-weaning ongole grade (PO) calves on body weight gain. *Journal of the Indonesian Tropical Animal Agriculture* 41(4):209-215.
- Xiao, J.X., G.M. Alugongo, R. Chung, S.Z. Dong, S.L. Li, I. Yoon, Z.H. Wu, & Z. J. Cao. 2016. Effects of *Saccharomyces cerevisiae* fermentation products on dairy calves: Ruminal fermentation, gastrointestinal morphology, and microbial community. *Journal of Dairy Science* 99(7):5401-5412.
- Yanuartono, A. Nururrozi, S. Indarjulianto, & H. Purnamaningsih. 2019. Peran protozoa pada pencernaan ruminansia dan dampak terhadap lingkungan. *Ternak Tropika* 20(1):16-28. [Indonesian].