SDRP Journal of Aquaculture, Fisheries & Fish Science (ISSN: 2575-7571)

Economic Impacts of Soybean Substitution by Guar korma in Tilapia Ration

DOI: 10.25177/JAFFS.2.1.4

Research

Received Date: 03rd Jun 2018
Accepted Date: 20th Jun 2018
Published Date:28th Jun 2018

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CONFLICTS OF INTEREST

There are no conflicts of interest for any of the authors.

CITATION

Ibrahim Ahmed, Economic Impacts of Soybean Substitution by Guar korma in Tilapia Ration(2018)SDRP Journal of Aquaculture, Fisheries & Fish Science 2(1)

Abstract

This study was carried-out to study the growth performance, feed utilization and economic efficiency of Nile tilapia fingerlings fed on different levels of Guar Korma meal replacement in tilapia ration instead of soybean meal. Fish of 10 g initial body weight were classified into 4 groups (25fingerlings /group) with 3 replicates for each. Group 1 was control group and fed on commercial diet (0% guar korma diet); group 2 fed on treated diet supplemented with 25% Guar korma meal instead of soybean meal; group 3 fed on 50% guar korma diet, and group 4 fed on 100% guar korma diet. All groups fed twice daily on the rate of about 5 % from the total weight for 10 weeks. Performance were evaluated in terms of body weight, body weight gain, specific growth rate, condition factor, total feed intake and feed conversion ratio, returns and costs due to different levels of guar korma substitution instead of soybean. The results showed significant reduction ($P < 0.01$) in all performance parameters as the level of guar korma increase in the three treated groups compared with control group. Significant difference in feed intake and feed conversion ratio (FCR) was detected among treatment groups where feed intake decrease and (FCR) increase as the level of guar korma increase. Also, there was significant difference in economic efficiency parameters, where 25% guar korma group is higher in net returns than other 50% and 100% guar korma treated group, whereas, 0% guar korma (control group) is the highest compared with other groups. Further studies could use guar korma as a replacement with enzymes to improve its performance and feed utilization.

Key words: Nile tilapia, Guar korma, growth performance, economic efficiency.

Introduction

Fish is an important source of animal protein for human consumption. In Egypt there is an increasing demand of food especially for protein sources, so, the fish cultures are intensified for facing this demand. Fish become the hope all-over the world for solving protein shortage problem. Fish culture development requires more knowledge about nutrition that increase yields with minimum costs ***(El-Sayed, 2007 and Mani et al, 2013).***

Oreochromis niloticus in Egypt is the most popular and economically important tilapia fish, and is widely cultured around the world with 12.2% annual growth rate. It represents the third largest productive group of farmed finfish species (***El-Sayed, 2007***).

Many researchers try to find substitutes of lower prices that can replace the main resources in formulation of fish ration where, the most important cost item in fish production is feed cost (***Smith et al., 2003 and Yilmaz et al., 2012***).

Guar meal is a relatively low-cost and high protein meal produced as a by-product of guar gum manufacture that considered a good source of essential amino acids. The protein content of guar meal ranges between 36-60% depending on fraction type ***(Verma and McNab, 1984 and Lee et al., 2003).***

Guar korma meal *(Cyamopsis tetragonoloba)* is obtained after processing of guar seeds and a relatively inexpensive high protein meal for animals, cattle, and poultry. Guar korma meal is used in rations to enhance the milk giving capacity in dairy animals. Guar korma meal price per protein % is lower than soybean and can be used to substitute any protein sources. Improvement of fish production industry in Egypt is one of the main objectives of private and public sectors in recent decades. Feed cost is the largest cost in fish production and accounting nearly about 60-70% of the total investment in fish industry. So, the alternatives of soybean meal SBM in fish diets considered too necessary. A partial replacement of SBM by guar meal in fish diets for decreasing feed costs may be a useful economic strategy without any negative effects on production ***(Kamran_et al., 2002 and Walaa et al., 2016***).

Use of low levels of guar meal resulted in higher carcass weight in broiler diets than that fed with higher levels of this meal. Also, It is observed that the amount of feed intake significantly decreased ($p<0.05$) when GKM level increased ***(Lee et al., 2005 and Salma et al., 2015)***.

However, body weight and feed efficiency are reduced in case of high concentrations of guar meal in chicken's diets as, the residual guar gum present in guar meal results in the increased intestinal viscosity that is responsible for reduced performance measures ***(Lee et al., 2003)***.

The feed conversion ratio was better ($p<0.05$) and improved digestibility percentages for most nutrients and feed utilization in (GKM-25) group followed by (GKM0) group than that of the (GKM-50) and (GKM-75) groups ***(Salma et al., 2015)***.

Materials and Methods

This study was conducted at department of animal husbandry and animal wealth development at faculty of veterinary medicine, Sadat City University, to study the effect of guar Korma meal replacement instead of soybean meal in Nile Tilapia diet on feed utilization, economic and productive performance parameters.

Guar korma.

The Guar korma were obtained from Faculty of agriculture, Minia University and was added to the basal diet at different levels as soybean replacement.

Table (1): Guar korma meal and Soybean meal analysis (%)

Items	Guar korma meal	Soybean meal
DM	92.5	91
Crude Protein	54.73	49
Ether Extract	2.95	3
Crud Fiber	7.16	7
Ash	4.82	7
NFE	30.34	34

Acclimatization.

Tilapia fingerlings were stocked in clean concrete pond of (3 X 1 X 1 m) dimension. The pond divided into 4 equal parts (groups) by net partitions, each net partition (nearly 30 fingerling / partition) and supplied with underground water. Fish adapted for a period of two weeks and were daily fed on the basal diet at a rate of 3% of their BWt to be adapted gradually to pelleted feed and environmental condition. The number of fingerlings per group was 25 and the average initial BWt was 10 g at the end of adaptation period. According to methods applied by ***(Shewita, 2003 and EL-Sayed, 2007).***

Environmental conditions.

During the experiment about 12 h. of natural light was available ***(Meske, 1985).*** The pond was cleaned periodically by removing the wastes in the bottom to avoid algal growth. Water samples were taken every week and the following parameters were measured:

PH value*:* The water pH value was recorded by using electric digital pH meter Orion Research model 201.

Temperature*:* Temperature of water was recorded in degree centigrade using a mercury thermometer.

Experimental design:

The effect of guar korma substitution instead of soybean in Tilapia diet and its effect on the growth performance and economic efficiency of *Oreochromis niloticus* were determined by classifying fish into 4 groups (25 fingerlings/group) with 3 replicates for each, first was control group and fed on commercial diet supplemented with soybean, and three other groups fed on treated diets supplemented with different levels of Guar korma meal that substituted the soybean meal as showed in table (2) and (3). Fish fed twice daily on the rate of about 5 % from the total weight.

Table (2): Classification of the different experimental groups

Group	Description
G1	25 Tilapia Fingerlings fed the diet contain only soybean meal for 10 weeks (control group).
G2	25 Tilapia Fingerlings received diet containing 25 % guar korma substitution for 10 weeks.
G3	25 Tilapia Fingerlings received diet containing 50 % guar korma substitution for 10 weeks.
G4	25 Tilapia Fingerlings received diet containing 100 % guar korma substitution for 10 weeks.
Water Quality	
Temperature	25 – 34°C ± 2 °C
PH value	8.1

Table (3): Composition of the different groups' diet (commercial and experimental)

Items	**Diet**			
	G1 (0%)	**G2 (25%)**	**G3 (50%)**	**G4 (100 %)**
Fish meal	10	10	10	10
Soybean meal	37	27.5	18.5	0
Guar korma	0	9.5	18.5	37
Corn meal	25	26	29	33
Wheat bran	18	17	14	10
Lin Oil	4	4	4	4
Vit. Mix	2	2	2	2
Min. Mix	1	1	1	1
CMC	3	3	3	3
Total	100	100	100	100

Measurements

1. Growth performance parameters

Body weight (BWt)

Fish were biweekly weighed as fingerlings lifted from water, allowed to drain for 30 seconds and directly transferred into container containing enough water to eliminate environmental stress. Fish weight individually recorded and then returned to the original water environment.

Body weight gain (BWt gain)

Body weight gain was calculated as the difference between two successive weights (grams).

Specific growth rate (SGR)

It was calculated according to ***Jauncy and Ross (1982)*** as follows:

$$SGR = \frac{Log_e W_2 - Log_e W_1}{T_2 - T_1} X 100$$

Where:

W1 = Weight of fish (g) at time T1 (days)

W2 = Weight of fish (g) at time T2 (days)

This gives the average percentage increase in body weight per day over a given period of time.

Body length

The whole body length (cm) measured from the anterior part of fish to the end of its tail.

Condition factor (K)

The condition factor, which relates body length to the body weight of fish and computed according to ***(Gjedrem and Gunnes, 1978)*** as follows:

$$K = \frac{\text{Body weight (gm)}}{(\text{Total length cm})^3} X 100$$

Where:

W= Body weight. L = Body length.

Feed conversion ratio (FCR)

It was calculated according to ***(Degani et al., 1986).*** It indicates the weight of feed required for producing a unit weight of fish as following:

$$FCR = \frac{\text{Feed intake (gm)}}{\text{Weight gain (gm)}}$$

2. Economic parameters.

Costs

a. Fixed costs (TFC)

It includes the costs of land and equipment depreciation value for each fish. The depreciation rate of building and equipment calculated as building within 25 year and equipment within 5 years according to ***El-Tahawy (2004)***, by the following equation:

$$\text{Depreciati on rate} = \frac{\text{Value of Asset}}{\text{Age of Asset (year)}}$$

b. Variable costs (TVC)

It includes purchased fingerlings costs and the feed costs. It was estimated per EGP during the experiment.

c. Total costs (TC)

Total cost (TC) = TFC + TVC

Returns

a. Total returns (TR)

Total return = Fish sale (according to the market price)

b. Net return

Net return = Total return - Total cost.

Statistical analysis

Data was analyzed using the computer program **SPSS/PC+(2001),** to estimate the effect of different treated groups on productive and economic efficiency parameters the statistical method used was one way ANOVA test. Data presented as mean ± SE and significance was declared at ($P < 0.01$).

Results and Discussion

Effect of soybean meal replacement by guar korma (GK) on growth performance parameters

The results of growth performance parameters in Table (4) showed that, there is a significant difference (P < 0.01) among the different three (GK) treated groups and control group on final body weight (g) of Nile tilapia. The lowest final BWt were 79.64 in group 4 fed 100 % guar korma diet and the highest final BWt were 112.59 in the group 1 (control group) that fed on the basal diet without any guar korma treatment. Whereas, the BWt for groups 2 and 3 that fed on 25 % and 50 % guar korma diets were 100.67 and 92.79 respectively.

The results of final length cleared that, there is a significant difference (P < 0.01) among different groups in its effect on final length (cm). The length ranged from 11.26 in group 4 fed 100 % guar korma diet to 11.91 in group 1 fed 0% guar korma diet. While, the final length were 11.86 and 11.83 in groups 2 and 3 fed on 25 % and 50 guar korma diet respectively.

The results of BWt gain (g) indicated that, there is a significant difference (P < 0.01) among the different 4 groups in its effect on BWt gain (g). The lower level of BWt gain were 69.63 in group 4 fed 100 % guar korma diet and the highest final BWt were 102.58 in the group 1 (control group) that fed on the diet without guar korma treatment. While, the BWt gain for 25 % and 50 % guar korma treated groups were 90.67 and 82.79 respectively. The specific growth rate results illustrated that, there is a significant difference (P < 0.01) among different 4 groups. The lower level of specific growth rate (%/day) were 0.66 in the group 4 fed 100 % guar korma and the highest level in group1(control) with 0% guar korma in the diet as were 0.76. Meanwhile, the specific growth rate in 25 % and 50 % guar korma treated groups were 0.75 and 0.73 respectively.

The results of condition factor showed that, there is a significant difference (P < 0.01) among the 4 groups in its effect on condition factor. The lowest condition factor were 1.46 in the group fed 100 % guar korma and the highest condition factor were 1.75 in control group fed 0% guar korma. While, the condition factor in 25 % and 50 % guar korma treated groups were 1.62 and 1.49 respectively. These results indicated that growth performance decrease as the level of guar korma increase than the level of soybean meal in diet and the growth parameters improved with increased soybean meal level in the diet. These results agreed with ***(Lee et al., 2006)*** as observed that the growth performance parameters decrease with increased level of guar meal in fish diet.

Effect of soybean meal replacement by guar korma (GK) on feed utilization.

The results in table (5) showed that, there is a significant difference (P < 0.01) in feed intake (g) among examined groups. The highest feed intake were 210.3 in 0% guar korma group (group 1) followed by 201.3 and 189.6 in group 2 and 3 fed on 25% and 50% guar korma diet respectively. While, the lowest feed intake were 170.6 in group 4 of 100% guar korma treated group. The results of feed conversion ratio showed a significant difference (P < 0.01) among the different groups where the higher feed conversion were 2.45 in the group fed 100% guar korma diet and the lower conversion ratio were 2.05 in 0 % guar korma group. Where, the feed conversion ratio in groups of 25 % and 50 % guar korma diet was 2.22 and 2.29 respectively.

The results of feed utilization showing a decreased level of feed intake and increased ratio of feed conversion with increased guar korma level and parameters improved with increasing level of soybean meal. This result may be owed to that fish eat high amount of feed due to palatable taste of soybean meal. The results may agree with ***Salma et al. (2015)***.

Effect of soybean meal replacement by guar korma (GK) on economic efficiency

The results in table (6) showed that, there is a significant difference of economic efficiency among different groups (P < 0.01). where, the group of 25 % guar korma replacement decrease the diet cost comparing to control group by about 26.12 (EGP) and 6.89%. Whereas, 50% guar korma replacement group decrease the cost by about 50.87 (EGP) and 13.4%, and by about 101.75 (EGP) and 26.8% in group of 100% guar korma diet. While, the difference in net return from control group were (5.66 (EGP) and 10.2%), (6.93 (EGP) and 12.49%) and (17.26 (EGP) and 31.1%) for 25%, 50% and 100% guar korma replacement groups respectively.

The results of cost and net return due to partial substitution of soybean indicated that as the substitution percent increase the costs of feed and net returns decrease as the lowest costs and return present in group 4 of 100% guar korma. From economic point of view the results indicated that, the substitution of soybean with guar korma at the level of 25 % is better than 50% and 100% substitution level where net return is higher in group 2 of 25% guar korma than group 3 and group 4 of 50% and 100% guar korma respectively. Meanwhile, the control group of 0% guar korma is the highest in net return compared to other treated groups. These results agreed with ***(Jarean, 1977 and Salma et al., 2015)*** where, concluded that lower level of soybean substitution with guar korma is better than higher levels as save the cost of the ration with higher returns.

Table (4): Effect of guar korma (GK) as a replacement on growth performance

Items	Group No.			
	G1 (0%)	G2 (25%)	G3 (50%)	G4 (100%)
Final Weight(g)	112.59 ± 0.3a	100.67 ± 0.2b	92.79 ± 0.4c	79.64 ± 0.1e
Final length (cm)	11.91 ± 0.05a	11.86 ± 0.06a	11.83 ± 0.05a	11.26 ± 0.04b
Weight gain (g)	102.58 ± 0.6a	90.67 ± 0.1b	82.79 ± 0.5c	69.63 ± 0.7e
Specific growth rate (%)	0.76± 0.02a	0.75 ± 0.03a	0.73 ± 0.01a	0.66 ± 0.02b
Condition factor	1.75 ± 0.01a	1.62 ± 0.03b	1.49 ± 0.03c	1.46 ± 0.02c

Means in the same row with different superscripts are significantly different ($p < 0.01$).

Table (5): Effect of guar korma (GK) as a replacement on feed utilization

Parameters	Group No.			
	G1 (0%)	G2 (25%)	G3 (50%)	G4 (100%)
Total Feed intake (g)	210.3 ± 0.6a	201.3 ± 0.4b	189.6 ± 0.1c	179.6 ± 0.8e
Feed conversion ratio (FCR)	2.05 ± 0.03a	2.22 ± 0.05b	2.29 ± 0.07c	2.45 ± 0.01e

Mean in the same row with different superscripts are significantly different ($p < 0.01$).

Table (6): Effect of soybean meal replacement by guar korma (GK) on economic efficiency

Items	Group No.			
	G1 (0%)	G2 (25%)	G3 (50%)	G4 (100%)
Guar korma % /100 Kg	0	9.5	18.5	37
Soybean meal % /100 Kg	37	27.5	18.5	0
Cost of guar korma (EGP)	0	71.25	138.75	277.5
Cost of soybean (EGP)	379.25	281.88	189.63	0
Difference in feed cost (EGP)	0	26.12	50.87	101.75
Decrease in feed cost (%)	0%	6.89 %	13.4 %	26.8 %
Total feed intake(Kg) /100 fish	21.03	20.13	18.96	17.96
Total cost of consumed feed (EGP) /100 fish	147.21	131.45	118.5	105.07
Weight of fish(kg) / 100 fish	11.26	10.07	9.28	7.96
Total Return (EGP) / 100 fish	202.68	181.26	167.04	143.28
Net return (EGP) / 100 fish	55.47	49.81	48.54	38.21
Difference in net return (EGP)	0	5.66	6.93	17.26
Decrease in net return (%)	0 %	10.2 %	12.49 %	31.1 %

REFERENCES

1.Degani, G., Viola, S. and Levason, D. 1986. Effects of dietary carbohydrate source on growth and body composition of the European eel (Anguilla anguilla). Aquaculture, 52: 97-107. 90029-3 View Article

2.EL-Sayed, S. A. A. 2007. Studies on the effect of some growth promoters in the diets on growth performance of tilapia nilotica. M.V.Sc thesis, Faculty of Vet. Medicine, department of nutrition and clinical nutrition. Zagazig University.

3.EL-Tahawy, A. (2004): Factors affecting the profitability of fish farms and their relation to veterinary management. M.V.Sc. "Department of Animal Husbundary" Thesis Fac. Vet. Med. Alex. University.

4.Gjedrem, T. and Gunnes, K. 1978. Comparison of growth rate in Atlantic salmon, Pink salmon, Arctic char, Sea trout and Rainbow trout under Norwegian farming condition, Aqua, 13: 135- 141. 90107-2 View Article

5.Jauncey, K. and Ross, B. 1982. A guide to Tilapia feeds and feeding. University of Stirling, institute of Aqua culture, Stirling, Scotland.

6.Kamran, M., Pasha, T.N., Mahmud, A. and Ali, Z. 2002. Effect of commercial enzyme (Natugrain) supplementation on the nutritive value and inclusion rate of guar meal in broiler rations. Int. J. Poult. Sci., 1: 167-173. View Article

7.Lee, J.T., Bailey, C.A. and Cartwright, A.L. 2003. Guar meal germ and hull fractions differently affect growth performance and intestinal viscosity of broiler chickens. Poult. Sci., 82: 1589-1595. PMid:14601737 View Article PubMed/NCBI

8.Lee, J.T., Connor-Appleton, S., Cartwright, A. and Bailey, C.A. 2005. Effects of guar meal by-product with and without β-mannanase hemicell on broiler performance. Poult. Sci., 84: 1261-1267. PMid:16156210 View Article PubMed/NCBI

9.Mani, A., Mullainathan, S., Shafir, E., and Zhao, J. 2013. Poverty Impedes Cognitive Function. Science, 341(6149):976–980. PMid:23990553 View Article PubMed/NCBI

10.Meske, C. 1985. Fish aquaculture technology and experiments. Pergamon Press, Oxford, New York, Toronto, Paris.

11.Salma H. Abu Hafsa., Basyony, M. M. and Hassan, A. A. 2015. Effect of Partial Replacement of Soybean Meal with Different Levels of Guar Korma Meal on Growth Performance, Carcass Traits and Blood Metabolites of Broiler Chickens. Asian Journal of Poultry Science, 9: 112-122. View Article

12.Shewita, R. 2003. Effect of dietary supplementation of ascorbic acid and/or vitamin E on productive performance, immune response and body composition of tilapia nilotica (Oreochromis niloticus). M.V. Sc. Thesis submitted to animal husbandry department, faculty of veterinary medicine, Alexandria University.

13.Smith S, Jacob S, Jepson M and Israel G. 2003. After the Florida Net Ban: The Impacts on Commercial Fishing Families. Soc. Nat. Resour. 16(1): 39-59 Crossref, Google Scholar. View Article

14.Spss (2001): SPSS/PC+ (2001), for the PC/XT. SPSS INC.

15.Verma, S. V. S. and McNab, J. M. (1984). Chemical, biochemical and microbiological examination of guar meal. Ind. J. Poult. Sci., 19: 165-170.

16.Walaa M. Abdel-Wahab, Salah K. Sayed, Reda A.M. Sabek, Mohamed S. Abbas and Hassan M. Sobhy, 2016. Effect of using guar korma meal as a new source of protein on productive performance of buffalos. Asian J. Anim. Sci., 10: 300-306. View Article

17.Yilmaz S., Ergun, S. and Celik, E. 2012. Effects of herbal supplements on growth performance of sea bass (Dicentrarchus labrax): change in body composition and some blood parameters. J. Biosci. Biotechnol., 1 (3), pp. 217-222