ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

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International Journal of Poultry Science 5 (2): 142-148, 2006
ISSN 1682-8356

Use of Artemia Meal as a Protein Supplement in Broiler Diet

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Abstract: Different levels of protein from two kind of Artemia meal include Artemia meal from Urmia lake and Artemia meal from earth ponds beside Urmia lake with levels of 0, 25, 50, 75, 100 percent replaced to prue fish meal protein. The experimental design was completely randomized with factorial method, include 10 treatments and 3 repetitions that in each repetition there were 10 one day-old male broilers from Ross 308 strain. This experiment was performed in 7 weeks and during and end of it, traits that related to broiler performance and carcass, was measured and analyzed. Results showed that effect of kind of Artemia meal and effect of level of protein replacement wasn't significant for feed intake. But interaction between this two was significant for this trait ($P<0.05$). The highest feed intake belong to Urmia lake Artemia meal treatment with 50% level of replacement and the lowest feed intake related to treatment of without Artemia meal (contain 5% fish meal). For body weight gain and feed conversion ratio, effect of kind of Artemia meal and effect of level of protein replacement and effect of interaction between this two weren't significant. These effects weren't significant for all dressing traits and gastro intestinal parts exception for femur percent that treatment of without Artemia meal (contain 5% fish meal) had a lowest percent to comparison with other treatments for this traits.

Key words: Artemia meal, broiler diet, fish meal, carcass traits

Introduction

A considerable amount of poultry diet is include protein ingredients. This proteins to make available by animal or plant origins resources. Three main resources of protein in poultry diets are included : oil seed meals, animal by-products meals and fish meal (Elwell and Soares, 1975; Gilbert, 2002).

In comparison to plant proteins, animal proteins have more benefits. The current resources of animal protein in poultry nutrition are : fish meal, poultry by-products and meat and bone meal (Lavens and Sorgeloos, 1996; Parsons, 1999).

In spite of superiority of animal proteins as compared with plant proteins, usage of some resources like meat and bone meal maybe restricted, because have salmonella pollution. Another problems that produce by use of fish meal deterioration include, decrease of broiler meat and eggs quality and gizzard erosion. If will not apply suitable temperature in process of fish meal production, thiaminase will remains in supplies and produce dangerous effects. Under condition of feed ingredients deposition before usage by animal, thiaminase will decrease thiamin level. Furthermore existence of trimethylamine in fish meal, causes unpalatable taste and odor in meat and egg that have produced. This situation will more observe when birds unable to produce enough trimethylamine oxidase for elimination of trimethylamine (Klasing, 1998; Leeson and Summers, 2001).

On the other hand, high temperature for assurance of processing of poultry by products, meat and bone meal and fish meal, perhaps will damage some amino acids and will decrease bioavailability of them (Johnson *et al.*, 1998; Leeson and Summers, 2001; Parsons, 1999; Shirley and Parsons, 2000).

Therefore we can use other animal resources in poultry nutrition. The climate of Iran is warm and dry, and this country has plentiful salt ponds and one of the biggest salt lake is Urmia lake. So there is suitable potential for artemia production in Iran.

Today in Iran after hatching of artemia cysts, larvae (nauplii) produce as a valuable feed resource in feeding of shrimp and sturgeon, but there isn't production of artemia biomass as expanded as.

Wouters *et al.* (2001) showed that feeding of artemia biomass increase activity of ovaries, number of fish cysts and quality of fish larvae.

In other experiment that performed by African cat fish, results showed when larvae eat diet contain just artemia, it has a better performance in comparison use of artemia with other ingredients in complex diet (Lavens and Sorgeloos,1996).

Ras *et al.* (2002) in a nutritional experiment, had replacement fish meal by sun cured artemia meal on one-day old broilers during 9 weeks. Diets included fish meal and other contain 2.5, 5, 7.5 and 10 percent of artemia meal. Results showed that mean of broilers weight with 2.5, 5, 7.5 percent of artemia had significant

Table 1: Ingredients of experimental diets in starting period

	Diets									
Ingredients	1	2	3	4	5	6	7	8	9	10
Corn	64.28	63.25	62.22	61.18	60.15	64.28	62.80	61.33	59.86	58.39
Soybean meal	27.67	27.86	28.05	28.24	28.43	27.67	27.94	28.22	28.49	28.77
Fish meal	5.00	3.75	2.50	1.25	-	5.00	3.75	2.50	1.25	-
ULAM	-	2.11	4.21	6.32	8.43	-	-	-	-	-
EPAM	-	-	-	-	-	-	2.15	4.31	6.46	8.61
Sunflower oil	0.01	0.04	0.08	0.12	0.16	0.01	0.28	0.55	0.82	1.09
Common salt	0.34	0.30	0.26	0.22	0.18	0.34	0.31	0.28	0.25	0.23
DCP	0.90	0.94	0.98	1.02	1.06	0.90	0.98	1.05	1.13	1.20
Oyster shell	1.20	1.14	1.08	1.02	0.95	1.20	1.17	1.139	1.11	1.08
Mineral premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.11	0.11	0.12	0.13	0.14	0.11	0.11	0.12	0.13	0.14
ME (kcal/kg)	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
Crude protein %	20.84	20.84	20.84	20.84	20.84	20.84	20.84	20.84	20.84	20.84
Crude fiber %	3.39	3.44	3.5	3.54	3.6	3.39	3.4	3.42	3.43	3.44
Calcium %	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
a.P %	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
Na %	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Ca/P	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22
ME/CP	139	139	139	139	139	139	139	139	139	139
Met %	0.45	0.45	0.47	0.47	0.46	0.49	0.48	0.48	0.47	0.46
Lys %	1.16	1.16	1.17	1.17	1.17	1.16	1.16	1.17	1.17	1.18
Met+Cys %	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Arg %	1.3	1.3	1.29	1.29	1.28	1.3	1.3	1.29	1.29	1.29
His %	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Leu %	1.82	1.83	1.83	1.83	1.83	1.83	1.84	1.85	1.86	1.86
Ile %	0.88	0.88	0.89	0.9	0.9	0.88	0.89	0.9	0.9	0.9
Thr %	0.8	0.81	0.81	0.81	0.82	0.8	0.8	0.81	0.81	0.81
Trp %	0.28	0.32	0.36	0.4	0.44	0.28	0.32	0.36	0.4	0.44
Val %	1	1	1.01	1.01	1.02	1	1.01	1.01	1.02	1.02
Phe %	0.95	0.96	0.98	0.99	1	0.95	0.97	0.98	1	1.02

difference in comparison with 10% artemia. There was significant differences between treatments from standpoint of feed intake and feed conversion ratio ($P<0.05$). This researchers had pointed that can use artemia or brine shrimp as a feed ingredients with high level of energy and protein in poultry nutrition (Ras *et al.*, 2002).

The goal of this research is use new feed ingredient with animal origin in poultry nutrition that not only produce a lot of need of protein in diet, but also decrease some problems that maybe produce by other protein resources.

Materials and Methods

This experiment had performed in Iranian animal science research institute in 2003. Two kind of artemia meal include Urmia Lake Artemia Meal(ULAM) and Earth Pond Artemia Meal(EPAM)was replaced in 5 levels of protein (0,25,50,75,100% of replacing) instead of peru fish meal proteins and broiler performance was measured. Therefore there were 10 treatments with 3 repetitions and each repetition included 10 one-day old male broiler from 308 Ross strain. The experiment was performed for 7 weeks and during it, traits relating to broiler performances measured and analyzed. First supposed that practical standard broiler diets had 5 percent fish meal, so protein amount of this fish meal were account and then different levels of artemia protein in two kind of artemia include: 0, 25, 50, 75, 100 percent replaced to that fish meal protein.

Diets were isoenergitic and isonitrogenous in each phase of feeding. Diets formulated according to nutrients requirements of poultry (1994) with use of UFFDA software (National Research Council, 1994) (Table 1 to 3).

For mixing of diets first small ingredients and sunflower oil were mixed with corn. Then all ingredients were mixed together. Diet for each treatment put into the pail and number of treatment and repetition marked on the pail.

Traits that measured include as follow : feed intake(gm), weight gain(gm), feed conversion ratio, mortality (%), carcass traits, abdominal fat (%), percent relating to weight of pancreases, small intestine, liver, heart, spleen that measured at the end of each week or end of experiment.

Mortality were very few in number and so this trait were not analyzed.

Table 2: Ingredients of experimental diets in growing period

	Diets									
Ingredients	1	2	3	4	5	6	7	8	9	10
Corn	70.297	69.266	68.234	67.204	66.174	70.297	68.825	67.352	65.881	64.409
Soybean meal	21.864	22.050	22.245	22.432	22.609	21.864	22.141	22.409	22.686	22.953
Fish meal	5	3.750	2.500	1.250	-	5	3.750	2.500	1.250	-
ULAM	-	2.110	4.210	6.320	8.430	-	-	-	-	-
EPAM	-	-	-	-	-	-	2.150	4.310	6.460	8.610
Sunflower oil	0.297	0.334	0.372	0.409	0.448	0.297	0.567	0.840	1.107	1.379
Common salt	0.241	0.202	0.163	0.124	0.084	0.241	0.213	0.183	0.157	0.129
DCP	0.516	0.556	0.597	0.638	0.678	0.516	0.592	0.667	0.743	0.818
Oyster shell	1.266	1.205	1.144	1.082	1.021	1.266	1.236	1.205	1.175	1.145
Mineral premix	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Vitamin premix	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
DL-Methionine	0.019	0.027	0.035	0.041	0.056	0.019	0.026	0.034	0.041	0.057
ME (kcal/kg)	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Crude protein %	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
Crude fiber %	3.12	3.17	3.22	3.27	3.32	3.12	3.13	3.14	3.16	3.17
Calcium%	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
a.P %	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Na %	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Ca/P	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52
ME/CP	160	160	160	160	160	160	160	160	160	160
Met %	0.38	0.37	0.36	0.36	0.36	0.38	0.37	0.36	0.36	0.36
Lys %	1.02	1.03	1.03	1.03	1.03	1.02	1.03	1.03	1.03	1.04
Met+Cys %	0.68	0.68	0.68	0.68	0.69	0.68	0.68	0.68	0.68	0.69
Arg %	1.14	1.14	1.13	1.13	1.12	1.14	1.14	1.14	1.13	1.13
His %	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Leu %	1.69	1.69	1.7	1.7	1.7	1.69	1.7	1.7	1.72	1.73
Ile %	0.79	0.79	0.8	0.81	0.81	0.79	0.8	0.81	0.82	0.83
Thr %	0.72	0.72	0.73	0.73	0.74	0.72	0.72	0.72	0.73	0.73
Trp %	0.24	0.28	0.32	0.36	0.4	0.24	0.28	0.32	0.36	0.4
Val %	0.91	0.91	0.91	0.92	0.92	0.91	0.91	0.92	0.92	0.92
Phe %	0.85	0.86	0.86	0.89	0.9	0.85	0.86	0.88	0.9	0.92

The experimental design was completely randomized design (CRD) with factorial method include(A*B=2*5) that A was kind of artemia and B was levels of protein replacement in diet. Data were analyzed with SAS software procedure. Means were compared with Duncan multiple range test.

Results

The comparison of feed intake showed in Table 4. From standpoint of this trait effect of kind of artemia and effect of level of replacement didn't show significant difference in starting period. But reciprocal effect of artemia and level of replacing was significant($P<0.05$). The highest feed intake belong to treatment of third (ULAM with 50% of replacing).

In growing and finishing period, effect of kind of artemia, effect of level of replacing and reciprocal effect of this two weren't significant (Table 4).

In total period, effect of kind of artemia and effect of level of replacing, from standpoint of feed intake, weren't significant. But there was significant difference for their reciprocal effect ($P<0.05$). The highest feed intake belong to ULAM (in 50%level) and the lowest depend to without ULAM treatment(5%fish meal).

From standpoint of weight gain in starter and finisher period, all effects weren't significant (Table 5). But effect of kind of artemia was significant in growing period ($P<0.05$). In this manner EPAM has a higher weight gain in comparison with ULAM. In total period all effects weren't significant for this trait. Anyway EPAM had a little more weight gain(level of 25%).

From stand point of feed conversion ratio all effects weren't significant in starting period.

In growing period, effect of kind of artemia showed significant difference for this trait ($P<0.05$) and EPAM had a lower FCR in comparison with ULAM. But in this stage, effect of level of replacing and reciprocal effect hadn't significant difference. In finishing period only level of replacing was significant for this trait and level of 75% had the most level and in total period all effects hadn't significant difference (Table 6). Anyway treatments with different level of EPAM had a better FCR in comparison with ULAM.

There wasn't significant difference from stand point of carcass traits and GI parts exception for femur percent (Table 7).

Table 3: Ingredients of experimental diets in finishing period

	Diets									
Ingredients	1	2	3	4	5	6	7	8	9	10
Corn	73.32	72.29	71.26	70.23	69.20	73.32	71.85	70.37	68.90	67.43
Soybean meal	18.32	18.52	18.73	18.91	19.09	18.32	18.61	18.90	19.16	19.43
Fish meal	5	3.75	2.50	1.25	-	5	3.75	2.50	1.25	-
ULAM	-	2.11	4.21	6.32	8.43	-	-	-	-	-
EPAM	-	-	-	-	-	-	2.15	4.31	6.46	8.61
Sunflower oil	1.11	1.14	1.18	1.21	1.25	1.11	1.37	1.64	1.91	2.18
Common salt	0.17	0.13	0.09	0.05	0.02	0.17	0.14	0.12	0.09	0.06
DCP	0.34	0.38	0.42	0.46	0.50	0.34	0.41	0.49	0.57	0.64
Oyster shell	1.24	1.18	1.12	1.06	0.99	1.24	1.21	1.18	1.15	1.12
Mineral premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DL-Methionine	-	-	-	0.01	0.03	-	-	-	0.01	0.03
ME (kcal/kg)	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100
Crude protein %	17.44	17.44	17.44	17.44	17.44	17.44	17.44	17.44	17.44	17.44
Crude fiber %	2.94	2.99	3.4	3.09	3.14	2.94	2.95	2.96	2.98	3
Calcium %	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
a.P %	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Na %	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Ca/P	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67
ME/CP	178	178	178	178	178	178	178	178	178	178
Met %	0.34	0.33	0.31	0.31	0.31	0.34	0.33	0.31	0.31	0.31
Lys %	0.94	0.94	0.94	0.94	0.95	0.94	0.94	0.94	0.95	0.95
Met+Cys %	0.63	0.62	0.61	0.62	0.62	0.63	0.62	0.61	0.62	0.62
Arg %	1.04	1.04	1.03	1.03	1.02	1.04	1.04	1.04	1.03	1.03
His %	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Leu %	1.06	1.61	1.61	1.61	1.61	1.61	1.61	1.62	1.63	1.64
Ile %	0.72	0.73	0.74	0.74	0.75	0.73	0.74	0.75	0.76	0.77
Thr %	0.67	0.67	0.68	0.68	0.68	0.67	0.67	0.67	0.67	0.67
Trp %	0.22	0.26	0.3	0.33	0.37	0.22	0.26	0.3	0.34	0.38
Val %	0.85	0.85	0.85	0.86	0.86	0.85	0.85	0.85	0.86	0.86
Phe %	0.78	0.8	0.81	0.83	0.84	0.78	0.8	0.82	0.83	0.85

Discussion

Increase of feed intake in some of treatments containing ULAM in starting period is about due to high amount of crude fiber in those to EPAM, because in this stage gastrointestinal tract of chick is sensitive to this high level of crude fiber. In growing period, effect of kind of artemia, effect of level of replacing and reciprocal effect between two weren't significant. In other words replacing of two kind of artemia meal in different level instead of fish meal didn't establishment significant difference between treatments and with increase age and developing GI, chicks didn't show sensitive to increase of crude fiber.

This results opposite with outcomes from Ras *et al.* (2002). They didn't observed any significant difference between different level of sun cured Urmia lake artemia meal instead of fish meal for feed intake (Ras *et al.*, 2002).

Another reason is isocaloric diets that caused approximately same levels of feed intake between treatments.

In finishing period, like growing period, all effects for feed intake weren't significant and GI was able to digestion and absorption of different levels of ULAM and EPAM without increase in feed intake.

In starting period all effects weren't significant for weight gain. This due to balancing of diets with same ME and crude protein. Results from this point similar to Escalona *et al.* (1986). They didn't observe any difference from chick weight gain in starting period when added 5% of poultry by-products meal to practical diets include corn and soybean meal that those diets were isocaloric and isonitrogenous.

But all treatments include artemia meal have high weight as compared with reference diet (without artemia treatment). This results are conform to Ras *et al.* (2002). They obtained high meaning weight of broiler chicks that had eaten 2.5, 5, 7.5 percent of artemia meal as compared with other treatments (Ras et al., 2002).

In growing period only effect of kind of artemia meal has been significant ($P<0.05$) and EPAM had higher weight gain as compared with ULAM. Cause of this different due to more crude fiber of ULAM than EPAM that showed itself in this stage of growth.

In a experiment Zuprizal *et al.* (1992) examinated correlation between age and sex on the protein digestibility and showed digestibility reduced with growing of chicks from 3 to 6 weeks of age (growing

Table 4: Comparison of feed intake means(gm)

Treatments	Starter	Grower	Finisher	Total
Kind of artemia :				
ULAM	687.13	2645.07	1210.13[b]	4542.33
EPAM	685.53	2665.53	1261.13[a]	4612.27
Level of replacing of fish meal protein:				
0%	648.33	2600.17	1225.53	4474
25%	681.5	2669	1259.33	4609.83
50%	740	2757.33	1239.5	4736.83
75%	685.83	2619.5	1228.5	4533.83
100%	676.17	2630.5	1225.33	4532
Kind of Artemia * level of replacing of fish meal protein:				
ULAM in level of 0%	652.70[b]	2553	1145.3	4351.00[b]
ULAM in level of 25%	651.00[b]	2564.7	1219	4434.70[b]
ULAM in level of 50%	815.70[a]	2913.3	1248	4977.00[a]
ULAM in level of 75%	679.70[b]	2567.3	1220.7	4467.70[b]
ULAM in level of 100%	636.70[b]	2627	1217.7	4481.30[b]
EPAM in level of 0%	644.00[b]	2647.3	1305.7	4597.00[ab]
EPAM in level of 25%	712.00[ab]	2773.3	1299.7	4785.00[ab]
EPAM in level of 50%	664.30[b]	2601.3	1231	4496.70[b]
EPAM in level of 75%	692.00[b]	2671.7	1236.3	4600.00[ab]
EPAM in level of 100%	715.70[ab]	2634	1233	4582.70[ab]

Means within the same column with different alphabets differ significantly at ($p<0.05$)

Table 5: Comparison of weight gain means (gm)

Treatments	Starter	Grower	Finisher	Total
Kind of artemia :				
ULAM	371.33	1240.33 b	514.73	2126.4
EPAM	386.13	1314.67a	527.33	2210.13
Level of replacing of fish meal protein:				
0%	335	1274.83	529.83	2139.67
25%	378.33	1303.83	533.5	2215.67
50%	369	1269.83	512.17	2151
75%	389	1250.83	479	2118.83
100%	377.33	1288.17	550.67	2216.17
Kind of Artemia * level of replacing of fish meal protein:				
ULAM in level of 0%	328.67	1192.67	500	2021.33
ULAM in level of 25%	376.67	1249.33	515.33	2141.33
ULAM in level of 50%	388.67	1286.67	514.33	2189.67
ULAM in level of 75%	386	1215.67	502.33	2104
ULAM in level of 100%	376.67	1257.33	541.67	2175.67
EPAM in level of 0%	341.33	1357	559.67	2258
EPAM in level of 25%	380	1358.33	551.67	2290
EPAM in level of 50%	349.33	1253	510	2112.33
EPAM in level of 75%	392	1286	455.67	2133.67
EPAM in level of 100%	378	1319	559.67	2256.67

Means within the same column with different alphabets differ significantly at ($p<0.05$)

period). This is maybe one of the reason that with increase of growth, FCR increase. In this experiment due to high amount of crude fiber in ULAM as compared with EPAM digestibility in ULAM reduced and weight gain decreased.

In most case as noticed, weight gain of levels of artemia, is more than reference diet. For confirmation of this results, some investigators reported suitable effect of adding of artemia to animal diet from standpoint of weight gain (Abatzopoulos *et al.*, 2002; Lavens and Sorgeloos, 1996).

Ras *et al.* (2002) showed in total period, meaning weight of broiler chicks that fed artemia with levels of 2.5, 5, 7.5 percent was more than treatment include fish meal.

Despite of insignificant FCR trait in some artemia meal treatments, this trait became better than fish meal

Table 6: Comparison of feed conversion ratio means

Treatments	Starter	Grower	Finisher	Total
Kind of artemia:				
ULAM	1.86	2.14a	2.36	2.14
EPAM	1.87	2.03b	2.42	2.09
Level of replacing of fish meal protein				
0%	1.94	2.06	2.32 b	2.1
25%	1.82	2.05	2.37b	2.08
50%	2.01	2.17	2.43ab	2.2
75%	1.76	2.1	2.58a	2.14
100%	1.75	2.04	2.23b	2.05
Kind of Artemia * level of replacing of fish meal protein:				
ULAM in level of 0%	1.99	2.16	2.3	2.16
ULAM in level of 25%	1.75	2.06	2.37	2.07
ULAM in level of 50%	2.11	2.27	2.43	2.28
ULAM in level of 75%	1.76	2.11	2.44	2.12
ULAM in level of 100%	1.69	2.09	2.25	2.06
EPAM in level of 0%	1.89	1.96	2.35	2.04
EPAM in level of 25%	1.88	2.05	2.37	2.09
EPAM in level of 50%	1.91	2.08	2.42	2.13
EPAM in level of 75%	1.77	2.08	2.73	2.16
EPAM in level of 100%	1.91	2	2.22	2.03

Means within the same column with different alphabets differ significantly at ($p<0.05$)

Table 7: Comparison of carcass traits and GI means

Treatment	Carcass Yield%	leg to carcass	Breast to carcass	Liver %	Heart %	spleen %	intestine %	abdom-inal Fat	Pancr-ease%
Kind of artemia :									
ULAM	61.6	31.35	32.22	2.08	0.54	0.16	4.62	1.24	0.075
EPAM	61.8	31.03	32.85	2.1	0.55	0.17	4.72	1.28	0.08
Level of replacing of fishmeal protein:									
0%	0.18	0.53	2.32	32.55	30.44	61.45	4.66	1.32	0.071
25%	31.56	61.71	32.88	2.14	0.54	0.17	4.89	1.33	0.089
50%	31.55	31.53	61.83	2.07	0.51	0.17	4.43	1.36	0.078
75%	32.88	30.9	62.22	1.93	0.57	0.15	4.86	1.2	0.085
100%	31.79	31.49	61.27	2.08	0.56	0.17	4.49	1.11	0.066
Kind of Artemia * level of replacing of fish meal protein:									
ULAM in level of 0%	4.33	0.17	0.54	2.16	30.74	31.51^{a}	61.58	1.34	0.07
ULAM in level of 25%	60.88	31.93	32.24^{a}	2.14	0.53	0.16	4.91	1.24	0.094
ULAM in level of 50%	62.36	32.52	30.64^{ab}	2.15	0.51	0.17	4.32	1.27	0.073
ULAM in level of 75%	62.6	33.47	31.18^{ab}	1.91	0.56	0.12	4.85	1.21	0.073
ULAM in level of 100%	60.57	32.43	31.16^{ab}	2.05	0.56	0.18	4.68	1.14	0.064
EPAM in level of 0%	61.32	34.37	29.38^{b}	2.3	0.51	0.18	4.99	1.29	0.072
EPAM in level of 25%	62.54	33.84	30.89^{ab}	2.14	0.56	0.18	4.88	1.41	0.083
EPAM in level of 50%	61.3	30.58	32.42^{a}	2	0.52	0.17	4.55	1.46	0.083
EPAM in level of 75%	61.85	34.3	30.62^{ab}	1.96	0.59	0.17	4.87	1.19	0.096
EPAM in level of 100%	61.98	31.15	31.82^{a}	2.12	0.15	0.56	4.29	1.08	0.067

Means within the same column with different alphabets differ significantly at ($p<0.05$)

treatment. The best FCR belong to ULAM (in 100% replacing). Results from this stage of experiment showed that at the beginning of broiler growth, replacement of artemia meal, instead of fish meal 'entirely' not only doesn't have any negative effect but also it become better than fish meal treatment. Ras *et al.* (2002) in their experiment showed that can use artemia or brine shrimp as a suitable ingredient with high energy and protein in poultry diet.

In growing period only effect of artemia had significant and EPAM as compared with ULAM had better FCR. Significance of different levels of replacing in finishing period hasn't logical process, and as you see in this stage, FCR increase up to 75% of replacing but all at once decreased in 100% of replacing. Thus judging and explanation in this circumstance will become difficult. One of the reason of this problem perhaps will be shorten of finishing stage (only one week) and information only were gathered and analyzed all at once. If number of weeks in this stage was two or

three, perhaps we could have better judgment in this field.

In total period all effects didn't significant for FCR. In spite of this, EPAM had some lower FCR from ULAM. Between the ten treatments EPAM in 100% level of replacing had lowest FCR and ULAM in 50% level of replacing had the most FCR in total period.

Results showed that replacing of artemia meal instead of fish meal as completely even had better FCR in broiler.

Result from this research was adverse to Ras *et al.* (2002). They showed that there was significant difference between different levels of replacing of artemia meal in broiler diets (Ras *et al.*, 2002).

In our research this replacing hadn't negative effects on all dressing traits and GI parts, exception for femur percent that treatment of without artemia meal (contain 5% fish meal) had a lowest percent to comparison with other treatments for this traits.

Acknowledgment

We offer our thanks to chairman, vice president and personals of Karaj Islamic Azad University, Iranian Animal Science Research Institute, Iranian fisheries Research Organization and Iranian Artemia Research Center, that had bring this research possibilities.

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