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# GROWTH OF POULTRY CHICKS FED ON FORMULATED FEED CONTAINING SILK WORM PUPAE MEAL AS PROTEIN SUPPLEMENT AND COMMERCIAL DIET

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ORIGINAL ARTICLE

**ABSTRACT:** *Waste silkworm pupae (SWP) generate vast resources of nutrients for livestock and poultry. In the present investigation, three days old chicks of RIR strain were allocated to five dietary treatments of silk worm pupae meal. The energy budget was prepared from calculated proximate analysis and growth performance of broiler chicks fed with different percentages of silk worm pupae. The result showed that the silkworm powder meal (SWPM) is the cheapest and has potential to replace the costly and contaminated fish meal, as the protein source, used in poultry industry.*

**Key words:** *Poultry; Fish Meal; Silkworm Pupae Meal; Proximate Analysis; Growth Performance; Energy Budget*

## INTRODUCTION

Broiler industry provides not only a good source of protein but also employment. Poultry meat contributes about 37% to the total animal protein consumption in India (Ahmed and Islam, 1990) and so broiler industry is gaining importance due to increasing demand of animal protein. But broiler producers are facing difficulty on account of availability and prices of feed ingredients. Feed cost account 65-70% of total poultry rearing cost (Bhuiyan, 1989). Compared to the other nutrient sources, animal protein is the most costly ingredient for formulation of poultry diets, account 15% of feed cost (Banerjee, 1992; Singh, 1990). Fish meal (FM) is the only conventional animal protein source for poultry and as a result the cost of fish meal (FM) is very high and its inclusion in diet hardly permits profitable poultry farming. In rural India, FM supply is not only very uncertain but also usually contaminated, may even contain lethal pesticides deleterious to poultry industry (Khatun et al., 2003).

Little work has been done in India to replace the traditional animal protein supplements in animal feed with by-products of agro-industrial origin (Wijayasinghe and Rajaguru, 1977). In silk industry silk worm pupae (SWP) are discarded after reeling of silk thread, which contains a high percentage of protein that can and have been experimentally used as a animal feeds for chicken, pigs, rabbits and cattle and also for freshwater fish (Das and Sutradhar, 1971). Silk worm pupae of *Antheraea mylitta*, Drury, a waste product of silk industry, is not only rich in protein (Bhuiyan, et al.,1998) but also is also an important source of Nitrogen, Calcium, Phosphorus, Crude Fibre, Lysine, Metheonine, etc. (Habib and Hasan, 1995).

Keeping the above facts in mind the present investigation was undertaken to see whether this unconventional but important protein and energy source for poultry can be utilized in replacement of FM for optimum performance of broiler chicks. The present study deals with evaluating silkworm pupae (SWP) as an economic substitute of protein concentrate (PC).

## MATERIAL AND METHODS

Unused silkworm pupae were collected from Central Tasar Research and Training Institute (CTR&TI), Ranchi, Jharkhand. The pupae were sun dried, powdered and used as silkworm pupae meal (SWPM). Three days old chicks of RIR strain were allocated to five dietary treatment groups: Group-1 (Gr.1) (100% FM + 0% SWP), Group-2 (Gr.2) (75% FM + 25% SWP). Group-3 (Gr.3) (50% FM +50% SWP), Group-4 (Gr.4) (25% FM + 75 % SWP) and Group-5 (Gr. 5) (0% FM + 100% SWP) in three replications, each were having 10 birds. Replication-wise body weight gain (g/day), feed intake (g/ day /bird) and growth performance were calculated. The energy budget was prepared according to Samuel et al. (2004). The data were statistically analyzed.



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## RESULTS

Table 1 shows the proximate composition of feed used in the present study. The feed were so prepared that only the fish meal (FM) was replaced by Silkworm pupae, at varying percentage in different groups. Group 3 has highest ash content (8.254 in 7-8 week) while phosphorus content is slightly higher in Gr. 3 (0.456 in 7-8 week), than other experimental groups. The protein content of left over feed is highest in Gr. 4 after 8 weeks. While the amount of crude fiber and lipid was maximum in Gr. 4 after 6 weeks. Other parameters are shown in Table 1 for all the groups during the entire treatment period.

**Table 1 - Proximate analysis of poultry feed on DM basis feed offered**

| | 0 – 6 Week | | | | | 7 – 8 Week | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Particular** | **Gr 1** | **Gr 2** | **Gr 3** | **Gr 4** | **Gr 5** | **Gr 1** | **Gr 2** | **Gr 3** | **Gr 4** | **Gr 5** |
| Crude protein | 21.88 | 20.92 | 20.84 | 20.89 | 20.88 | 23.254 | 23.45 | 23.456 | 23.595 | 23.53 |
| Crude fiber | 4.102 | 4.201 | 4.105 | 4.406 | 4.321 | 4.202 | 4.314 | 4.215 | 4.312 | 4.313 |
| Lipid | 2.245 | 2.631 | 2.734 | 2.634 | 2.678 | 2.345 | 2.249 | 2.543 | 2.615 | 2.532 |
| Total Ash | 6.885 | 7.145 | 6.956 | 6.856 | 6.989 | 6.956 | 7.005 | 8.254 | 7.105 | 7.981 |
| Calcium | 1.125 | 1.25 | 1.254 | 1.321 | 1.312 | 1.325 | 1.254 | 1.095 | 1.129 | 1.112 |
| Phosphorus | 0.456 | 0.321 | 0.356 | 0.41 | .359 | 0.51 | 0.432 | 0.456 | 0.412 | 0.432 |

When a nutritional study was carried out to know the feasibility of formulated feed containing different % of Silkworm pupae (SWP) by replacing fish meal (FM) in identical percentage on the growth and conversion efficiency of poultry chick, it was found that the best relative growth was observed in Gr. 1 followed by Gr. 3, while Gr. 5 performed poorly (Table2). The gain in the body weight by the chicks in different groups is presented in table 3 which showed that the increase in the weight was maximum in Gr. 3 as compared to other groups.

**Table 2 - Growth performance of broiler chicks on diets containing different levels of silkworm pupae powder**

| **Variable** | **Dietary Groups** | | | | |
|---|---|---|---|---|---|
| | **Gr-1** | **Gr-2** | **Gr-3** | **Gr-4** | **Gr-5** |
| Live Weight at Start of Expt (g/bird) | 45.16±0.24 | 43.4±0.62 | 48.02±0.35 | 45.4±0.62 | 47.6±0.5 |
| Live Weight at end of Expt (g/bird) | 1573.8±1.81 | 1543.52±0.29 | 1576.4±0.62 | 1532.22±0.44 | 1462.02±0.29 |
| Weight gain (g/day) | 25.06±0.24 | 24.59±0.01 | 25.05±0.18 | 24.37±0.17 | 23.19±0.11 |
| Feed consumption (g/day/bird) | 16.58±0.20 | 16.2±0.15 | 16.3±0.16 | 16.07±0.14 | 15.58±0.15 |

Gr-1 (100% FM + 0% SWP), Gr-2 (75% FM + 25% SWP), Gr-3 (50% FM +50% SWP), Gr-4 (25% FM + 75 % SWP) and Gr-5 (0% FM + 100% SWP); FM (fish meal); SWP ( silk worm pupae meal)

Energy budget of chick fed on different level of SWP are presented in Table 4. Comparatively higher production was observed in Gr. 1, followed by Gr. 3. Gr. 3 also showed highest assimilation ratio, followed by group 1. Higher gross growth efficiency $K_1$ (142.63%) and net growth efficiency $K_2$ (140.47%) was observed in feeding gr.1 (fed exclusively with commercial feed with 100% F.M.) and lowest $K_1$ & $K_2$ in Gr. 5. Gr.3 was next to Gr. 1 in $K_1$ and $K_2$ value as shown in Table 4. Hence Gr. 3 with cheaper SWP may be considered to be suitable alternative to commercial feed containing costlier FM.

Keeping the feed cost low and at the same time providing a balanced diet to poultry has been the main concern of both the poultry production and feed manufacturer. Economics of feed cost without impairing poultry production can be achieved by formulating low cost diets by appropriate selection of feed ingredients. Keeping this in mind and gradually replacing the costly fish meal by cheaper silkworm pupae meal, it is possible to reduce the overall cost of chicken production.

The economics of broiler production under the five regimes of feeding in the present investigation has been calculated based on the cost per kg live weight gain as shown in Table 5 which is dependent on the cost of ingredients used for their feeding and the feed efficiency in various feeding groups.

Cost of the feed ingredients has been detailed in Table 5 and the same have been calculated on the basis of cost price at the local market of Upper Bazar Ranchi. The perusal of data incorporated in the table revealed that the cost of total feed offered was lowest in where SWP replaced 100% protein of fish meal. The cost of feed offered was highest for Gr.1.

This shows that with a linear increase of incorporation of SWP in the poultry feed there is corresponding decrease in cost per unit of feed. However the cost per kg live weight gain shown in Table 5 was lowest in Gr.3 followed by Gr. 4, Gr. 2 and lastly Gr. 1 respectively. The cost per kg live weight gain was comparatively higher in Gr. 1 than other group.

## DISCUSSION

Increased broiler growth performance on increasing level of dietary SWP is supported by many previous finding (Chaudhary et al., 1998; Hossain et al., 1993; Borthakur and Sharma et al., 1998; Nandeesha et al.,1989;



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Jayaram and Shetty, 1980; Rahman, 1990; Shyma and Keshavanath, 1993; Begum, 1992; Rahman et al., 1996; Mahata et al., 1994). Improved feed conversion of broiler or diets with SWP in the current study coincides with finding of Venkatchalam et al. (1997) and Ling (1967).

In the present investigation, resultant data on important variables viz. live weight gain, feed consumption are presented in Table 2. Body weight gain at 8 week age of broiler chicks was found highest in the treatment Gr-3 as compared to other treated groups (50% FM + 50% SWPM). This supports the work of Das and Saikia (1972) and Horie and Watanabe (1980).

**Table 3 - Mean body weight gain of broiler chicks in g/day**

| | Gr-1 | Gr-2 | Gr-3 | Gr-4 | Gr-5 |
|---|---|---|---|---|---|
| Mean weight gain (g/day) | 25.5 | 24.92* | 26.73** | 24.28*** | 23.58**** |
| | 25.9 | 24.99* | 26.78** | 24.34*** | 23.56**** |
| | 26.1 | 24.96* | 26.77** | 24.65*** | 23.59**** |
| | 25.3 | 24.98* | 27.00** | 25.02*** | 24.00**** |
| | 25.00 | 25.00* | 26.00** | 24.33*** | 23.22**** |
| | 25.56 | 24.97* | 26.65** | 24.52*** | 23.59**** |

*$F > F^{crit}$ as compared to Gr-1 (with values 8.746 and 5.318 respectively) ; **$F > F^{crit}$ as compared to Gr-1 (with values 17.478and 5.318 respectively); ***$F > F^{crit}$ as compared to Gr-1 (with values 18.116 and 5.318 respectively); ****$F > F^{crit}$ as compared to Gr-1 (with values 70.69and 5.318 respectively)

The efficiency of feed conversion was highest in Gr-3 dietary combination conforming the findings of Sengupta et al. (1995). No significant difference in survivability was found which also coincides with the findings of Das and Saikia (1972) and Sengupta et al. (1995). This is also supported by the fact that the Gross Growth Efficiency, Net Growth Efficiency and Assimilation efficiency was found to be quite satisfactory when chicks were fed with meal containing 50% SWP as evident from Table 4.

**Table 4 - Energy Budget of broiler chick fed on formulated diet containing SWP & Commercial feeds**

| Feed group | Initial weight (g) $W_1$ | Final weight (g) $W_2$ | Production (g) $P = W_2 - W_1$ | Total Food consumption (g) C | Average Feacal output (g) F | Assimilation $A = C - F$ | Metabolism R $= P - A$ | Assimilation efficiency A/C % | Growth ross efficiency $K_1 = P/C$ % | Net growth efficiency $K_2 = P/A$ % |
|---|---|---|---|---|---|---|---|---|---|---|
| Gr 1 | 45.16 | 1573.8 | 1528.64 | 1011.38 | 14.6 | 996.78 | 531.86 | 98.55 | 151.14 | 153.36 |
| Gr 2 | 47.6 | 1543.52 | 1500.12 | 988.2 | 15.04 | 973.16 | 526.96 | 98.48 | 151.80 | 154.15 |
| Gr 3 | 48.02 | 1576.4 | 1528.38 | 994.3 | 14.06 | 980.24 | 548.14 | 98.59 | 153.71 | 155.92 |
| Gr 4 | 45.4 | 1532.22 | 1486.82 | 980.27 | 14.98 | 965.29 | 521.53 | 98.47 | 151.67 | 154.03 |
| Gr 5 | 47.6 | 1462.02 | 1414.42 | 950.38 | 15.10 | 935.28 | 479.14 | 98.41 | 148.82 | 151.23 |

**Table 5 - Comparative cost of feed formulation of different Experimental Group**

| Items | Rs/Kg | Gr 1 | | Gr 2 | | Gr 3 | | Gr 4 | | Gr 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Kg | Cost | Kg | Cost | Kg | Cost | Kg | Cost | Kg | Cost |
| Maize | 5.4 | 27.73 | 149.74 | 27.73 | 149.74 | 27.73 | 149.74 | 27.73 | 149.74 | 27.73 | 149.74 |
| G.N.C. | 12.5 | 10.66 | 133.25 | 10.66 | 133.25 | 10.66 | 133.25 | 10.66 | 133.25 | 10.66 | 133.25 |
| Fish meal | 58 | 3.88 | 225.04 | 2.91 | 168.78 | 1.94 | 112.52 | 0.97 | 56.26 | 0 | – |
| SWP | Free | – | – | 0.97 | – | 1.94 | 3.88 | 2.91 | – | 3.88 | – |
| Rice polish | 6 | 16.32 | 97.92 | 16.32 | 97.92 | 16.32 | 97.92 | 16.32 | 97.92 | 16.32 | 97.92 |
| Wheat bran | 7 | 1 | 7 | 1 | 7 | 1 | 1 | 1 | 7 | 1 | 7 |
| Bone meal | 40 | 0.5 | 20 | 0.5 | 20 | 0.5 | 20 | 0.5 | 20 | 0.5 | 20 |
| Min. Mix. | 76 | 0.5 | 38 | 0.5 | 38 | 0.5 | 38 | 0.5 | 38 | 0.5 | 38 |
| Salt | 9 | 0.25 | 2.25 | 0.25 | 2.25 | 0.25 | 2.25 | 0.25 | 2.25 | 0.25 | 2.25 |
| Total feed cost | | | 673.2 | | 616.94 | | 558.56 | | 504.42 | | 445.91 |

Thus, cheaper silkworm powder meal (SWPM) may be a supplement and has potential to replace the costly protein meal used in poultry industry. There was no mortality recorded in any group, which is also supported by Sengupta et al., (1995) and Das and Saikia (1972) who reported that mortality did not increased with SWP feeding. Early death of a few chicks was recorded in Gr-4 and Gr-5 due to cold winter weather of Ranchi. Post mortal investigation did not show any pathological symptoms. This indicated that SWP is not toxic to birds. This is also supported by the fact that there was no toxicological effect on broiler chicks and there may be some unidentified growth factors in SWP which have contributed to the better growth of broilers (Horie and Watanabe, 1980).


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The economics of the feed cost and broiler production is shown in Table 5. Profit was significantly higher as the level of dietary SWP was increased. These finding also coincide with the finding of Chaudhary et al. (1998), Rahman et al. (1996), Nandeeshi et al. (1989), and Habib and Hasan, (1995). They reported that SWP can be useful economical protein rich feed and can reduce production cost when F.M. is replaced by SWP

The feed efficiency was calculated by taking into account the total gain in live weight as well as total diet intake for the whole feeding trial period of 61 days. The cost of different diets was calculated on the basis of the prevailing market prices of feed ingredients and SWP which are free of cost. The total cost of feed and SWP in unit gain in live weight was calculated on the basis of quantity of feed consumed for one kg (Table 5). The cost benefit analysis was also calculated and it was found that the profit margin was highest for Gr.3.

## CONCLUSION

The ingredients and dietary level of protein have received much attention of nutritionists because of the nutritional efficiency of protein. Feed cost per kg at 8 week of age gradually declined on increasing dietary level of SWP. Many authors concluded that the average weight gain is directly related to the level of protein in the diet. Hence this cheap waste product of Tasar silk industry can be effectively used as the replacement of costly, usually contaminated, fish meal as protein source in poultry feed.

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## REFERENCES

Ahmed S and Islam N (1990). Backyard poultry development project in 100 villages. Proceeding of the 1st conference of Bangladesh Animal Husbandry association, Bangladesh Agricultural University, Bangladesh.

Banerjee GC (1992). Poultry (3rd edition). Oxford and IBH publishing Co. Pvt. Ltd, New Delhi, pp.168-172.

Begum NN (1992). Study on the use of Silkworm pupae and clam meat as replacement for fish meal in the diet of Indian major Carp, *Labeo rohita*. M.S. Thesis, Dept. Fish Technology, Bangladesh Agricultural University Mymensingh, Bangladesh.

Bhuiyan AKMA, Begum NN, Begum M and Hoq ME (1989). Survey of potential fish feed ingredients of Bangladesh on the basis of their availability and biochemical composition. Final Report. FRI Research Progress Report 1. Freshwater station. Fri, 70.

Bhuiyan MZ (1998). Complete replacement of fish meal by full fat soyabean and supplementation of lysine and methionine to broilers. M.S. Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Borthakur S and Sharma K (1998). Effect of some non-conventional fishmeal replacers on the growth, feed conversion and body composition of *Clarias batrachus* (L) fingerlings. Environment and Ecology. 15: 311–314.

Chaudhary K, Das J, Saikia S, Sengupta S and Chaudhary SK (1998). Supplementation of broiler diets with antibiotic and probiotic fed muga Silkworm pupae meal. Indian Journal of Poultry Science. 33: 339–342.

Das PC and Saikia A (1972). Utilization of industrial and agricultural by-products in starter ration for meeting amino acid requirement with special reference to silkworm pupae in Assam. Indian Journal of Poultry Review.4: 263-270.

Das A and Sutradhar R (1971). Systematic study of by-products of agro industrial origin for evolvement of economic poultry layers rations. Indian Veterinary Journal. 48(9): 941-946.

Habib MAD and Hasan MR (1995). Evaluation of silkworm pupae as dietary protein source for Asian catfish, *Clarias batrachus* (L) fingerlings. Bangladesh Journal of Aquaculture. 17: 1-7.

Horie Y and Watanabe H (1980). Recent advances in Sericulture. Annual Review of Entomology. 25: 49–71.

Hossain MA, Islam MN and Alim MA (1993). Evaluation of Silkworm pupae meal as dietary protein source for catfish (*Heteropneustes fossilis*). In: Kaushik SJ and Luguent P (Eds.) Fish nutrition in practice. Biarritz, France, pp.785-791.

Jayaram MG and Shetty HPC (1980). Influence of different diets on the proximate body composition of *Calta Catla*, *Lobeo rohita* and *Cyprinus carpio*. The Mysore Journal of Agricultural Sciences. 14: 381–384.

Khatun R, Howlider MAR, Rahman MM and Hasanuzzaman M (2003). Replacement of fish meal by silkworm pupae in broiler diets. Pakistan Journal of Biological Sciences. 6(11):955-958.

Ling S W (1967). Feeds and feeding of warm water fishes in ponds in Asia and the Far East. FAO Fisheries Report. 44(3): 291–309.

Mahata SC, Bhuiyan AKM, Zaher M, Hossain MA and Hasan MR (1994). Evaluation of Silkworm pupae as dietary protein source for Thai Sharpunti, *Puntius gonirnotus* (Blaker). Journal of Aquaculture in the Tropics. 9: 77–85.

Nandeeshi MC, Srikanth GK, Varghese TJ, Keshavanalh P and Shethy HPC (1989). Influence of Silkworm pupae based diets on growth, organoleptic quality and biochemical composition of catla-rohu hybrid.



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Scienceline/Journal homepages: http://www.science-line.com/index/; http://www.ojafr.ir

In: Huisman EA, Zonneveld N, Bouwmans AHM (Eds.), Aquaculture Research in Asia ,Management Techniques and nutrition, Pudoc. Press, Wageningen, pp. 211-220.

Rahman MA (1990). Formulation of suitable ingredients for intensive culture of mirror Carp *(Cyprinus carpio* Linn.) M.S. Thesis, Dept. of Fish Technology, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Rahman MA, Zaher M, Mazed MA, Haque MZ and Mahata SC (1996). Replacement of costly fishmeal by SWP in diet of mirror Carp. Pakistan Journal of Scientific and Industrial Research. 39: 64-67.

Samuel JN, Thirunavukkarasu N, Soundarapandian P, Shanmugam A and Kannupandi T (2004). Fishery potential of commercially important portunid crabs along Parangipettai coast. Proceedings of International conference and exposition on marine living resources of India for food and medicine, Aquaculture Foundation of India, Chennai. pp. 165-173.

Sengupta S, Chaudhuri K and Bhattachrya SK (1995). Effect of feeding muga silkworm pupae waste as a substitute for fish meal in broiler ration. Indian Journal of Animal Science. 65: 827-829.

Singh RA (1990). Poultry Production, 3rd ed. Kalyan publishers, New Delhi, Ludhiana.

Shyma S and Keshavanath P (1993). Growth response of Tor Khudree to Silkworm pupa incorporated diets. In : Kanshik SJ and Luquet P (Eds.), Fish Nutrition in practice. *Paris-France- Institute National De – La – Recherche – Agronomique* . pp.779-788.

Venkatesh B, Thangamani R, Pandiyan V and Shanmugasundran S (1997). Effect of reducing antinutritional factor in Silkworm pupae meal on its feeding value of broiler. Indian Journal of Poultry Science. 32: 182-184.

Wijayasinghe MS and Rajaguru ASB (1977). Use of Silkworm (*Bombyx moii* L.) pupae as a protein supplemeat in poultry rations Journal of the National Science Foundation of Sri Lanka. 5(2): 95-104.



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