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# EFFECT OF GOAT MANURE INCORPORATION AS A SUBSTITUTION TO DIETARY FISH MEAL ON THE PERFORMANCE OF TILAPIA (*OREOCHROMIS SPILURUS* Gunther) REARED IN TANKS.

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**Key words**: manure meal, Nile tilapia, growth performance

## ABSTRACT

This study was conducted to determine the suitability of dried Goat Manure Meal (GMM) as an ingredient for tilapia *(Oreochromis spilurus)* feed. Five experimental diets (I, II, III, IV and V) were formulated to contain 35%, 30%,25%,20% and 15% crude protein respectively. Diet I without GMM and contained fish meal, minerals, vitamins, lipids, dextrin, α-cellulose and carboxymethylcellulose (binder). Diets II,III,IV and V contained GMM as a substitution to part of the fish meal. Diet VI contained 100% GMM and it had 19.4% crude protein.

The 56-day feeding trial was conducted in triplicates treatment in 200 L circular fiber glass tanks with sea water which was changed every 4 hours. The maximum growth rate was obtained with diet I (control). There was a trend of reduced growth performance and FCR with increase in GMM level for all treatments. Significant decreases (P?0.05) of lipid levels and increases of carbohydrates and ash levels of the fish muscles were recorded. However, the maximum saving of fish meal with good weight gain and FCR were obtained with the diet containing 19.8 GMM. Because of the low price of tilapia, it is not economical to feed them with high protein, expensive feed. Therefore, it can be concluded that low inclusion of GMM in tilapias diet is recommended.

## INTRODUCTION

Fish feeding is one of the most important factors affecting the gross yield and the economic production of fish farming. Feed costs range from 30% to over 50% of the total production costs irrespective of the form of fish culture (ADCP, 1983 and Atay, 1992). Feed cost could be reduced by using similarly effective but cheaper feed ingredient instead of the most expensive item, the protein source (fish meal).

Fish meal remains an important but very expensive ingredient and its presence even in small amounts greatly improves the nutritional value of the entire fish diet (FAO,1983). Numerous studies have been reported on the possible replacement of fish meal by other animal protein sources (Omar, 1984 & 1986), plant proteins (Nour *et al.*, 1985; Omar *et al.*, 1994) and single cell protein (Omar *et al.*, 1989 and Abdel-Halim *et al.*, 1992).

The inclusion of unconventional dietary protein sources in tilapia feeds should be considered from the view point of both fish growth (production) and economic potential. If the protein source is expensive or locally unavailable, a submaximum (optimum) level may be most profitable. Cheaper sources may also be added at certain levels, and the reduction in fish production associated with their incorporation may be compensated by lower feed costs. Formulating a fish feed is therefore, a compromise between cost and return (cost /benefit ratio) of the feedstuffs used (El-Sayed, 1991).

In this study, the use of Goat Manure Meal (GMM) was tried as a total or partial substitute to fish meal in the diet of tilapia (*O. spilurus*).

## MATERIAL AND METHODS

Research was conducted at fish culture Research Farm of the Faculty of Marine Science in Southern Obhur, Jeddah City. Tilapia (*O. spilurus*) fingerlings, of a mean weight of about *3.5* gm were housed as 500 fish per 200 litre circular fiber glass tanks. Open water system was used to pump water from the Red Sea with flow rate of about one litre per minute (i.e. the turning over was about 3.3 L / hour). Oxygen was pumped to the experimental tanks through air pumps as to maintain oxygen concentration at a level of 5 mg per liter.

Fingerlings of the studied fish were distributed in 6 groups and they were fed for 8 weeks. The first diet (diet I) which was the

control diet contained fish meal (72% protein), minerals, vitamins, lipids, dextrin, a-cellulose and carboxymethylcellulose (binder) and the final protein content was *35%.*

Goat manure meal (GMM) was dried and chemically analysed for nutritional components. GMM was added as a substitute to fish meal in addition to the other components in diet I, to prepare diets II,III,IV and V with total protein contents of 30%, 25%, 20% and 15% respectively. Diet VI had only GMM without any other additions and contained 19.4% crude protein. Each diet was represented in three replicate tanks.

Fish were fed three times daily and the feeding rate was 5% of the total biomass of the fish. At the end of the experiment ten fish were sacrified for chemical composition of their muscles.

The specific growth rate was calculated according to the equation: $\log W_2 - \log W_1/t_2 - t_1 \times 100$

where $W_1$ and $w_2$ were the fish weights at times ti and t2 respectively. Food conversion ratio (FCR) was calculated as gin dry food fed per gm live weight gain.

Analysis of samples of fish muscles was done for moisture, protein, lipids and ash at the beginning and end of the experiment according to the method described by (El-Ghobashy,1990).

The different statistical parameters in the present study were calculated according to Snedecor and Cochran (1967).

## RESULTS AND DISCUSSION

Fish meal is considered as the main source of protein for fish feeding. However, demands and cost of fish meal increase gradually with the increase of aquaculture production throughout the world.

Many feed stuffs can be used for feeding fish. The type of feed used depends on the species of fish and the prices of available feeds (Omar *et al*,1994). In this investigation, Goat Manure Meal (GMM) was used as a partial replacement for fish meal in diets or the only source of protein for *0. spilurus.* Analysis of GMM indicated that it contains 19.4% crude proteins (Table 1).

Six diets of different protein contents were offered to *O.spilurus.* The first diet (diet I) was without the addition of GMM and had *35%* protein content. Diets II,III,IV and V contained GMM as a partial replacement to portions of fish meal and their protein

contents were 30%,25%,20% and 15% respectively. Diet VI consisted of pure GMM (Table 2).

The control diet (diet I) was formulated to contain 35% proteins because the maximum growth of tilapia can be achieved with diets containing similar percentages of proteins (Mazid *et al.*, 1979; Winfree and Stickney, 1981; Jauncy & Ross,1982). Fish were reared in circular fiber glass tanks and were fed on the experimental diets for 8 weeks. The maximum average increase in weight was found with diet I (16.4 gm). There was a reduction in growth weight with the increase in the amounts of GMM in diets (Table 3). Increase in fish weights at five diets (II, III, IV,V and VI) in relation to diet I were 75.2, 55.2, 41. 29.1 and 6.6% respectively. It is clear that fish weights decreased as the amount of GMM increase in diets.

Although diet VI contained a higher percentage of protein (19.4%) compared to diet V (15%) fish fed on it gained a lower weight (Fig 1). This may be attributed to the high percentage of fibers in GMM which might interfere with digestion of the diet (Learly and lovell, 1975). In addition, fishes do not produce cellulase enzymes in their digestive system to utilize fibers GMIVI (Jauncy and Ross, 1982). Also feeding on one source of food usually, leads to lower growth rate (Wu and Jan, 1977) because all the essential amino acids may not be available, unless more than one source of proteins is used (Mohsen and Lovell, 1990).

The effeciency of food conversion is generally quantified as the food conversion ratio (FCR), which is the weight of food required to produce unit weight gain of live fish during a determined feeding period. The lowest value of FCR (the best) was recorded (1.72) for fish fed with diet I. When GMM replacement increased in diets, the values of FCR increased. The highest value was observed when fish were fed on GMM without any other additions (Fig 2). This is consistent with the lower growth rate of *O. spilurus* fed on diets containing greater amounts of GMM. Fish fed on all diets were morphologically normal and low mortalities were recorded for fish in all the experimental tanks.

Great amounts of unconsumed food were noticed in tanks of fishes fed on diet VI (60.9%) compared to the amounts (0.7) observed when fishes were fed on diet I. The same phenomenon was also noticed with regard to the percent of faeces to total food and the percent of faeces to consumed food when the two types of diets were compared (Table 4). This may be explained on the basis that GMM

contains a high percentage of fibers as previously mentioned, and possibly GMM was not very palatable to fishes.

Chemical composition of muscles of fishes fed on different diets revealed insignificant differences in ash contents. On the other hand, although moisture and carbohydrates were higher in fishes fed on diet VI, protein and fat were lower compared to fishes fed on diet I (Fig 3). It is known that GMM contains a low amount of fats [8.81%] (Table 1), which is in agreement with the results obtained with Edwards (1980). Furthermore, Shiau *et al.* (1988) found that the increase in cellulose contents of fish feed leads to a decrease in the fat contents of fish muscles. The significant lower content of proteins in fish muscles fed on diet VI may also be attributed to the previously mentioned possibility of lack of essential amino acid. Davis *et al.*, (1990) reported that about 70% of dietary fish meal could be replaced with common animal by-products in *O.niloticus* diets. However, blood meal, for example, is deficient in lysine and methionine (Hardly, 1989). Therefore, when blood meal was used as a replacement for fish meal in tilapias diets, fish growth rate was significantly reduced (Otubusin, 1987).

Tilapia fishes are marketed at low prices and fish meal required for optimum growth is expensive. Nevertheless, the optimum dietary protein level, in terms of growth, is not necessarily optimum in economic terms. If high protein feeds are expensive, then economics may be improved at suboptimal dietary protein levels increasing the time taken for fish to reach market size, but incurring lower feed costs. The optimum economic level of dietary protein is determined, to some extent, by the relationship between feed costs, capital investment, nature of the farming operation and the level and stability of market prices (Jauncey & Ross, 1982). Reasonable weight gain of *O. spilurus* was achieved with the diet containing 19.8% of GMM as a substitution for fish meal. Therefore, we recommend the inclusion of this percent of GMM in *O.spilurus* diets.

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Table 1. Composition and total energy of Goat Manure Meal (GMM).

| **GMM** | **Contents** | | | | | |
|---|---|---|---|---|---|---|
| | Water contents | Crude protein | Lipids | Ash | Carbohydrates | Total energy calories |
| Wet | 10.8 | 17.3 | 7.86 | 13.69 | 50.34 | 4046 |
| Dry | -- | 19.4 | 8.81 | 15.35 | 56.44 | 4536 |

Table 2. Contents of the six tested diets.

| Contents | % Compositions | | | | | |
|---|---|---|---|---|---|---|
| | Diet I | Diet II | Diet III | Diet IV | Diet V | Diet VI |
| Fish meal | 48.6 | 39.1 | 29.6 | 20.0 | 10.5 | -- |
| Goat Manure | -- | 9.6 | 19.1 | 28.7 | 38.2 | 100 |
| Mineral mixtures | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | -- |
| Vitamin mixtures | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | -- |
| Lipids | 5.5 | 5.6 | 5.6 | 5.7 | 5.6 | -- |
| Carboxymethylcellulose | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | -- |
| α- Cellulose | 14.6 | 14.4 | 14.4 | 14.3 | 14.4 | -- |
| Dextrin | 24.3 | 24.3 | 24.3 | 24.3 | 24.3 | -- |
| Protein contents (%) | 35.0 | 30.0 | 25.0 | 20.0 | 15.0 | 19.4 |

Table 3. Effect of substitution of fish meal by GMM on the percentage increase in weight of fish total growth.

| Parameters | Diets | | | | | |
|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI |
| % of GMM substitution | 0 | 19.8 | 29.3 | 59.1 | 78.6 | 100 |
| % of final weights to the control | 100% | 75.2% | 55.2% | 41.0% | 29.1% | 6.6% |
| Protein content (%) | 35 | 30 | 25 | 20 | 15 | 19.4 |

Increase in weight in case of diet I was considered 100%

Table 4. Diet residues of treatments I and VI.

| food | Residual food/total food X 100 | Faeces/total Food X 100 | Faeces/consumed food X 100 |
|---|---|---|---|
| Diet I | 0.7 | 6.1 | 6.2 |
| Diet VI | 60.9 | 15.2 | 40 |

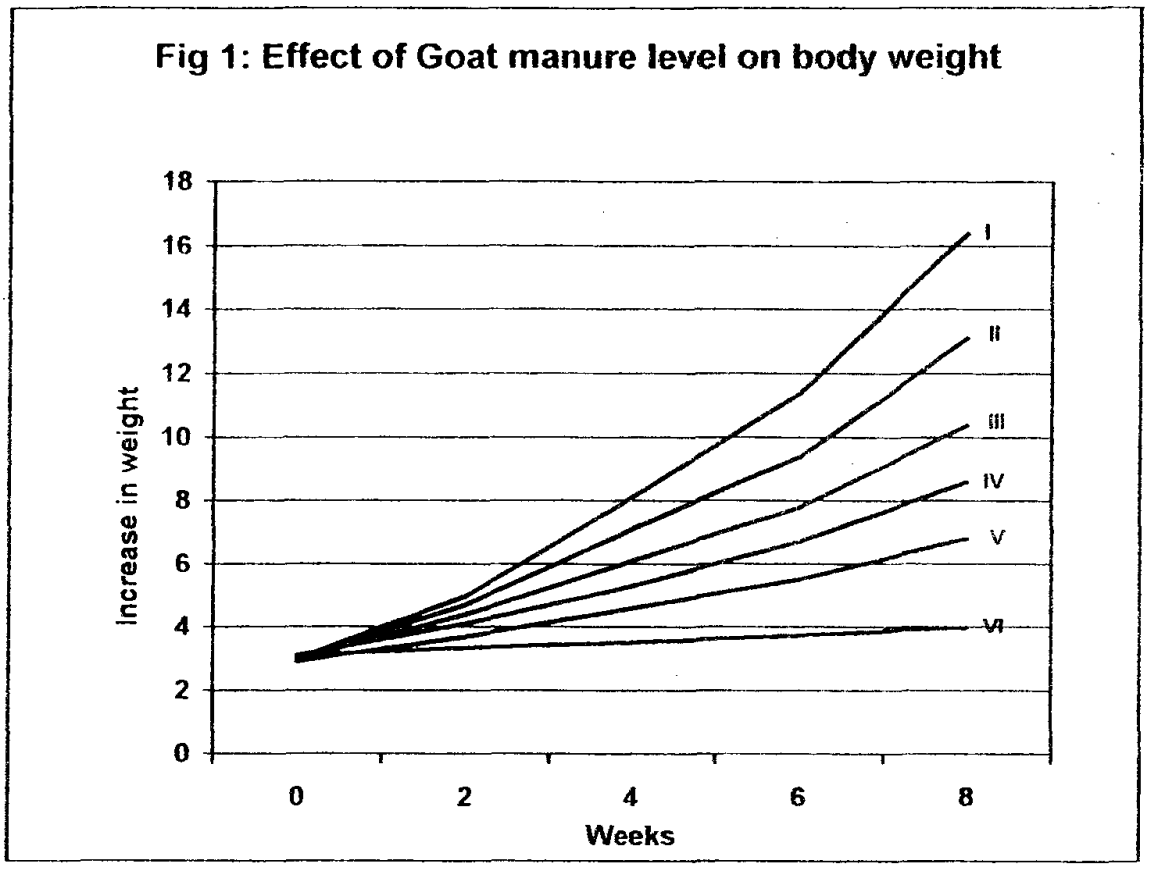


**Fig. 2: Food conversion ratio (FCR) as affected with goat manure incorporation.**

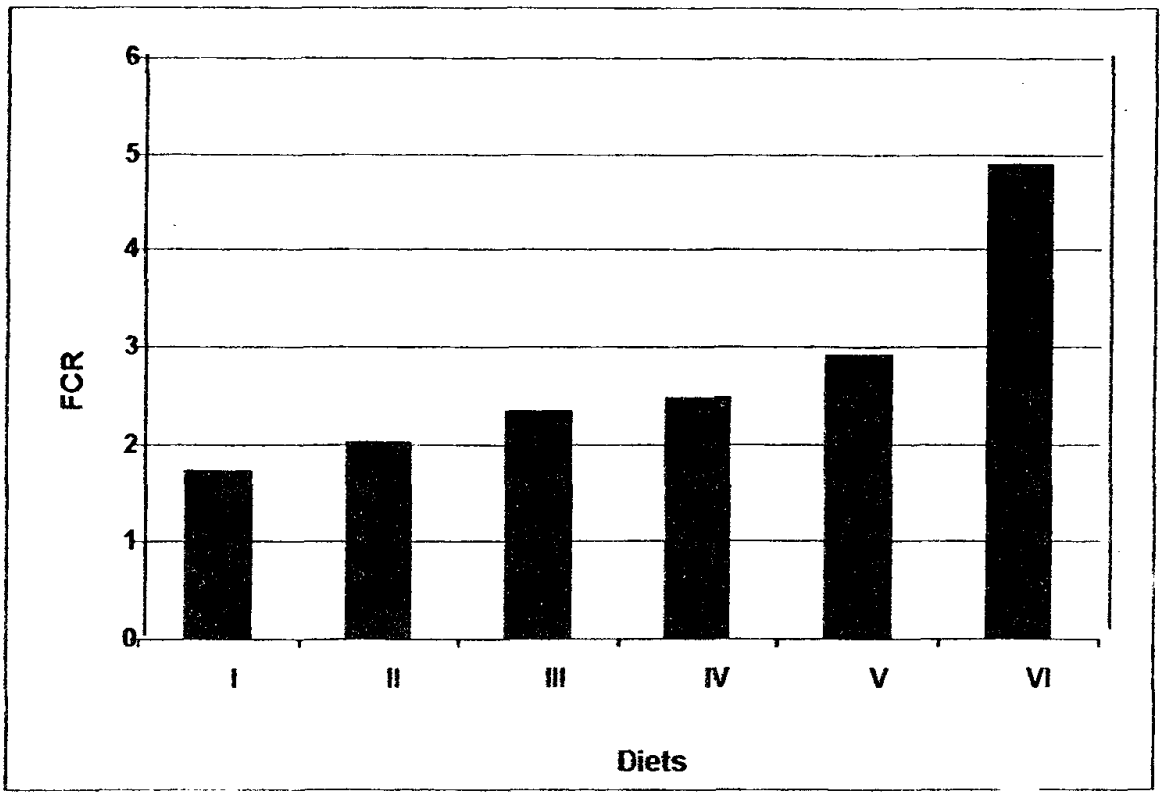

**Fig 3. Chemical composition of *O.spilurus* muscle as affected with dietary treatments**