Jurnal Peternakan Integratif
Journal homepage: https://talenta.usu.ac.id/jpi/workflow/index/16319/3

Feeding Concentrate and Market Waste on the Performance of Collared Crickets (*Gryllus bimaculatus*)

Samudera Ginting [1], Makruf Tafsin [*1], Achmad Sadeli[1], Endang Sulistyowati[2]
[1]*Animal Science Study Program, Agriculture Faculty, Universitas Sumatera Utara,Medan, 20155, Indonesia*
[2]*Animal Science Faculty, Universitas Bengkulu, Bengkulu 38225, Indonesia*
[*]Corresponding Author: maruf_tafsin@usu.ac.id

ARTICLE INFO

How to cite:
S Ginting, M Tafsin, A Sadeli1, E Sulistyowati, "Feeding Concentrate and Market Waste on the Performance of Collared Crickets (Gryllus bimaculatus)" Jurnal Peternakan Integratif, Vol. 12, No. 01,pp. 1-8 May. 2024, doi: 10.32734/jpi.v12i1.16319

ABSTRACT

In Indonesia, crickets (*Gryllus sp.*) are used as feed for pet animals, especially insectivorous animals, one of which is the kalung/collared cricket. Collared crickets have a short life cycle, high egg hatchability, fast growth, low feed conversion, and have softer body skin that is preferred by birds and other insectivorous animals. Feed is very important in intensive cricket rearing, especially in hatching crickets. The feed given to crickets is generally in the form of concentrates and leaves. This study aims to determine the effect of giving concentrates and market waste (kale, cabbage, cassava leaves) on the performance of collared crickets (*Gryllus bimaculatus*). This research was conducted at the Livestock Biology Laboratory, Department of Animal Science, Faculty of Agriculture, Universitas Sumatera Utara, from March to April 2020. This research was conducted experimentally using a completely randomised design (CRD) consisting of 4 treatments and 5 replications. The treatments consisted of P0 = 100% market waste, P1 = 75% market waste + 25% concentrate, P2 = 50% market waste + 50% concentrate, P3 = 25% market waste + 75% concentrate. The results of this study showed that the provision of concentrate and market waste (kale, cabbage, and cassava leaves) had no significant effect on the performance of collared crickets. The average mortality in this study was 6.4%, the feed consumption value was 8.74 g/head/day, the average body weight gain was 0.43 g/head/day, and the average feed conversion was 20.71 g/head. In conclusion as there is no difference between each treatment on cricket performance, the 100% market waste treatment can be used for collared cricket feed.

Keywords: Crickets, Conversion, Feed, Growth, Hatchability

1. Introduction

Crickets farming is widely practised considering that the time needed for egg production to be traded only takes 2-4 weeks, while for the production of crickets for fish and bird feed and for flour, it only takes 2 to 3 months. In her life cycle, a female cricket can produce more than 500 eggs. Collared crickets have a short life cycle of 75-78 days [1]. These crickets have high egg hatchability, fast growth and low feed conversion, and have softer body skin that is preferred by birds and other insectivorous birds.

Crickets are small to large insects or insects that are closely related to grasshoppers and cockroaches because they are classified into the Orthoptera order. Crickets are also nocturnal and cold-blooded. The classification of crickets is phylum Arthopoda, class Hexapoda (Insecta), order Orthoptera, sub order Ensifera, family Gryllidae (Crickets), sub family Gryllinae (Field/home crickets), genus Gryllus, species *Gryllus bimaculatus* (Collared Crickets), *Gryllus mitratus* (Cliring Crickets) and *Gryllus testaceus* (Cendawang Crickets) [2].

Crickets have black or slightly reddish skin and outer wings and on the back (base of the outer wings) there is a yellow line so that it resembles a necklace [3]. Adult male and female crickets can be distinguished by the presence or absence of an ovipositor at the end of the abdomen that characterises female crickets. Although in general the body sizes of male crickets are larger, female crickets have a higher body weight than males [4].

Feed is very important in intensive cricket rearing, especially in hatching crickets. Crickets can produce eggs and hatchability is high at 80-90% when given a highly nutritious diet. Each farmer has special ingredients given to the mother crickets, including corn bran, fishmeal, duck egg yolk [5]. Judging from the life of crickets in nature, the composition of vegetable feed is more than animal feed. For feed in cultivated crickets can be divided into two types, namely dry feed 70% while wet feed 30% only. The feed given to crickets is generally in the form of concentrates and leaves. Crickets that are given artificial feed can grow faster than crickets that are given vegetation alone. According to [6] crickets generally prefer leaves and plant parts that contain more water, because these animals do not consume water for drinking like most other animals. Kale leaves as a plant that grows a lot in Indonesia can be used as cricket feed because they contain a lot of water and increase the immune system of crickets. Crickets like young leaves that contain a lot of water as a substitute for drinking water such as kale leaves, spinach leaves, mustard leaves, cabbage and others. In this study, various levels of concentrates and market waste (kale, cabbage and cassava leaves) were given to determine the effect of giving concentrates and market waste (kale cabbage and cassava leaves) on the performance of necklace crickets (*Gryllus bimaculatus*).

Crickets are insects that undergo imperfect metamorphosis. The life cycle starts from the egg then becomes a young cricket (nymph) and passes several instar stages before becoming an adult cricket (imago) which is characterised by the formation of two pairs of wings[6]. Crickets can be found almost everywhere, especially in areas with a temperature range of 20-32 °C with 65-85% humidity with loose or sandy soil and lots of shrubs [7].

Adult crickets are ready to mate at the age of 45 days which is characterised by the disappearance of the wings. The male crickets will mate with a loud voice which is a signal that the cricket is ready to fertilise the female, while the female cricket who is ready to be fertilised and knows the signal will look for the source of the sound and approach it. During mating, the male cricket will take the bottom position and the female cricket the top. After fertilisation, seven days later the eggs in the abdomen of the female crickets are old and the crickets is ready to lay eggs [7]. The female will look for a moist and loose place to lay her eggs. In *Gryllus bimaculatus* species, the eggs will hatch on day 10-12 after being laid.

2. Materials and Methods

2.1. Place and Time

The study was conducted at the Livestock Biology Laboratory of the Department of Animal Husbandry, Faculty of Agriculture, Universitas Sumatera Utara, Jl. A. Sofyan No. 3 Campus, Medan. This study was conducted from March to April 2020.

2.2. Materials and Equipment

The materials used were 10-day-old collared crickets. Concentrates and market waste (kale, cabbage, cassava leaves) as forage. The tools used are 20 units of brood cages with a size of 30×25×30 cm2, each cage is equipped with one feed bin with a size of 10×6×2 cm2. Electric scales serve as a tool for weighing the live weight of crickets, thermometers to measure cage temperature.

2.3. Research Methods

This study used a completely randomised design (CRD) consisting of 4 treatments and 5 replicates. Where the treatment is market waste (kale, cabbage, cassava leaves) in a ratio of 1: 1: 1 and using commercial concentrate broiler starter given various levels. The treatments in this study are as follows:

P0 : 100% market waste

P1 : 75% market waste + 25% broiler commercial concentrate

P2 : 50% market waste + 50% broiler commercial concentrate

P3 : 25% market waste + 75% broiler commercial concentrate

Table 1. The arrangement of the research treatment

P0U1	P1U5	P1U1	P0U5	P2U1
P3U5	P0U4	P2U5	P3U4	P1U2
P2U3	P3U2	P3U1	P1U3	P0U2
P1U4	P2U2	P0U3	P2U4	P3U3

2.3. Research Parameters

2.3.1. Cricket Mortality

Total mortality is the percentage of crickets that died from the total crickets during the study by dividing the crickets that died during the study by the number of individuals at the beginning of the study multiplied by 100%.

$$\text{Mortality (\%)} = \frac{\text{number of died crickets during study}}{\text{number of cricket at the beginning of study}} \times 100\%$$

2.3.2. Dry matter consumption

Feed consumption per day is calculated based on dry matter, namely the amount of feed given minus the amount of feed remaining divided by the measurement time interval and multiplied by the percentage of dry matter.

$$\text{Feed consumption} = \frac{\text{amount feed given (g/head/day)}}{\text{timeinterval (day)}} \text{ \% DM}$$

2.3.3. Body Weight Gain

Body weight gain can be calculated by reducing the final body weight by the initial body weight then divided by the length of maintenance.

$$\text{Body Weight (g/head/day)} = \frac{\text{Final Body Weight (g) - Initial Body Weight (g)}}{\text{Length of maintenance (day)}} \times 100\%$$

2.3.4. Feed Conversion

Feed conversion is calculated based on the ratio between the ration consumed and body weight gain.

$$\text{Feed convertion} = \frac{\text{Feed consumption (g/head/day)}}{\text{Body weight gain (g)}}$$

2.4. Data Analysis

The research data were observed using analysis of variance, if there were differences between treatments then continued with the Duncan test.

3. Result and Discussion

3.1. Collared Cricket Mortality

The average mortality rate of brood stock during the study can be seen in Table 2.

Table 2. Average Mortality of Collared Cricket with Market Waste and Concentrate (%)

Treatments	Replications					Mean ± SD^{tn}
	1	2	3	4	5	
P0	4	2	4	6	4	4,0 ± 1,41
P1	4	4	10	2	8	5,6 ± 3,29
P2	4	6	10	6	6	6,4 ± 2,19

P3	2	6	4	8	6	5,2 ± 2,28

Note : tn indicates no significant effect (P>0,05)

Table 2 shows that the P2 treatment (50% market waste + 50% concentrate) produced the highest percentage of collared cricket brood mortality when compared to other treatments. The average mortality in P2 was 6.4%, while the lowest treatment was in the P0 treatment (100% market waste) which resulted in an average percentage of mortality of dragonfly broodstock of 4%.

The results of the analysis of variance in Table 2 show that the provision of market waste and concentrate had no significant effect on the mortality of brood stock. This is thought to be because the nutrients contained in the feed are sufficient for the survival needs of the parent crickets to breed. Collared cricket that have entered the adult phase, will enter the mating stage so that the aggressiveness of crickets becomes higher. According to [8] crickets behave very aggressively and tend to fight, resulting in a high mortality rate.

The most commonly encountered thing is the accumulation of crickets in a place that is considered hidden, resulting in the weak will be pressed and crushed by other crickets. This is supported by the statement of [9] which states that overcrowding can trigger cannibalism, thus slowing the growth and development of crickets. [10] also stated that mass rearing of crickets needs to pay attention to density because excessive density will increase competition for food and hiding places, create uncomfortable conditions, increase cannibalism and ultimately increase mortality.

The average mortality rate of necklace crickets in this study was 21.2%, which is lower than [11] study which resulted in an average mortality rate of 56%. This is thought to be due to the larger size of the drum, the maintained condition of the drum, and the necklace crickets that will be used are sorted first so that the size of each cricket is the same size to avoid cannibalism.

3.2. Feed Consumption

The average amount of feed consumed by collared crickets during the study can be seen in Table 3. The results of analysis of variance in Table 3 show that the provision of market waste with broiler commercial concentrate has no significant effect on feed consumption of collared crickets. This is because the concentration of the treatment given is not much different so that feed consumption in each treatment produces the same pattern, causing the results obtained to be insignificant. Table 3 can be seen that the P1 treatment (75% market waste + 25% broiler commercial concentrate) resulted in the highest cricket feed consumption when compared to other treatments. The average feed consumption in the P1 treatment was 8.74 g, while the lowest treatment was in the P0 treatment (100% concentrate) which resulted in an average feed consumption of 8.40%.

Table 3. Average Amount of Feed Consumed by Collared Crickets (g/head/day)

	Treatment	Replications					Mean ± SD^{tn}
		1	2	3	4	5	
Feed Consumption Age 10 Days	P0	5,55	5,08	5,18	4,45	3,90	4,83 ± 0,65
	P1	4,94	5,57	3,20	5,84	5,48	5,01 ± 1,06
	P2	5,17	5,00	4,80	5,80	4,17	4,99 ± 0,59
	P3	4,57	4,57	4,44	6,75	4,44	4,95 ± 1,01
	Treatment	Replications					Mean ± SD^{tn}
		1	2	3	4	5	
Feed Consumption Age 20 Days	P0	8,87	9,77	7,70	7,70	7,20	8,25 ± 1,05
	P1	8,72	9,84	9,20	8,20	9,80	9,15 ± 0,71
	P2	9,04	8,81	8,64	9,30	8,90	8,94 ± 0,25
	P3	8,84	9,72	9,20	9,20	7,60	8,91 ± 0,80
		Replications					

	Treatment	1	2	3	4	5	Mean ± SD[tn]
Feed Consumption Age 30 Days	P0	12,84	10,68	11,90	11,80	12,80	12,00 ± 0,89
	P1	12,74	12,70	13,40	10.90	11,80	12,31 ± 0,97
	P2	12,43	12,43	10,80	12,90	12,40	12,19 ± 0,81
	P3	12,22	12,60	11,90	10,80	12,50	12,00 ± 0,73

	Treatment	Replications					Mean ± SD[tn]
		1	2	3	4	5	
Total Feed Consumption	P0	8,55	8,98	8,01	8,42	8,05	8,40 ± 0,40
	P1	8,84	9,33	8,60	8,65	8,29	8,74 ± 0,38
	P2	8,91	8,51	8,63	8,60	8,92	8,71 ± 0,19
	P3	9,01	8,77	8,21	8,88	8,40	8,65 ± 0,31

Note: tn indicates no significant effect (P>0,05)

The high feed consumption in the P1 treatment (75% market waste + 25% concentrate) is closely related to the physical condition and texture of market waste which is soft and has more water content when compared to other treatments so that it will affect palatability.
According to [12] crickets generally prefer leaves and plant parts that contain more water, because these animals do not consume water for drinking like most other animals. Collared crickets rely on drinking water input from the food consumed, so this is what causes treatment P1 to produce higher feed consumption when compared to other treatments.

In addition, the nutritional needs of insects will change according to their age, growth phase, and reproductive state. The development of crickets that are increasingly mature, the crickets will consume more forage feed when compared to crickets in the clondo phase [12]. [13] explained that the higher the level of forage feed given, the higher the energy consumed. Energy is needed as a source of strength for life and production [14].

3.3. Body Weight Gain

The average total body weight gain of collared crickets during the study can be seen in Table 4.

Table 4.Average Total Body Weight Gain of Collared Crickets (g/head/day)

	Treatment	Replications					Mean ± SD[tn]
		1	2	3	4	5	
Body weight of 10-day-old crickets	P0	0,11	0,10	0,10	0,11	0,07	0,10 ± 0,02
	P1	0,09	0,09	0,90	0,10	0,14	0,26 ± 0,36
	P2	0,14	0,14	0,14	0,08	0,11	0,12 ± 0,03
	P3	0,13	0,11	0,13	0,07	0,07	0,10 ± 0,03

	Treatment	Replications					Mean ± SD[tn]
		1	2	3	4	5	
Body weight of 20-day-old crickets	P0	0,14	0,16	0,14	0,11	0,16	0,14 ± 0,02
	P1	0,32	0,35	0,35	0,14	0,18	0,27 ± 0,10
	P2	0,28	0,29	0,30	0,11	0,14	0,22 ± 0,09
	P3	0,18	0,18	0,18	0,16	0,35	0,21 ± 0,08

	Treatment	Replications					Mean ± SD[tn]
		1	2	3	4	5	
Body weight of 30-day-old crickets	P0	1,00	1,00	1,00	0,37	1,10	0,89 ± 0,30
	P1	1,30	1,30	1,10	0,37	1,30	1,07 ± 0,40
	P2	1,10	1,10	1,30	0,34	1,00	0,97 ± 0,37
	P3	0,90	0,90	1,00	1,08	0,90	0,96 ± 0,08
	Treatment	Replications					Mean ± SD[tn]
		1	2	3	4	5	
Total Body Weight of Crickets	P0	0,50	0,50	0,58	0,17	0,40	0,42 ± 0,03
	P1	1,23	0,42	0,68	0,19	0,47	0,60 ± 1,39
	P2	0,59	0,60	0,53	0,19	0,53	0,49 ± 0,17
	P3	0,40	0,39	0,43	0,45	0,44	0,43 ± 0,16

Note: tn indicates no significant effect

Table 4 can be seen that the P1 treatment (75% market waste + 25% concentrate) produced the highest weight gain of crickets, which was 0.43 g/head, while the lowest weight gain of crickets was in the P0 treatment (100% concentrate) which produced an average weight gain of 0.42 g/head.

The results of the analysis of variance in Table 4 show that the provision of market waste and concentrates has no significant effect on cricket body weight gain. This is due to the amount of feed consumed is not different in each phase. One of the growth and weight gain of crickets is influenced by the amount of feed consumed, where if feed consumption increases, then body weight gain increases as well. In addition, energy also affects cricket body weight gain.

Crickets need energy for the continuity of various processes in their body and provide materials to build and repair damaged or used body tissues and regulate body environmental conditions. Young crickets need food for growth while adult crickets perform eating activities to obtain energy in order to carry out the mating process and then breed [15]. Food can affect reproduction, growth, development, behaviour, and other morphological traits, such as size and colour in crickets.

3.4. Feed Conversion

Feed quality can be assessed from the efficiency of feed use by calculating feed conversion. The average feed conversion of necklace crickets during the study can be seen in Table 5.

Table 5. Average Feed Conversion of Collared Crickets (g/head)

Treatments	Replications					Mean ± SD[tn]
	1	2	3	4	5	
P0	17,10	17,96	13,81	49,53	20,13	23,70 ± 14,61
P1	22,53	22,49	19,73	19,73	19,09	20,71 ± 1,66
P2	7,24	20,26	12,69	45,26	18,98	20,89 ± 14,59
P3	14,98	15,55	16,23	45,53	15,64	21,59 ± 13,39

Note: tn indicates no significant effect (P>0,05)

In Table 5, it can be seen that the P1 treatment (75% market waste + 25% concentrate) produced the lowest feed conversion when compared to the other treatments. Feed conversion in the P1 treatment showed a value of 20.71 g/head, while the highest feed conversion value was found in the P0 treatment (100% concentrate) with a value of 23.70 g. Low feed conversion value indicates that the addition of a certain amount of feed can result in the addition of animal body weight to a greater proportion.

Some of the main factors that can affect feed conversion are genetic quality, disease, temperature, cage sanitation, ventilation, and cage management. Feeding factors are also very instrumental in influencing ration conversion. According to [16] if the higher the feed conversion value, the more feed is needed to increase body weight and this will certainly be a waste. Feed conversion is one of the important parameters as an economic review of feed costs. The lower the feed conversion value, the more profitable it will be. This is also supported by Nastiti [17] which states that the feed conversion value is related to production costs, especially feed costs, because the higher the feed conversion, the higher the feed costs because the amount of feed consumed to produce body weight in a certain period of time.

4. Conclusion

4.1. Conclusion

The results showed that the provision of market waste and broiler commercial concentrate did not have a significant effect on mortality, feed consumption, body weight gain, and feed conversion in collared crickets.

4.2. Suggestion

The high consumption by the crickets was influenced by the high palatability of market waste, while concentrates had no effect. The growth rate of collared crickets is also influenced by environmental factors, where collared crickets prefer an environment with little lighting, away from noise, and the density of crickets in one cage so further research needs to be done on environmental conditions of collared crickets.

References

[1] Widiyaningrum, P. (2000). Pengaruh Padat Penebangan dan Jenis Pakan terhadap Produktivitas Tiga Spesies Jangkrik Lokal yang Dibudidayakan.

[2] Yusdira, A., Hidayatullah, S., & Krotobond, T. (2016). *Budi Daya Jangkrik*. AgroMedia.

[3] Hasanah, U. (2015). *Pengaruh pemberian aneka pakan hijauan yang berbeda terhadap daya tahan hidup jangkrik kalung (gryllus bimaculatus)* (Doctoral dissertation, IAIN Palangka Raya).

[4] Wiarto, G. (2010). http://budidaya Jangkrik. Tanggal diakses 06/02/2015. Widyaningrum, P. 2001. *Pengaruh Padat Penebaran dan Jenis Pakanterhadap Produktivitas Tiga Spesies Jangkrik Ideal yang Dibudidayakan*. Disertasi.Program Pasca Sarjana. Institut Pertanian Bogor, Bogor.

[5] Prabawati, R. (2020). Pertumbuhan Jangkrik Hitam (*Gryllus mitratus* L.) Dengan Pemberian Pakan Daun Sawi *(Brassica chinensis* L.). *Biolearning Journal*. 7(1) : 20-24.

[6] Borror, D.J., C.A. Triplehorn, dan N.F. Johnson. (1992). *Pengenalan Pelajaran Serangga*. Edisi XI. Penerjemah: Soetiyono, P. Gadjah Mada University Press, Yogyakarta.

[7] Armansyah, V., & Handayani, M. T. (2020). Pemanfaatan Potensi di Desa Cibanteng untuk Integrasi Pertanian-Peternakan “Budidaya Jangkrik”. *Jurnal Pusat Inovasi Masyarakat (PIM)*, *2*(1), 108-116.

[8] Aryani, R. (2002). Pengaruh tipe kandang bersekat terhadap pertumbuhan jangkrik kalung (Gryllus bimaculatus) [skripsi]. Fakultas Peternakan. Bogor (ID) : Institut Pertanian Bogor.

[9] Permana, A.D., Yahya, I.F., Agustiningrum, S., Choiria, R.D., Nasrullah, A.J. 2020. Dampak Kepadatan (Density) Kandang Terhadap TingkatDeplesi pada Ayam Broiler Parent Stock Fase Grower. *J of Animal Research Applied Sciences*. 2(1) : 7-12.

[10] Gunawan, H. (2019). *Mendulang Untung dari Budi Daya Jangkrik*. Laksana.

[11] Hutabarat, A.L.R. (2008). Evaluasi Pertumbuhan Jangkrik Kalung (*Gryllus bimaculatus*) yang Diberi Pakan Dengan Campuran Dedak Halus. [skripsi].Bogor (ID) : Institut Pertanian Bogor.

[12] Resh VH, Carde RT. (2006). *Encyclopedia of Insects*. New York (US): Academic Pr.

[13] Samsiyah, S., Rachmawan, A. F., Ardiansyah, T., Sari, A. P., Mas’ulah, L., Kiroma, K., & Nufus, A. H. (2023). STRATEGI KEBERHASILAN BUDI DAYA JANGKRIK (Studi Kasus Pelaku Peternak Jangkrik di Desa Ploso, Kecamatan Krembung, Kabupaten Sidoarjo). *BUDIMAS: JURNAL PENGABDIAN MASYARAKAT*, *5*(2).

[14] Budhiarta, D.H., Sudjarwo, E., Cholis, N. (2014). Pengaruh Kepadatan Kandang Terhadap Konsumsi Pakan, Pertambahan Bobot Badan Dan Konversi PakanPada Ayam Pedaging. *J. Ternak Tropika*. 15(2) : 31-35.

[15] Intania, A. (2006). Subtitusi Tepung Kunyit (*Curcuma domestica*) dalam Pakan Jangkrik Kalung (*Gryllus bimaculatus*) pada Periode Bertelur. Bogor :Institut Pertanian Bogor.

[16] Villas-Bôas, S. G., Esposito, E., & Mitchell, D. A. (2002). Microbial conversion of lignocellulosic residues for production of animal feeds. *Animal Feed Science and Technology*, *98*(1-2), 1-12.

[17] Oonincx, D. G., Van Broekhoven, S., Van Huis, A., & Van Loon, J. J. (2015). Feed conversion, survival and development, and composition of four insect species on diets composed of food by-products. *PloS one*, *10*(12), e0144601.