

Protein Requirement of Gamitana (*Colossoma macropomum*) in Fingerling Stage

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ABSTRACT

The protein requirement for gamitana in the fry stage, was determined through the zootechnical parameters of liveweight gain and food conversion. There were used 128 gamitana fingerling of 3.19 g on average liveweight with increasing levels of protein (30%, 32%, 34% and 36%). Diets were isoenergetics (3.6 Mcal/kg DE), were fed for six weeks. The protein requirement was determined by the quadratic polynomial regression method. The results were: the protein requirement for the gamitana fingerling with the daily weight gain variable was 32.61%, and with the food conversion variable it was 33.83%.

KEYWORDS: Gamitana, *Colossoma macropomum*, Protein requirement.

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INTRODUCTION

The gamitana is a fish which is developed in Peru. In 2021 has been reported production was 852 Tm per year, however in comparison with other fishes it is lower production in comparison to other fish species in spite several advantages of this fish (FONDEPES.2014)

The gamitana is a mild fish with good resistance to management and eats simple balanced diet producing food conversion similarly to 1.5 or less. It is omnivorous that eats a several dietary ingredients even regional ingredients Its grows rapidly reaching 1 kg in 8 months depended on quality of food and density of sowing rate. moreover, its accepts controlled environment in the aquarium.

For other side exist not much information for farmer to precise good information about fish production and production of fish feeding factory and feeding plant for fish. Moreover of food technology in the contest for this reason the importance of this work In spite there are some studies of requirement of protein of gamitanas in these requirement is scarce. They did not determine the protein requirement on fingerling; therefore, this research treats to determine the protein requirement fingerling of gamitana.

MATERIAL AND METHODS

This experiment was carried out in the Research Laboratory of Nutrition and feeding of fish and crustaceous (LINPAC), Department of, Nutrition, Zootenic Faculty, (UNALM). The elaboration of diets was done in feeding Plant of balanced, Nutrition department, Zootenic Faculty (UNALM).

The determination of protein requirement of gamitana fingerling last six weeks. These fish were placed in two adjusted aquariums. In the first day were not fed, then we fed a standard diet for seven days. At the begin of experiment they weighted placed in sixteen aquariums, they were weighted and length of fish were done at beginning and six week later at the end of the experiment, Fish were fed with small spoon until t satiety to avoid loses feed particles. This food was floated. Fishes were fed five times per day since 8 am till 5 pm.

Treatments were: I, 30%, II, 32%, III, 34% and IV, 36% of protein levels. The supplied feed has done with little spoon in order not to lose feed and floating to be catch then were provided feed. Since 8 a.m. till 5 p.m. for seven days.

Consumption were measured daily then subtracted from the last feeding of the consumption from total the feeding supplied. Food conversion = Total feeding supplied/live weight gain

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Completed randomized design was used with four treatment levels of protein and four replicates. Tuckey test were used to compare median of treatments.

Estimation of water quality

Temperatures was measured using digital thermometer, range from 0⁰ to 40⁰ C

Dissolved oxygenic measured using multiparamer Hanna instrument

Hardiness of water as measured used kit calorimeter JBL

Potential of hydrogen (ph.) was measured using ph. meter Oaklon mark. Range of calibration 1.0 to 15 ph

Ammoniac Nitrogen was measured was using Kalorimeter JBL kit

Nitrite was measured calorimeter kit of three reagents JBL mark.

Water quality was measured the following parameters: temperature, ph., dissolved oxygen, hardiness, level of nitrites, and levels of ammonium. These results of water quality were normal with agreement to normal ranges (Rios, 2020)

RESULTS

The protein requirement of gamitana fingerlings was determined through three methods; the analysis of median of Tuckey test, regression of broken-line and polynomial quadratic regression

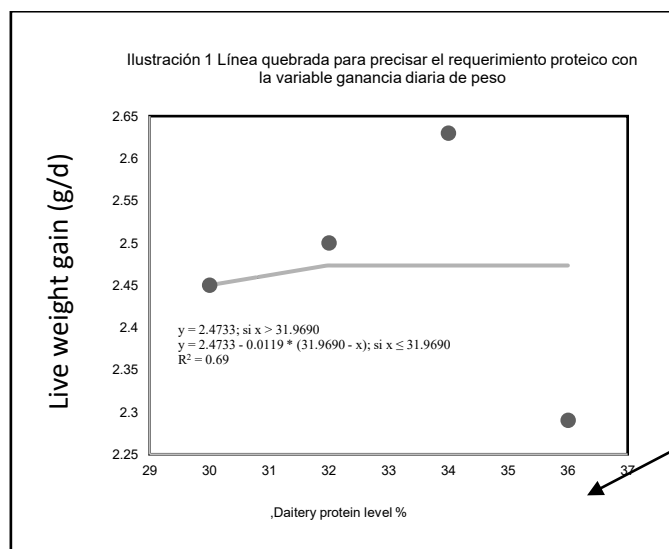
The protein requirement determined with median comparison of the Tuckey test is presented in the table 1

Table 1: Results of Effect of level of dietary protein dieter on the productive parameters in fingerling gamitana

Treatment	Level crude protéin c (%)	Initial weighth (g)	Final weigt(g)	Live weigh gain (g/d)	Daily consumption (g/d)	Food conversión
I	30.00	3.19	106.20 ^{ab}	2.45 ^{ab}	2.01 ^a	0.82 ^a
II	32.00	3.18	108.35 ^{ab}	2.50 ^{ab}	1.92 ^a	0.77 ^b
III	34.00	3.20	113.85 ^a	2.63 ^a	1.95 ^a	0.74 ^b
IV	36.00	3.19	99.55 ^b	2.29 ^b	1.74 ^b	0.76 ^b
Probability			0.032	0.032	0.001	0.001

Requirement of broken-line Regression

The application of broken-regression equal to of dietary crude protein level for live weigh gain of fish as used to determine of minimum level of protein to acquire the best grows for the specie (Robbins et .al 2006).



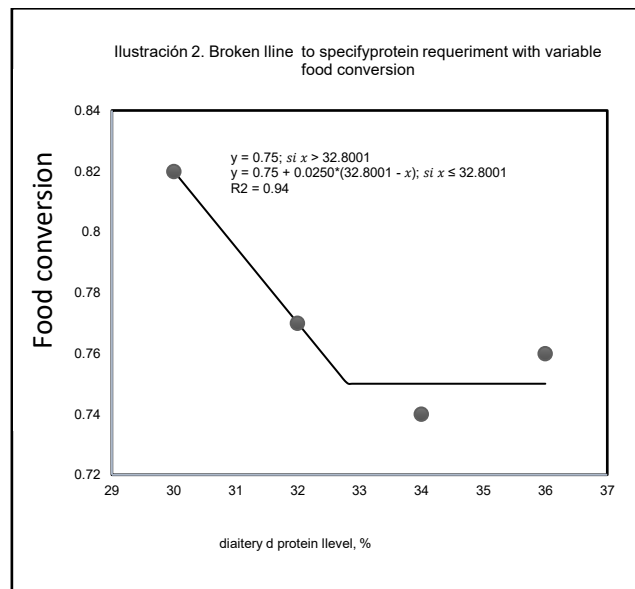
In illustration 1 shows the protein requirement to increment daily live weigh to equation regression taking in consideration that variable response was:

$$y = \{2.4733; \text{if } x > 31.9690\} | 2.4733 - 0.0119 * (31.9690 - x); \text{if } x \leq 31.9690\}$$

$$R^2 = 0.69$$

x = dietary protein level (%)

y = live weight gain(g).



In illustration 2 shows protein requirement to optimize the food conversion its equation taking in consideration this variable was:

$$y = \{0.75; \text{ if } x > 32.8001 \mid 0.75 + 0.0250*(32.8001 - x); \text{ if } x \leq 32.8001\}$$

$$R^2 = 0.94$$

x = level of dietary protein (%).

y = Food conversion.

Protein Requirement using quadratic polynomial regression

The illustration 3 shows curve of quadratic polynomial regressions for protein requirement utilization the food conversion and variable and daily live weigh respectively. focus the protein for maximum live weight gain should be 32.61% meanwhile to optimized food conversion should be 33.82%.

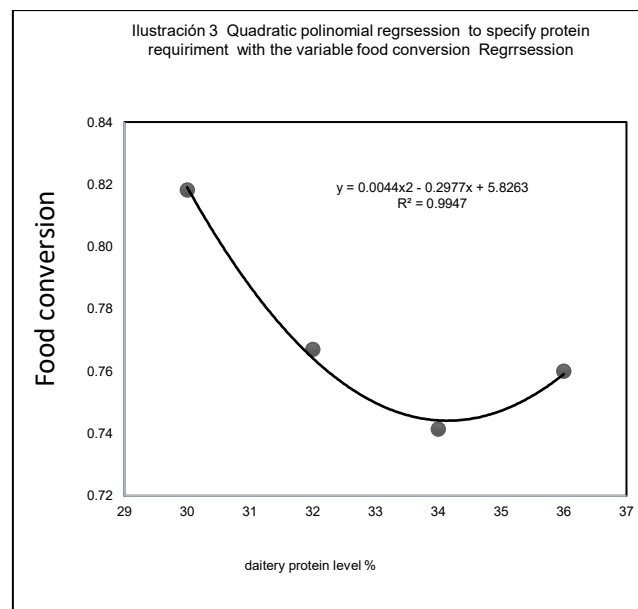
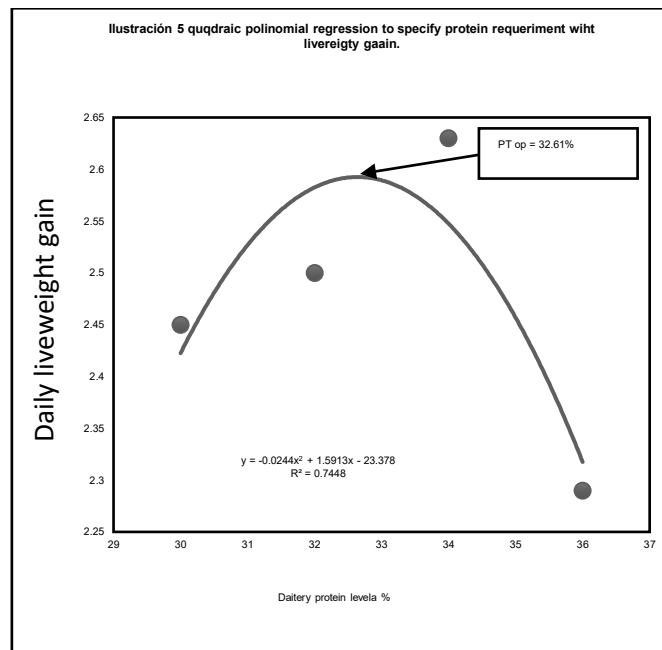


Illustration 3 shows the protein requirement to optimized food conversion for the quadratic polynomials regression its equation considering this variable was:

$$y = 5.8263 - 0.2977 * x - 0.0044 * x^2 \quad R^2 = 0.9947:$$

y = Food conversión.

x = Daily dietary protein, %



The illustration 4 shows the protein requirement to increase the daily live weight gain for the equation for quadratic polynomial regression taking in consideration of this variable was:

$$Y = 23.378 + 1.591 * x - 0.0244 x^2 \quad R^2 = 0.74$$

y = Daily live weight gain (g).

x = dietary protein level %.

DISCUSSION

The liveweight gains of gamitana fingerling at 42 days were similar in treatment fed 30% and 32% of Protein, but they were inferior ($p \leq 0.05$) to treatment with 34%. The group with 36%, of protein was the minor liveweight gain. Likewise, the fed consumption of treatment with 30%, 32% and 34% were similar. Meanwhile the treatment with 36% of protein decrease the consumption. Finally, the food conversion was greatest ($p \leq 0.05$) in treatment with 30% and treatment II, 32% and treatment IV, 36% were similar, however the treatment with 34% shows better ($p \leq 0.05$) food conversion.

The simplest way to determined consumption to determine of protein requirement is matching point using a test of comprising of averages and the analysis of variance (Pesti et.al,2009). This method suppose that requirement is the minimal concentration of nutrient that to offer to response, that is not considered significantly different to minimal response (food conversion) or maximal (increase weight) to nutrient level; In this method the protein requirement of fingerling of gamitana to increase weigh was 30% due this productive indicator was not significantly better that 32% or 34% of protein however the 36% of protein has reduced significantly live weight gain.

Considering food conversion, protein requirements 32%, protein since increased protein level have not presented significant different. The 30% level was not significant mayor to respect to this parameter. Then it need major feed consumption to reach of weight of rest of treatments In this research indicated the fish with 36% shows good conversion due the lower the consumption. These results are similar to data of Buzollo et. al. (2019) who have done research in gamitana fingerling with initial weights of 6,53 g. They fed the increasing level of protein (14, 17, 20, 23, 26, 29, and 32%) for 120 days, using Tuckey test treatment II with 32 % of protein were the best results. In the same way study was conduct by Uzcategui et.al (2014) have done other study in cachamay (*Colossom macropomum* x *Piaractus brachypomus*) Initial weight 14.76 g evaluated five protein levels 20, 22, 24, 26, and 28% of protein fed until satiety for 60 days obtained that best response ($p \leq 0.05$) with 28% of protein in liveweight gain.

For other side Gutierrez et. al. (2010) have determined the protein requirement of Gamitana working with increased levels of protein (25, 27, 29, 31 and 33% of protein) Diets were isocaloric (2.7 DE kcal/g), using fish ,6.73 g of initial weight It last 83 days to maximize the live weigh gain and minimized food conversion obtained that 25 and 27% of protein were the optimum levels. However, the live weigh gain (51.6 g) witch was minor that obtained in our research (106.g).

In relation to this model, Sherer (2000) express this analysis present infravaloration of the requirement e inclusive with lower research similar to data of gamitana. The difficulty of this method that they always express those theirs conclusions in the study concentration e exclude level of protein to levels of the other research among the levels. Therefore, they have not showed the exact level of protein requirement

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The application of the broken line is the most used in experiment of dose-response. It assumes that increased the protein concentration in the diet has effect on the response until certain point (requirement). This is maximum response (live weight gain) and minimum (food conversion) achieved.

The result according with this method shows that the increased level of dietary protein increased of the growing gain until certain point that exigence of protein to increased live weight gain is 31.97%. Protein requirement to optimize food conversion is 32.80% is important the mentioned there are some point they increased live weight gain reduced food conversion corresponding to specify requirement however they are despicable.

With the method Oishi et al. (2011) using meal soybean and residues of slaughter house as source of protein the appropriate protein requirement was 30% considering live weight gain and food conversion, The initial liveweight 46.4 g in our study was (3.19 g). in some way Buzollo et al. (2019) using broken line regression obtain 29% of protein using fingerling gamitana with initial weight, 6.53 g which is similar to our initial weight to this research.

However this method has been rejected for various researchers Salvador and Guevara (2013) those howse affirmed the animal response is not linear concerning that progressive energetics level set forth and the pendent of curve decreased in agreement the energetic level has nearer to nutrition demand. This nominated depressing yield de gamitana called phenome of decreased yield.

Analysis of polynomial regression with second order base in increased weigh and dietary protein level the proportioned the optimum level of protein range minimum to require the growing growth (Robins et al 2006). Illustration 3 and 4 show the curve of quadratic polynomial regression and for protein requirement using food conversion and variables of daily growth. In this consideration this approach and variable of daily growth. Taking in consideration this approach the requirements to maximize daily live weight gain was 32.61% meanwhile to optimize food conversion. was 33.83%.

Using this model (quadratic polynomial regression). It was determining (De Lima et al 2019) the protein requirements for fingerling gamitana with initial weight 1.7 g. Using isocaloric diets (4.2 Mcal/kg DE) with increased level protein (30, 35, 40 and 45%) in 60 experimental days... They found that protein requirement to maximize live weight gain was 30%. of protein.

On the other side De Souse et al (2016) working with gamitana fingerling and increased protein levels (24, 28, 32, 36, and 40% protein). The experimental time lasted 45 days. They found the protein requirement was 31.57% with variable of liveweight gain level. Our result of dietary protein was slightly inferior to our result of 32.61%. In the same way the fish were younger than ours. The experimental period was similar however the liveweight gain (15.70 g) was highly minor than our obtained live weight).

CONCLUSIONS

The optimum level of protein requirement to fingerling gamitana considering daily liveweight gain using the quadratic polynomial model was 32.64% of dietary protein and taking in consideration food conversation was 33.83% of dietary protein

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