

BIOCHEMICAL STUDIES ON AQUACULTURE FISH
FED ON DIFFERENT DIETS

BY

ASMAA ALY AHMED EL KERDAWY

A thesis submitted in partial fulfilment
of
the requirements for the Degree of

631.417
A. A

DOCTOR OF PHILOSOPHY

in

(Agricultural Biochemistry)

رسالة

44673

Department of Agricultural Biochemistry
Faculty of Agriculture
Ain Shams University

1992



Approval Sheet

BIOCHEMICAL STUDIES ON AQUACULTURE FISH
FED ON DIFFERENT DIETS

BY

ASMAA ALY AHMED EL KERDAWY

B.Sc.(Agric.Biochem.),Cairo University,1974
M.Sc.(Agric. Biochem.),Ain Shams University 1985

This thesis for Ph D degree has been approved
by:

Prof. Dr. M. A. TORKI
Prof. of Agric. Biochem.,
Faculty of Agric., Moshtohor.

M.A. Torki

Prof. Dr. F.M. ABD ELNAEM
Prof. of Agric. Biochem,
Faculty of Agric., Ain Shams
University.

F.M. Abdel naem

Prof. Dr. Z. A. EL HADIDY
Prof. of Agric., Biochem.,
Faculty of Agric., Ain Shams
University.

EL-Hadidy, Z.

Date of examination : 2 / 9 / 1992.



BIOCHEMICAL STUDIES ON AQUACULTURE FISH
FED ON DIFFERENT DIETS

BY

ASMAA ALY AHMED EL KERDAWY

B.Sc.(Agric.Biochem.), Cairo University,1974
M.Sc.(Agric. Biochem.), Ain Shams University,1985

Under the Supervision of: Prof. Dr. SALWA A. EID
Prof. of Biochem. Dept.,
Faculty of Agriculture,
Ain Shams University.

Prof. Dr. Z. A. EL HADIDY
Prof. of Biochem. Dept.,
Faculty of Agriculture,
Ain Shams University.

Prof. Dr. M. A. SHATLA
Prof. of Biochem. Dept.,
Faculty of Agriculture,
Ain Shams University.

ABSTRACT

Four dry ingredients, brewer tefla, activated sludge, single cell algae, and brewer yeast were tested with Tilapia niloticus. Chemical composition, amino acid content, fatty acid content, nucleic acid content and digestibility coefficient were determined for the test ingredients. All the test ingredients were well digested, assimilation values ranging from 59.9% (activated sludge) to 94.4% (brewer yeast). Four experimental diets and the control have been prepared to reach 25% crude protein. The experimental period was 12 weeks. We found that there is a highly correlation between fat content of fish and growth $r = 0.879$, and negative correlation between ash and growth $r = -0.771$, but low correlation between protein content and growth were observed. We found that all the fish fed the experimental diets characterized by high percentage of total unsaturated fatty acids and a higher correlation between w3 fatty acids and crude fat, moisture, weight gain $r = 0.995$,

since the correlation between w6 fatty acids and the previous parameters was 0.713, Enzyme activities of fish liver tissue were studied, GOT activity was higher in fish fed diet contain algae. GPT activity did not differ significantly among treatments. We notice a highly relation between RNA/DNA concentration in tested ingredients and RNA-DNA concentration in fish muscle. Body weight increment after 12 weeks of experiments showed no significant difference between the average body weight of fish fed diet contain yeast and diet contain algae. However, there were a significant different in average body weight of fish fed diet contain brewer tefta and diet contain activated sludge.

ACKNOWLEDGEMENT

The writer is greatly indebted to Prof. Dr. SALWA A. EID, Professor of Agric. Biochemistry for her former supervision and generous valuable help throughout the promotion of this work.

My words bound no limits in its expression to Prof. Dr. EL HADIDY, Z. Professor of Agric. Biochemistry for his fruitful help, advice and constructive criticism during his supervision in connection with reading the manuscript and the final preparation of the dissertation.

Thanks are also to Dr. SHATLA, M. Professor of Agric. Biochemistry for his willings, advice, helpness during this work.

The writer could never forget the great help and efforts of Dr. AMIN M. ABD ALLAH, Professor of Food Science & Technology, Faculty of Agriculture, Ain Shams University, who provided all facilities, technical assistance and for preparing the manuscript and sincer guidance.

Deepest thanks are extended to Dr. A. KAHATTER, The director of Central Laboratory for Fish Research. Abbassa, Sharkia, for his great efforts and helpful throughout the promoting of the work.

Many thanks to Dr. DAWLAT A.S. for her available help and effort in this manuscript.

The author is especially indebted and muchly appreciated the generous assistance of her collegus of the Central Laboratory for Fish Research especially an engineering Yassir Awed and Dr. Magdy Salah, and Computer department.

C O N T E N T S

	Page
** INTRODUCTION	1
** REVIEW OF LITERATURE	5
1.1. The experimental ingredients and replacement of fish meal	5
1.2. Amino acid content of the experimental ingredients.	9
1.3. Fatty acid composition of the experimental ingredients.	11
2.1. Effect of the experimental diets on body composition	13
2.2. Effect of fatty acid composition of experimental diets on fish fatty acid.	14
2.3. Effect of dietary protein on enzymes activities of fish liver tissue	17
2.4. Effect of experimental diets on fish muscle RNA/DNA	18
2.5. Sodium dodecyl-polyacralimid gel electrophoresis.	20
3. Nutritional Parameters	22
4. Digestibility Coefficient	26
** MATERIALS AND METHODS	30
1.1. Test animals and experimental system	30

	Page
1.2. Diet preparation	32
1.3. Feeding regium	32
2. Determination of major components	33
2.1. Determination of amino acids of experi- mental ingredients.	34
2.2. Determination of fatty acid composition	40
2.3. Determination of Enzymes activity	43
2.4. Determination of DNA/RNA content	43
2.5. Polyacrylamid gel electrophoresis of muscle proteins	45
3. Nutritional Parameters	47
3.1. Body weight increament	47
3.2. Specific growth rate	47
3.3. Food conversion ratio	48
3.4. Protein efficiency ratio	48
4. Digestibility Coefficient	48
4.1. Test animals and acclimation procedures	48
4.2. Diet preparation	49
4.3. Feaces collection procedure	49
4.4. Mathematical formulation	50
4.5. Analysis of indicators substance	50
4.6. Chromic oxide analysis	50
4.7. Chromogen analysis	50

	Page
5. Statistical Analysis	52
** RESULTS AND DISCUSSION	53
PART 1: Analysis of Ingredients Used in Formulation of Fish Diets.	53
1.1. Chemical analysis of experimental ingredients	53
1.2. Amino acid content of the experimental ingredients	56
1.3. Fatty acid composition of the experimental ingredients	63
PART 2: Relation Between Diets Constituents and Selected Biochemical Properties on Nile Tilapia.	67
2.1. Effect of experimental diets on carcass composition	67
2.2. Effect of experimental diets on fatty acid composition	69
2.3. Effect of experimental diets on enzymes activity of fish liver tissue.	78
2.4. Effect of the experimental diets on fish muscle DNA/RNA concentration.	91
PART 3: Nutritional Parameters	100
3.1. Weekly body weight gain %	102
3.2. Specific growth rate	104

	Page
3.3. Final weight gains	106
3.4. Feed conversion and protein efficiency	108
PART 4: Digestibility Coefficient for the Experimental Ingredients.	111
** SUMMARY	115
** CONCLUSION	122
** REFERENCES	123
** APPENDIX	139
** ARABIC SUMMARY	-

LIST OF TABLES

No.	Title	Page
1	Ingredients composition (%) of the experimental diets.	35
2	The chemical analysis of the experimental diets (% on dry basis).	36
3	The proximate analysis of some ingredients used in feeding formulation for fish.	54
4	Mineral content of some ingredients used in feed formulation for fish.(% of ash).	55
5	Amino acid profile of the experimental ingredients. (Percent %)	58
6	Fatty acids composition (as % total fatty acid weight) of experimental ingredients lipids.	64
7	Chemical analysis of whole fish, oreochromis niloticus after feeding on the experimental diets.(% Based on dry matter).	68
8	Fatty acid composition (as % total fatty acid weight of carcass lipids of Oreochromis niloticus fed different diets.	70
9	Comparison between w3 and w6 of the Tilapia fish and the experimental ingredients.	73

No.	Title	Page
10	Relation between w3/w3 and w6/w6 of the tilapia fish in relation to the experimental ingredients.	75
11	Changes of GOT, GPT and Alkaline phosphatase activities as affected by different diets.	80
12	The relation between enzymes activity and growth,protein efficiency,and feed conversion.	87
13	Effect of the experimental ingredients on fish muscle DNA-p-RNA-p concentration of nile tilapia. (mg/100 g).	92
14	Molecular weight of water soluble muscle protein of fish fed the experimental diets.	97
15	Percentage weight gain for fish fed the experimental diets.	103
16	Specific growth rate percentage for <u>Oreochromis niloticus</u> fed the experimental diets.	105
17	Feed conversion ratio, feed efficiency ratio and protein efficiency ratio for fish fed the experimental diets.	107

No.	Title	Page
18	Crude protein digestability coefficient of the experimental ingredients for <u>Oreochromis niloticus</u> .	112

LIST OF FIGURES

No.	Title	Page
		55
1	Amino acid profile of the experimental ingredients %	59
2	Amino acid profile of the experimental ingredients %	60
3	Amino acid profile of the experimental ingredients %	61
4	Relation between w3 of the fish and w3 of the ingredients	76
5	Relation between w6 of the fish and w6 of the ingredients	77
6	Changes of GOT activities as affected by different diets.	81
7	Changes of GPT activities as affected by different diets.	82
8	Changes of Alkaline phosphatase activities as affected by different diets.	83
9	Regression of gain weight on alkaline phosphatase.	91