Feed Formula To Improve The Performance Of Lovebird (Agapornis spp.)

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Abstract

Lovebird *(Agapornis spp.*) farming in Indonesia has grown tremendously. The main problem faced by farmers is the death of chicks cared for by their parents in the nest. An attempt to overcome this high mortality is to wean early from the parents, which poses a new challenge to provide quality feed to care for the chicks. The objective of this study was to obtain a good quality feed formula for chicks, improving performance and survival of lovebirds. This research was conducted in two stages. The first stage was to conduct laboratory testing of the content of the feed formula, while the second stage was the application of the feed formula to lovebird chicks through hand feeding. In this investigation, 64 lovebird chicks with an average body weight of 24 g ±0.58 g and an age of two weeks were used. The research used completely randomized design with 4 treatments and 4 replications. Each replication used 4 lovebird chicks. P1: giving Nutribird A21; P2: giving Nutribird A21 75% + 25% of treatment feed composition; P3: giving Nutribird A21 50% + 50% of treatment feed composition and P4: giving Nutribird A21 25% + 75% of treatment feed composition. The dependent variables observed were: feed consumption, total consumption, weight gain, feed conversion ratio, digested nutrient, body weight after 4 weeks of treatment, percentage of survival and mortality of lovebird chick. The results showed that The results showed that the use of Nutribird A21 feed ingredients plus white millet, yellow cracked corn, CP 511 Bravo, mung beans, soya beans, Masamix Bro, Mineral B12 and coconut oil according to the composition of the prepared feed formula can be used for lovebirds aged 2-6 weeks. All of these feed formulas have the same good nutritional quality, excellent nutrient digestibility and no adverse effects on lovebird chicks. The performance of 2-6 week old lovebirds in all treatments was found to be equally good. Feeding 2-6 week old lovebirds with the hand feeding method every 8 hours per day has fulfilled the nutritional needs of lovebirds to grow well and produce 100% survival. It can be concluded that the various feed formulas given can be used as the main formula for lovebird chicks. We have also found that hand feeding every 8 hours in 2 to 6 week lovebird chicks resulted in a 100% survival rate.

Keywords: feed formula, lovebird chick, performance, nutrients digestibility, survival

1. Introduction

Lovebirds *(Agapornis spp.*) are a type of bird that is widely recognised by people around the world. In Indonesia itself, lovebird fans are increasing (Sumarno & Prasetiyo, 2019). Lovebirds can be kept for hobbies, entertainment, chirping competitions, beauty contests, recreation, breeding, education, and conservation. As the demand for lovebird farming grows, more and more lovebird farming businesses are starting to emerge. However, in lovebird farming, the high mortality of chicks is a major obstacle. Several factors have been recognized as the cause, including when the number of cubs is large, the mother being unable to provide adequate nutrition for her cubs, the mother's character not being able to care for her cubs and the stress experienced by the mother, including the emergence of lust too soon so that she no longer wants to care for her cubs. Management improvements must be made to overcome these problems (Egwumah & Iboyi, 2017). One of the efforts to overcome the problems mentioned above is to wean early, so that breeders can meet the nutritional needs of lovebird chicks. However, until now there has been no recommended standard for lovebird nutritional needs. Where, feeding must be in accordance with the nutritional needs or standard needs of lovebirds, so it is necessary to find a feed formula that can improve their performance (Panggayu & Widodo, 2021).

Feeding must be in accordance with the nutritional needs or standard needs of lovebirds (Hess & Axelson, 2023), so it is necessary to find a feed formula that can improve their performance including reducing the mortality rate of their chicks. Common types of feed for lovebirds include grains such as millet, canary seeds, brown rice, young corn, and others. Additional feed can include vegetables and fruits. The feed given to lovebirds should contain protein, carbohydrates, fat, water, vitamins, and minerals (Panggayu & Widodo, 2021).

Energy and protein are among the nutrients required by animals, especially for growth and production purposes (Mousa, Naqash, & Lim, 2019). Proteins are essential for supplying the body with vital amino acids, nitrogen, and energy across all age ranges. Particularly, proteins are crucial during periods of rapid growth such as pregnancy, lactation, childhood, and overall tissue development (Geirsdóttir & Pajari, 2023). Protein requirements can be adjusted according to the animal's ability to consume protein and consider the balance of feedstuffs as this will affect the speed of growth (Henchion, Hayes, Mullen, Fenelon, & Tiwari, 2017).

Unlike other songbirds such as canaries, information on the formulation and composition of lovebird feed is minimal. There is only one commercial feed available for lovebirds, NutriBird-A21, which is produced in Belgium and has very little availability in Indonesia. The nutritional content of NutriBird-A21 can be used as a reference in preparing rations for lovebirds. Thus, we conducted research on several formulations made from local products as alternative feed for lovebirds.

2. MATERIAL AND METHOD

Ethical statement

This research has received approval from the experimental animal ethics commission of the Faculty of Veterinary Medicine, Udayana University with letter number B/140/UN 14.2.9/PT.01.04/2023.

Lovebird sample

A total of 64 chicks with homogeneous body weight, and aged 2 weeks. Lovebird chicks were obtained from lovebird breeders in Bali Province. We selected chicks that are uniform in size and weigh between 22-26 grams. We used 16 cages with a length of 47 cm, width of 30 cm, and height of 28 cm to keep 4 chicks each. The cages are equipped with heaters, temperature and humidity controls, and sawdust as cage litter. Lovebird chicks were studied from 2 weeks old to 6 weeks old.

Research design

The research used a completely randomized design (CRD) with 4 treatment and 4 replications. The four treatment are P1 (Control): giving Nutribird-A21; P2: giving Nutribird-A21 75% + treatment feed ingredients 1; P3: giving Nutribird-A21 50% + treatment feed ingredients 2 and P4: giving Nutribird-A21 25% + treatment feed ingredients 3. Each treatment used 4 lovebird chicks as a replication. The composition of the feed formula as treatment in this study is presented in Table 1. While the nutritional content of each formula is presented in Table 2.

Table 1. Composition of lovebird feed formula

Ingredients Composition	**Treatment (%)**			
	P1	**P2**	**P3**	**P4**
NutriBird-A21	100	75	50	25
White millet	-	13.6	16.1	38.8
Soybean meal	-	5.7	13.5	16.3
Mung beans	-	1.1	5.3	11
Cracked corn	-	1.1	5.3	1
CP 511 Bravo	-	1.1	5.3	1
Masamix Bro	-	0.2	0.2	0.2
Mineral B-12	-	0.2	0.3	0.7
Coconut oil	-	2	4	6
Total volume	100	100	100	100

Description: P1 (Control): giving Nutribird-A21; P2: giving Nutribird-A21 75% + treatment feed ingredients 1; P3: giving Nutribird-A21 50% + treatment feed ingredients 2 and P4: giving Nutribird-A21 25% + treatment feed ingredients 3. Composition of feed ingredients in the form of fine powder texture.

Table 2. Nutritional content of lovebird feed formula

Nutrient Content	**Treatment**			
	P1	**P2**	**P3**	**P4**
ME (Kcal/kg)	3763	4078	4029	3837
Crude Protein (%)	20.90	20.69	20.94	20.80
Fat (%)	8.04	7.96	10.70	11,36
Crude Fiber (%)	2.33	3.58	3.89	5,18
Calcium (%)	0.96	1.20	1.23	1,16
Phosphor (%)	0.59	0.57	0.55	0,55

Description: P1 (Control): giving Nutribird-A21; P2: giving Nutribird-A21 75% + treatment feed ingredients 1; P3: giving Nutribird-A21 50% + treatment feed ingredients 2 and P4: giving Nutribird-A21 25% + treatment feed ingredients 3. Analyses were conducted at the Laboratory of Nutrition and Forage Science, Faculty of Animal Husbandry, Udayana University in 2023.

Treatment with different feed formulations

Feeding lovebirds using the hand feeding method with a spuite that has been modified at the sharp end using a safety rubber. The feed is mixed with water until it forms a porridge. The frequency of feed is 3 times a day every 8 hours and drinking water is given at the same time as feeding. The dosage of feed and warm water is 1:3, for example, to make 10 g of feed, 30 ml of water needs to be added. Drinking water is given in the amount of 3 times the volume of feed.

Variable and data collection

The independent variable of this research was the feed formula. While, the dependent variables observed were: daily feed consumption, daily water consumption, weight gain, feed conversion ratio, digested nutrient, body weight after 4 weeks of treatment, percentage of survival and mortality of lovebird chick.

Feed consumption

Weighing the feed before mixing the water. The weight of feed during treatment was summed up.

Water consumption

The volume of drinking water through hand feeding was measured. Total drinking water consumed is the amount of drinking water during the study.

Weight gain and final body weight

On the first day of the study, the body weight of all samples was weighed before feeding. Weight gain was calculated based on the amount of weight gain until the end of the study time. While, final body weight is measured at the end of study period.

Feed conversion ratio

Feed conversion ratio (FCR) is the ratio between the amount of feed consumed during the 4-week study period and the weight gain at the end of the study.

Digested nutrient

Dry matter, organic matter and protein digestibility were calculated based on feed consumption data and faecal content of these materials.

Digestibility of dry matter and organic matter

These data was calculated based on the total collection method (Tillman, Hartadi, Reksohadiprodjo, Prawirokusumo, & Labdosoekojo, 1998). The total collection method was conducted in metabolic cages with fecal trays underneath. This was done in the fifth week and feces were collected for 7 days. The feces (excreta) were sun-dried until air-dried and then heated in an oven at 70-80 °C for 24 hours. The excreta were finely ground for the purpose of proximate analysis. For the determination of dry matter, 4 g samples of excreta were taken and then heated in an oven at 105°C for 9 hours to a constant weight. Dry matter of excreta is the component of excreta that does not contain water. The energy content of the excreta was determined by burning it with an adiabatic bomb calorimeter, while the protein content was measured by the Kjeldhal method (AOAC, 1984). Dry matter digestibility (DMD) and organic matter digestibility (OMD) calculated by the formula below:

$$\text{DMD} = \frac{(\text{A} - \text{B})}{\text{A}} x100\%$$

DMD: Dry matter digestibility
A: Feed dry matter consumption (g)
B: Total dry matter in excreta (g)

$$\text{OMD} = \frac{(\text{A} - \text{B})}{\text{A}} x100\%$$

OMD: Organic matter digestibility
A: Feed organic matter consumption (g)
B: Total organic matter in excreta (g)

Protein digestibility

Protein digestibility (PD) was calculated based on the total collection method by Prasad & Singh (1996). Feces were collected for 7 days, sun dried to air dry and then oven dried at 60 °C for 24 hours. faces (excreta) were analyzed proximate to determine the protein content of feces. Feed consumption for 7 days was oven dried at 70 °C for 24 hours to obtain dry weight. The air-dried excreta and rations were finely ground and then proximate analyzed to determine the protein content using the Kjeldahl method (AOAC, 1984). Protein digestibility was obtained by calculating the difference between protein consumption and excreta protein corrected by protein consumption. Protein digestibility was calculated using the formula:

$$\text{PD} = \frac{(\text{A} - \text{B})}{\text{A}} x100\%$$

PD: Protein digestibility
A: Protein consumption (g/day)
B: Protein content of feces (g/day)

Survival rate of lovebird

During the study, the incidence of morbidity and the number of deaths in the sampled lovebird chicks were recorded. The percentage of lovebirds that survived until the end of the study was calculated.

Study location and period

Field research was conducted at a private lovebird aviary located at Pasraman Unud Blok C no 13 Bukit Jimbaran, Badung Regency, Bali. The research was conducted from 16 August 2023 to 13 September 2023. Laboratory research to obtain nutrient digestibility was carried out at the Laboratory of Nutrition and Forage Science, Faculty of Animal Husbandry, Udayana University from 15 September to 15 October 2023.

Statistical analysis.

Data from the study were tabulated, grouped based on each treatment, descriptive and comparative analyses were conducted. Comparative tests were carried out with variance analysis, to determine the differences among treatments, significance of difference calculated at P=0.05. Tests were carried out on the SPSS for Windows programme (Ostertagová & Ostertag, 2013)

3. RESULTS AND DISCUSSION

Lovebird Performance

The main nutritional requirements of birds are protein, carbohydrates, fat, minerals, vitamins and water. Energy and protein are nutrients that are needed by animals, especially for growth and production purposes. The role of energy and protein balance is very important in the animal body, not only as a determinant of production quality, but also for basic living needs and activities (Endrinikapoulos et al., 2023). Protein requirements are adjusted to the ability of animals to consume protein and consider the balance of other feed substances that also affect growth (Wu, 2014). According to Handiono et al. (2015) feed consumption in birds must be calculated based on the standard nutrients needed.

Table 3. Lovebird performance at ages two to six weeks, nutritional absorption, and lovebird survival rate in feed formula

Performance Variable	Treatments				SEM
	P1 (control)	P2	P3	P4	
Initial body weight (g)	24.02[a]	24.07[a]	23.58[a]	24.27[a]	0.23
Total feed consumption (g/bird)	179.60[a]	176.10[a]	171.46[a]	169.21[a]	3.22
Daily feed consumption (g/bird/day)	6.41[a]	6.29[a]	6.12[a]	6.04[a]	0.16
Total water consumption (ml/bird)	538.81[a]	528.30[a]	514.37[a]	507.63[a]	9.65
Daily water consumption (ml/bird/day)	19.24[a]	18.87[a]	18.37[a]	18.13[a]	0.34
Weight gains (g)	25.41[a]	24.57[a]	26.61[a]	25.37[a]	1.54
Final body weight (g)	46.43[a]	48.63[a]	50.19[a]	49.64[a]	1.49
Feed conversion ratio	7.07[a]	7.27[a]	6.58[a]	6.69[a]	0.38
Nutrients digestibility					
rude protein digestibility (%)	87.00[a]	86.73[a]	88.20[a]	87.10[a]	1.05
ry matter digestibility (%)	73.84[a]	75.38[a]	74.82[a]	74.43[a]	1.48
rganic matter digestibility (%)	78.89[a]	77.45[a]	77.88[a]	77.17[a]	1.26
Survival rate (%)	100	100	100	100	0

Note: P1 (Control): giving Nutribird-A21; P2: giving Nutribird-A21 75% + treatment feed ingredients 1; P3: giving Nutribird-A21 50% + treatment feed ingredients 2 and P4: giving Nutribird-A21 25% + treatment feed ingredients 3; SEM: Standard Error of Treatment Means; Mean values with the same superscript indicate not significantly different (P>0.05).

Lovebirds are grain-eating birds, but not many have examined their nutrient needs. The only commercial feed available for lovebirds is Nutribird-A21. According to the laboratory test Nutribird A21 contains a maximum water content of 14%, crude protein 21%, crude fat 8%, crude fibre 3%, ash 6%, calcium 0.9%, phosphorus 0.6% and this feed contains sodium 0 2%, lysine 1.15%, methionine 0.53%, magnesium 0.17%, threonine 0.80%, tryptophan 0.80%, vitamin A 12. 000 IU/kg, vitamin D3 1,500 IU/kg, vitamin E 80 mg/kg, vitamin K 3 mg/kg, vitamin B1, vitamin B12, magnesium, and zinc.

In the preparation of the lovebird feed in this study, the nutritional content of Nutribird-A21 was used as a reference. We tried to find available feed raw materials to compile according to the required nutritional standards (Table 2).

From the results presented in Table 3, we found no significant differences in the performance of lovebird chicks fed with different formulas (P1-P4). This is because the nutrients contained in all feed formulas are equivalent. Thus, lovebird breeders will have many choices in preparing feed formulas, by adjusting the availability of raw materials in their place. In this study, we managed to raise lovebirds with a 100% survival rate. This happens because the nutritional needs of both the volume and quality of the lovebird feed are fulfilled. Moreover, through the hand-feeding method, we believe that all obstacles that can be experienced in natural situations can be overcome.

Through hand feeding, breeders can measure and ensure the volume of drinking water given. According to the needs of the animal's body, the provision of drinking water is 3 times the feeding of lovebirds. It is also known that poultry consume drinking water two to three times more than their ration consumption. Water consumption in livestock is important to help the process of dissolving feed in the intestines and to transport nutrients and metabolic waste that are toxic to the livestock's body and play a role in the respiratory process, regulation of body temperature and the course of the nervous system (Kutay, 2024).

Feed conversion ratio is a benchmark of livestock maintenance to determine the level of efficiency of ration use. FCR in treatments P1, P2, P3 and P4 were 7.07; 7.27; 6.58 and 6.69, respectively. The lowest level of feed efficiency was obtained in P3 treatment which was 6.58, while the highest FCR was P2 treatment which was 7.27 but statistically not significantly different. The FCR results in all treatments are the same because the ration formula is relatively the same, only the crude fiber in the P4 treatment is slightly higher but still tolerable and still within the limits of poultry livestock needs. This data is also supported by the growth rate of lovebird body weight which is almost the same. We found that the studied lovebirds had a high FCR value of 6.58-7.27. This means that to gain 1 g of body weight, lovebirds consume 6.58 g to 7.27 g of feed. This is because lovebirds are small birds and their growth is not fast and body weight is not heavy, so their feed conversion ability is less efficient than other breeds such as quail and broiler chickens.

Nutrient Digestibility

Statistically, the nutrient digestibility rates of the four feed formulations were similar. The formulated feed has a relatively low fiber content, which slows down the rate of feed digestibility, causing digestive enzymes to work longer, resulting in increased nutrient degradation and increased protein digestibility. Conversely, increasing fiber intake decreases fat and protein digestibility (Zhang et al., 2023).

Based on the protein digestibility value, feed quality can be classified into 3 categories: low digestibility value of 50-60%; medium digestibility value of 60-70%; and high digestibility value above 70% (Joye, 2019). The results of this study showed a crude protein digestibility value of 86.73-88.20%, which is included in the high protein digestibility category. Some of the benefits of a high digestibility feed formula include; Improved digestive efficiency: Easily digestible feed helps farm animals to produce more energy from the feed they consume. This can reduce energy loss through feces and make nutrients more available for growth or production (Chuang et al., 2021). Better growth and production: With more nutrients available

from easily digestible feed, farm animals tend to grow faster or produce more products such as meat or eggs in the case of poultry (Pesti & Choct, 2023). Better health: Feeds with high digestibility rates tend to reduce digestive stress in farm animals, which can reduce the risk of digestive disorders such as diarrhea or other digestive problems (Salem et al., 2023). More efficient feed management: By optimizing feed digestibility, farmers can better plan and manage feed, reducing wastage and costs associated with inefficient feed processing (Pomar, Andretta, & Remus, 2021). Reduction in environmental pollution: Easily digestible feed tends to produce less feces and is more consistent in its nutritional composition. This can help reduce the negative impact of environmental pollution from livestock waste (Varijakshapanicker et al., 2019). By paying attention to feed digestibility, farmers can improve farm animal welfare, production efficiency and the overall sustainability of their operations.

The dry matter digestibility of the prepared feed formula ranged from 74.43-75.38%, this data was slightly higher than the control which was 73.84. Dry matter digestibility reflects the amount of carbohydrates contained in feedstuffs (Azaza, Saidi, Dhraief, & El-Feki, 2020), with plant dry matter content ranging from 50-80% (Karydogianni et al., 2022). Dry matter digestibility also refers to the proportion of the nutrients in a food or feed that can be digested and absorbed by an animal's digestive system. It is a crucial measure in animal nutrition because it indicates how efficiently the animal can extract nutrients from the food it consumes (Karasov & Douglas, 2013).

We noted that the organic matter digestibility of the feed formula ranged from 77.17-77.88 which was almost the same as the control at 78.89. Feed organic matter digestibility refers to the ability of organisms, such as animals or microbes in their digestive system, to digest or achieve nutrient absorption from the organic matter present in the feed. This is important because the level of digestibility affects how efficiently the nutrients in the feed can be utilized by the animals for their growth, production and health (Ravindran & Abdollahi, 2021). In practical terms, the digestibility of feed organic matter can be measured by looking at how much of the organic matter in the feed is digested and absorbed by the animal's body, compared to the amount consumed. Feed quality greatly affects this digestibility, as better feed can be digested more efficiently and provide better nutrition to the animal (Owens, Sapienza, & Hassen, 2010). By understanding and improving the digestibility of feed organic matter, farmers and scientists can optimize feed formulations to maximize farm animal health and productivity, as well as reduce undigested nutrient waste excreted by animals (Pomar et al., 2021).

4. CONCLUSION

It can be concluded that the preparation of feed rations for lovebird chicks must meet the criteria for their nutritional needs. The use of Nutribird A21 feed ingredients plus white millet, yellow cracked corn, CP 511 Bravo, mung beans, soya beans, Masamix Bro, Mineral B12 and coconut oil according to the composition of the feed formula in the table above can be used for lovebirds aged 2-6 weeks. All of these feed formulas have the same good chemical (nutrient) quality, excellent nutrient digestibility and do not have adverse (negative) effects on lovebirds. The performance of 2-6 week old lovebirds in all treatments was found to be equally good.

Feeding 2-6 week old lovebirds with the hand feeding method every 8 hours per day has fulfilled the nutritional needs of lovebirds to grow well and produce 100% survival. Providing drinking water 3 times the volume of feed results in optimal growth. Additionally, the care given to lovebird chicks, which involves hand feeding and drinking every eight hours has proven to meet their nutritional demands with good performance and resulted a survival rate of 100%.

Suggestion

Lovebird breeders can choose one of the feed formulas that are adjusted to the availability of raw materials in their place.

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Conflict of Interest

All authors declare no conflict of interest in this research

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