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# Growth Performance of Indigenous Village Chickens Fed Palm Pith (*Corypha gebanga*) as a Substitute for Maize

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**Abstract:** Palm pith, which is available at all seasons, is used in a practical manner by farmers on Timor Island as an additional feed source for chicken during critically dry seasons. This study investigated the utilization of palm pith as a substitute for maize for the feeding of village chickens. Sixty-four birds, consisting of 48 females and 16 males, were divided into four groups fed different feeding treatments, each with four replicates and their growth performance, egg production, weight and size were measured. The four treatments were the following: T1 (30% maize, 20% fish meal, 50% palm pith meal); T2 (0% maize, 20% fish meal, 60% palm pith meal); T3 (10% maize, 20% fish meal, 70% palm pith meal) and T4 (20% fish meal, 80% palm pith meal). The data were analyzed through a multivariate analysis. Significant differences in live weight were observed in weeks 6, 7 and 8: the birds receiving 80% palm pith meal in their diet (T4) had higher average live weights than those receiving 60 and 70% palm pith meal. The results revealed that the effect of the interaction between time (week) and treatment on live weight was highly significant ($p<0.01$). The birds fed T4 had significantly higher weight than those receiving T2. Greater differences were found when the birds spent a longer time feeding. The growth performance of the birds fed T4 suggested that the protein level in the diet was likely closer to the determined level than the predicted level. The balance of amino acids may have been closer to an optimal level in the fish meal-*Corypha gebanga* mix (T4) than in the diets containing all three ingredients. The average egg production per month increased over the four months, with 8.8, 15.1, 36.6 and 40.6 eggs produced in months 1 to 4, respectively. The egg weight and length were 30.5 g and 775 cm, respectively. The profits from selling the village chickens contributed to quick-cash incomes for small farming families. A major constraint identified in chicken rearing is the inability of native chickens to respond to improved management practices due to their limited genetic potential. The feeding practices were inefficient in the use of existing feed resources, resulting in an inadequate amount and a low quality of the feed available for chickens and long durations between hen clutch cycles, thereby yielding a low annual egg production per hen.

**Key words:** Growth performance, village chicken, *Corypha gebanga*

## INTRODUCTION

Possible improvements to the existing village farming systems need to take into account their practicality, physical and economic feasibility, social acceptance, gender roles and likely effects on the systems (Conway, 1983; Sumarti and Fuah, 2015). There has been a growing awareness of the need for farm trials involving livestock (Sabrani and Knipscheer, 1982), although these are considered more difficult than trials on crop farms (Bernsten *et al*., 1983). Trials completed at research stations can be conducted when a high degree of experimental control is considered more important than farmer involvement in trials performed under realistic village conditions. Experiments using specific breeds, various types of feeds, different levels of feeding treatments and specific problems defined at the farmer level are examples of topics that may be best studied at research stations. The extensive involvement of farmers in any FSR studies, including trials that adopt the practices of farmers through an “on-farm trial”, greatly strengthen researchers’ understanding of the real problems faced by farmers (Rhoades and Booth, 1982; Ashby, 1986) and help them find solutions. The existing pattern practiced by farmers was usually the basis for conducting a series of feeding trials (Dhillon and Anderson, 1984; Norman and Collinson, 1985). Supplementary feeding trials completed under controlled conditions at research stations using local feedstuffs are considered promising for improving the productivity of village chickens. Closer attention to management practices and feeding systems is required because high temperatures in tropical areas highly influence many factors, such as the breed, age and nutrition of the birds as well as the ability of the birds to maintain high meat and egg production levels (Arad *et al*., 1981; Brishman, 1974). Considerations of poultry nutrition in the tropics require specific feeding strategies (Ochetim, 1989). Some studies have revealed that additional energy in broiler diets containing high levels of lysine has

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beneficial effects on the growth performance of birds (Dale and Fuller, 1979, 1980; Mc Naugghton and Reece, 1984; Iskandar *et al*., 2003). These results suggest that increasing the energy level in the diet of broilers in tropical climates must be accompanied by an adequate intake of lysine and that an optimal balance of amino acids must be maintained. With regard to village chickens, there is no particular standard available for either feed requirements or feeding management and only limited information is available on all aspects of feeding. Smith (1992) reported specific characteristics of village chickens in different agricultural systems.

Palm pith, which is available at all seasons, has a high carbohydrate content that can be used as an energy source (Kanro *et al*., 2003) and may be substituted for the maize used in chicken feed. Palm pith has always been used by farmers in Timor Island as additional feed for chickens, goats and pigs during critically dry seasons when traditional feeds are unavailable (Fuah and Pattie, 2013). In contrast, in Papua New Guinea, *Metroxylon sagu* is a staple food for humans (Kanro *et al*., 2003; Lestari, 2009). Because of the ready availability of palm (*Corypha gebanga*)-derived feedstuffs at research sites, a trial was conducted to examine the potential value of the locally available feeds as partial substitutes for maize and soybean in the diets of village chickens. The objective of this study was to improve the performance of local kampung chickens fed palm pith meal from a practical viewpoint of the farmers.

## MATERIALS AND METHODS

This study was designed to evaluate the ability of palm pith meal to replace maize grain with no adjustment in the nutrient composition. A proximate analysis of samples of various combinations of feed supplements given to village chickens was conducted; the results are shown in Table 1. The amount of palm pith increased progressively from T1 to T4, whereas the amount of maize meal decreased. Due to difficulties in obtaining birds of a similar age from village farmers, the number of animals used in this study was as the lowest acceptable number out of necessity. Sixteen cages, each containing four birds (three females and one male), were used. These birds were obtained from small-scale chicken-rearing farms in the villages near a research station that was participating in some on-farm studies conducted in the localities. An initial study of chicken growth was conducted for eight weeks at the Animal Research Centre in Kupang, East Nusa Tenggara, Indonesia. Following this study, another study was conducted to measure egg production, weight and size. A randomized block design of the four treatments, with four replicates per treatment and four birds for each replicate, was used.

The parameters measured were feed consumption, live weight gain and (after reaching sexual maturity) egg production and size. The feed conversion for meat growth and the income after accounting for feed and bird costs were calculated. The birds were weighed weekly and the data were analyzed using a multivariate analysis (SAS, 1985).

## RESULTS AND DISCUSSION

**Effect of treatments on feed consumption and growth:** The effect of increasing levels of palm pith meal as a replacement for maize in the diet on the live weight growth of village chickens is shown in Fig. 1. The differences in live weight among chickens fed different treatments increased as time progressed. Significant differences were observed in weeks 6, 7 and 8: the birds receiving 80% palm pith meal in the diet (Treatment 4) had a higher average live weight than those receiving 60 and 70% palm meal. Palm pith meal provides energy to birds, as stated by Russell (2005) and village chickens rely on the feed available for energy. The results of a repeated-measures analysis of variance using a general linear model (Table 2) revealed that the effect of the interaction between time (week) and treatment on live weight was highly significant ($p<0.01$). This finding is due to the better performance of the birds that received Treatment 4 compared with those that received the other treatments, particularly in week 7. The birds fed Treatment 4 had a significantly higher weight that those that received Treatment 2. A longer feeding time resulted in a greater difference in the growth performance of the birds given the different treatments.

**Feed consumption:** The effect of the feeding treatments on the feed consumption of birds is presented in Table 3. The treatment has no effect on the feed consumption of village chickens; however, the birds receiving Treatment 4 tended to exhibit a slightly lower feed consumption and a higher overall rate of weight gain (103 g per bird per week) than those fed the other treatments (93 g for T1, 92

Table 1: Ingredients and nutrient composition (g/kg) of the four poultry diets containing increasing levels of palm pith meal

| | Diet | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Maize | 300 | 200 | 100 | - |
| Fishmeal | 200 | 200 | 200 | 200 |
| Palm pith meal | 500 | 600 | 700 | 800 |
| Dry water | 886 | 886 | 791 | 798 |
| Crude protein | 164 | 165 | 168 | 170 |
| Crude fibre | 193 | 189 | 175 | 173 |
| Ether extract | 67 | 77 | 96 | 90 |
| Ash | 78 | 68 | 71 | 69 |
| Calcium | 1.32 | 1.11 | 1.27 | 1.26 |
| Phosphorus | 0.70 | 0.62 | 0.67 | 0.64 |

The four treatments were the following:
T1-30% maize, 20% fish meal and 50% palm pith meal
T2-20% maize, 20% fish meal and 60% palm pith meal
T3-10% maize, 20% fish meal and 70% palm pith meal
T4-20% fish meal and 80% palm pith meal

Table 2: General linear model procedure for repeated-measures analysis of variance of the live weights of village chickens given increasing levels of palm pith meal in their diet over eight weeks

| Source | DF | SS | MS | F | Pr>F |
|---|---|---|---|---|---|
| Treatment | 3 | 741,702 | 247,234 | 1,27 | 0.33 |
| Error | 12 | 2,336,868 | 194,739 | | |
| Time | 7 | 5,403,876 | 771,982 | 200.24 | 0.0001 |
| Time*Treatment | 21 | 259,358 | 12,350 | 3.20 | 0.0001 |
| Error (time) | 84 | 323,839 | 3,855 | | |

DF: Degrees of freedom, SS: Sums of squares, MS: Mean square

Table 3: Least square means of feed consumption (g/bird/week) of village chickens given increasing levels of palm pith meal in their diet

| Treatment | LSM | SE |
|---|---|---|
| 1 | 284.9 | 12 |
| 2 | 291.9 | 12 |
| 3 | 290.2 | 12 |
| 4 | 269.2 | 12 |

g for T2 and 88 g for T3). The FCR ratios of Treatments 1, 2, 3 and 4 were 3.1, 3.3 and 2.6, respectively, indicating that Treatment 4, which comprised 80% palm pith and 20% fish meal, presented a considerably better feed conversion efficiency than the other treatments. The better growth and feed efficiency performance of the birds fed Treatment 4 are not readily attributable to differences in the nutrient composition of the diets determined by proximate analysis (Table 1). Furthermore, the actual dietary protein content determined by proximate analysis was difficult to distinguish from the predicted protein content of the component ingredients. The only ingredient in which crude protein was actually measured was *Corypha gebanga* (30.5 g/kg), but fish meal was predicted to contain approximately 600 g/kg protein and maize meal contained approximately 100 g/kg protein. Thus, the determined crude protein in Treatment 1, 164 g/kg, was similar to the predicted value (approximately 145 g/kg) but was lower than that of the NRC (1994) and that reported by Leesons and Summers (2001).

The growth performance of birds fed Treatment 4, however, suggested that the protein level in the diet was likely closer to the determined level of crude protein than the predicted level. The relative performance suggests that the amino acid balance may have been closer to optimal in the fish meal-*Corypha gebanga* mix than in the diets containing all three ingredients. It is possible that a nutritional factor was unaccounted for in the maize meal, but this seems unlikely. Another possibility is that the maize meal used in the study was contaminated by mold. This contamination is frequently observed in village-grown grain in wet, tropical regions.

**Egg production, egg size and constraints:** Table 4 presents the average egg production, egg size and cash income received (minus feed costs) from selling eggs from hens given the four dietary treatments. The average number of eggs produced by each hen during the first month (August) of the laying period was lower than the number produced in September. The egg production per hen was similar with all treatments during the first month, whereas the hens receiving Treatment 4 presented a lower egg production than the other groups in the second laying month. The average egg weight, length and width were similar for all treatments. This finding suggests that the feeding treatments applied to the local chickens did not cause any differences in the egg size, particularly at the beginning of bird maturity. Due to the lower egg production in the second month of laying found for hens given Treatment 4 compared with that of the birds given the other treatments, the average egg returns in this group were considerably lower than those for the hens fed the other treatments, although the standard errors were very high. According to Brishman (1974), the feed and feeding practices play roles in egg production. From an economic point of view, the provision of feeds with high availability, efficiency and low price would afford more benefits to farmers.

The measures of egg production may not reflect long-term responses to the dietary treatments, but the apparent depression in bird performance in the second month observed with Treatment 4 indicates the possibility of a nutrient deficiency or imbalance in the diet affecting optimal egg production. Despite the short duration of the experiment, the results showed the potency of *Corypha gebanga* to replace maize as a source of energy for village chicken feeding. The egg production results were lower than those reported by Prayogi (2011) due to the short period of egg production (two months) and the egg weight was lower than that reported by Faruque *et al.* (2013). This difference might be due to the different genetic potentials and different management techniques of chickens. Village farmers have always used low-priced local feeds to feed their chickens with the aim of minimizing costs, as reported by Aini (1990). It is worth noting that the opposite response was found for growth and egg production in this study; however, it is well recognized that diets formulated to promote rapid growth are not appropriate for optimal egg production in terms of dietary energy, protein and calcium. It is also well accepted that nutritional management aimed at maximizing growth rate during rearing results in depressed reproductive performance. Heat stress might also be responsible for low reproductive performance, as observed by Bird *et al.* (2003), particularly in free-ranging village chicken. The relevance of this consideration to the response of the birds receiving

Table 4: Average egg production and size during the first and second months of laying obtained from hens given increasing levels of palm pith meal in their diet

| | Treatment[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | |
| Traits | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| **No. of eggs/hen/m** | | | | | | | | |
| August | 8.8 | 0.73 | 9.3 | 0.9 | 9.2 | 1.95 | 8.3 | 1.42 |
| September | 15.1 | 1.98 | 11.5 | 1.32 | 13.3 | 1.12 | 9.8 | 1.07 |
| Egg weight (g) | 36.6 | 1.21 | 36.7 | 0.61 | 35.6 | 0.74 | 36.7 | 1.34 |
| Egg length (cm) | 40.6 | 0.17 | 40.8 | 0.29 | 40.7 | 0.19 | 40.0 | 0.51 |
| Egg width (cm) | 30.5 | 0.21 | 30.2 | 0.23 | 28.5 | 1.53 | 30.1 | 0.63 |
| Income over feed cost (IDR/hen/2 m) | 38.910 | 12.650 | 32.650 | 26.710 | 36.720 | 18.830 | 27.390 | 41.635 |

[1]The dietary compositions of the treatments (rations) are the following:
1 (30% maize, 20% fish meal and 50% palm pith meal) 2 (20% maize, 20% fish meal and 60% palm pith meal)
3 (10% maize, 20% fish meal and 70% palm pith meal) 4 (20% fish meal and 80% palm pith meal)

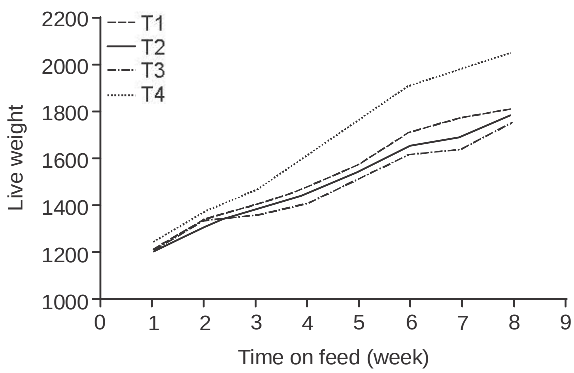


Fig. 1: Effect of the replacement of maize by *Corypha gebanga* meal in the diet of village chickens on live weight from 12 to 20 weeks of age

Dietary Treatment 4 might be somewhat tenuous, but the preliminary indications suggest that reasonable egg production could be achieved in birds fed diets supplemented with 70% *Corypha gebanga* pith.

**Conclusion:** The raising of village chickens contributes to the quick-cash incomes of small farming families. A major constraint identified in the process of chicken rearing is the inability of native chickens to respond to improved management due to their limited genetic potential. The current feeding practices inefficiently use existing feed resources, resulting in an inadequate amount and a low quality of the feed available for chickens and long durations between hen clutch cycles, affording a low annual egg production per hen. Trials conducted at research stations revealed that palm pith could be used as a substitute for maize in chicken feeding because the type of feed and the feeding rate have been identified as major constraints to improving village chicken productivity. The experiment represented vast inputs of time, effort and money. The cost of the station trial was likely not justified by the value of other studies; however, the information obtained regarding the feeding value of palm pith as a local feed resource will be useful in future work. The economic returns offered by indigenous kampung chickens constitute the area of study with the greatest development and benefit potential to village farmers in Eastern Indonesia.

## REFERENCES

Aini, I., 1990. Indigenous Chicken production in South East Asia. Worlds Poult. Sci. J., 46: 51-57.

Arad, Z., J. Marder and M. Soller, 1981. Effect of gradual acclimation to temperatures up to 44°C on productive performance of the desert Bedouin fowl, the commercial white Leghorn and the two reciprocal crossbreds. Br. Poult. Sci., 22: 511-520.

Ashby, J.A., 1986. Methodology for the participation of small farmers in the design of on-farm trials. Agric. Administ., 22: 1-19.

Bernsten, R.H., H. Fitzhugh and H.C. Knipscheer, 1983. Livestock in Farming Systems Research.

Bird, N.A., P. Huton, W.D. Morris and L.J. Weber, 2003. Heat stress in caged layers. Ontario (CA). Ministry of Agriculture and Food.

Brishman, D.H., 1974. Feeding for egg production in the tropics and subtropics. Wld. Anim. Rev., 12: 14-18.

Conway, G.R., 1983. Agro-ecosystems analysis. Imperial college of Experimental Technology, Series E No 1.

Dale, N.M. and H.R. Fuller, 1979. Effects of diet composition on feed intake and growth of chicks under heat stress. I. Dietary fat levels. Poult. Sci., 58: 1529-1534.

Dale, N.M. and H.L. Fuller, 1980. Effects of diet composition on feed intake and growth under heat stress. II Constant vs. cycling temperatures. Poult. Sci., 59: 1434-1441.

Dhillon, J.L. and Anderson Jr., 1984. Concept and practice of farming systems research. In: Proceedings of conference on Agricultural Research in Africa, Ed. J.V Mertin. ACIAR Canberra, pp: 171-186.

Faruque, S., M.S. Silam, M.A. Afroz and M.M. Rahman, 2013. Evaluation of the performance of antive chicken and estimation of heritability for body weight. J. Bangladesh Acad. Sci., 37: 93-101.

Fuah, A.M. and Pattie, 2013. Production systems and strategies for improvement of village chickens in east nusa tenggara, Indonesia. J. Anim. Prod. Proc. Technol., 1: 122-126.

Iskandar, S., H. Resnawati and T. Pasaribu, 2003. Growth and carcass responsis of three lines of local chickens and its crossing to diettary lysine and methionine. Proceedigs of the 3rd international seminar on tropical anumal production and total management and local resources. Faculty of Animal Science, Gajah mads University.

Kanro, M.Z., A. Rouw, A. Widjono, Syamsudin, Amisnaipa and Atekan, 2003. Tanaman sagu dan pemanfaatannya di Propinsi Papua. J. Litbang Pertanian, 22: 116-124.

Lestari, M.S., 2009. Penerapan teknologi pengolahan sagu rakyat di Kabupaten Jayapura Papua. J. Ilmiah Tambua, 8: 440-445.

Leesons, S. and J.D. Summers, 2001. Nutrition of the Chicken. 4th Ed. Guelph. Ontario. Canada.

Lestari, M.S., 2009. Implementation of sago processing technology in Jayapura Regencyof Papua. J. Ilmiah Tambua., 8: 440-445.

Mc Naugghton, J.L. and F.N. Reece, 1984. Response of broiler chickens to dietary energy and lysine levels in a warm environment. Poult. Sci., 63: 1170-1174.

National Research Council, 1994. Nutrient requirements of the chicken. 9th Revised Edition. Washington DC. Academy Press.

National Research Council, 1994. Nutrient requirements of the chicken. 9th Revised Edition. Washington DC. Academy Press.

Norman, D. and M. Collinson, 1985. Farming systems approach in theory and practice. In: Agricultural Systems Research for Developing countries. Ed. J.F. Remenyi. ACIAR, Canberra, pp: 16-30.

Ochetim, S., 1989. Tropical feeding strategies. Poult. Misset, 5: 41-43.

Prayogi, H.S., 2011. The improvment of indonesia native chicken: Estimation of Genetic Parameters, Response to Selection and Disease Resistence Ability. J. Ilmu-Ilmu Peternakan, 21: 1-7.

Russell Parker, 2005. Village chicken keeping in solomon Islands. ACIAR Proceedings of an International Conference Held in Dares Salaam, Tanzania, 5-7 October.

Rhoades, R.E. and R. Booth, 1982. Farmers back to farmers: a model for generating acceptable agricultural technology. Agric. Admin., 11: 127-137.

Sabrani, M. and H.C. Knipscheer, 1982. Small ruminants for small farmers. Indon. Agric. Res. Dev. J. Bogor, 4: 86-90.

Sumarti, T. and A.M. Fuah, 2015. Women, gender equality in livestock development : case study from papua and central java. Proceeding 3rd International Seminar on Animal Industry, Faculty of Animal Science.

SAS, 1985. SASuser's guide: Statistics. Version 5 edition, Statistical Analysis System Institute Inc.

Smith, A.J., 1992. Integration of poultry productioninto the agricultural systems. In the tropical agriculturalist: poultry. CTA McMillan, pp: 179-191.