EFFECTS OF FATTY ACID AND VITAMIN C ENRICHMENT ON THE NUTRITIVE VALUE OF *Artemia urmiana* NAUPLII FOR PERSIAN STURGEON (*Acipenser persicus*) LARVICULTURE

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Introduction

For restocking the sturgeon larvae (anadromus species) in the Caspian sea, the improvement of the biochemical composition and vitamin C content of fish larvae is a current practice to evaluate its salinity tolerance under the sea water condition (~12 ppt salinity). The present work intends to determine the effects of the bio encapsulation of Artemia urmiana nauplii with highly unsaturated fatty acids (HUFA) supplemented with vitamin C AP) on larviculture of Persian Sturgeon Acipenser persicus larvae .

Materials and methods

The larvae were reared in a semi-closed circuit as described by Pousao-Ferreira and Silva (1989), and fed with *Artemia urmiana* nauplii unenriched from the first feeding stage to 5th day. The actual feeding experiments lasted from day 5 to day 20 when the larvae were fed with bio encapsulated Artemia nauplii. Two oil sources, ICES30/4c and Sturgeon ovary oil three vitamin C levels(10, 20 and 30%) during two enrichment periods(12 and 24 h) were tested.

At day 20 (after 1 day of starvation) the larvae were collected for chemical analysis and compared with the bio encapsulated Artemia. The HUFA were determined by the methods described by Bligh and Dyer (1959) and Metcalfe and Schmitz (1961) using liquid-gas chromatography. The salinity tolerance were measured in 6, 12 18 ppt at 1,2,4 to 120 h using the survival percentage.

The experiments were carried out in three replicates and results analyzed by three factor factorial ANOVA. Data were normalized by an arc-sine%p transformation (Sokal and Rohlf, 1981) and significant differences determined by a Tukey multiple comparison tests, using SPSS, Ver. 14.

Results and discussion

The results show that the total amounts of (n-3) long chain fatty acids (C>20) were significantly different in all treatments mainly due to the DHA/EPA ratio (Fig. 1). The ration (n-3)/(n-6) was significantly different, with a higher level of (n-6) HUFA in the larvae fed the *ICES30/4c*-enriched treatment (Fig. 2)

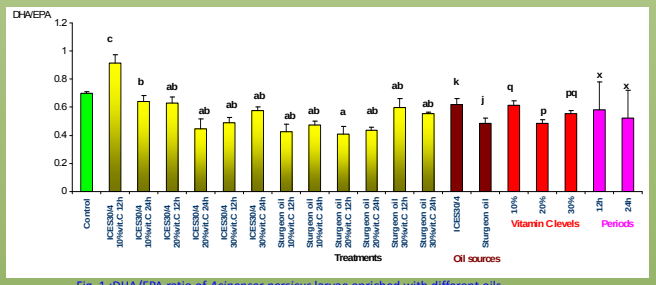

Fig. 1 :DHA/EPA ratio of *Acipenser persicus* larvae enriched with different oils, vitamin C levels at 12, 24 h enrichment periods. Mean within the grouping followed by the different letters show statistically different (P<0.05).

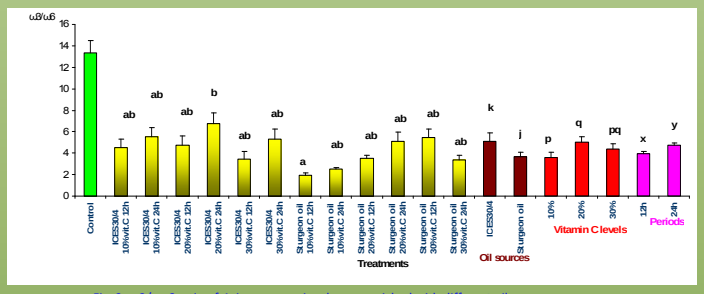

Fig. 2 ω-3/ ω-6 ratio of *Acipenser persicus* larvae enriched with different oils, vitamin C levels at 12, 24 h enrichment periods. Mean within the grouping followed by the different letters show statistically different (P<0.05).

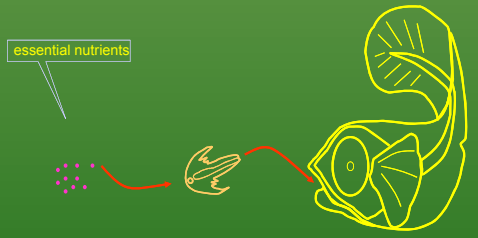

Table 1. Protein, lipid, vitamin C and fatty acids compositions of Persian sturgeon larvae enriched with different oils, effects of different vitamin C levels(%) and enrichment periods. Values are the averages of three replications (SD)

	SOURCES		VITAMIN C LEVELS			ENRICHMENT PERIODS	
	ICES30/4c	Sturgeon Oil	10 %	20 %	30 %	12h	24h
Protein% DW	68.48(2.21)^{k}	64.89(1.56)^{j}	68.10(2.59)^{r}	67.20(2.52)^{q}	64.75(1.50)^{p}	66.09(3.00)^{x}	67.28(2.10)^{y}
Lipid%DW	16.08(2.02)^{k}	15.20(0.96)^{j}	16.38(2.37)^{q}	15.97(0.52)^{q}	14.56(0.73)^{p}	15.84(2.13)^{x}	15.44(0.88)^{x}
Vit. C µg/g DW	144.95(17.33)^{k}	80.76(17.01)^{j}	99.37(14.59)^{p}	123.52(14.86)^{q}	115.62(14.86)^{q}	98.03(18.39)^{x}	127.0(16.31)^{y}
Fatty acids mg g^{-1} DW							
C14:0	0.82(0.06)^{j}	0.90(0.16)^{k}	0.94(0.16)^{q}	0.86(0.09)	0.79(0.09)^{p}	0.85(0.13)	0.88(0.13)
C14:1n5	0.72(0.20)	0.67(0.15)	0.76(0.14)^{q}	0.77(0.19)^{q}	0.57(0.12)^{p}	0.78(0.18)^{y}	0.62(0.14)^{x}
C15:0	0.50(0.06)^{j}	0.75(0.34)^{k}	0.52(0.09)^{p}	0.83(0.39)^{q}	0.54(0.06)^{p}	0.61(0.26)	0.65(0.28)
C15:1	0.70(0.15)^{j}	1.00(0.28)^{k}	0.95(0.25)^{q}	0.97(0.28)^{q}	0.64(0.14)^{p}	0.81(0.23)^{x}	0.89(0.31)^{y}
C16:0	15.39(1.56)^{j}	16.08(0.80)^{k}	16.24(1.69)^{r}	15.86(0.69)^{q}	15.11(1.04)^{p}	15.09(0.78)^{x}	16.37(1.36)^{y}
C16:1n7	6.37(1.31)^{k}	5.52(1.09)^{j}	5.81(1.22)^{pq}	6.68(1.43)^{q}	5.35(0.73)^{p}	5.84(1.51)	6.06(0.99)
C17:0	1.34(0.90)	1.35(0.39)	1.73(0.90)^{r}	1.23(0.50)^{q}	1.07(0.40)^{p}	1.35(0.83)^{y}	1.34(0.52)^{x}
C17:1n7	1.90(0.75)^{k}	1.56(0.35)^{j}	1.74(1.01)	1.67(0.28)	1.79(0.20)	1.82(0.80)^{y}	1.65(0.30)^{x}
C18:0	8.74(2.35)	8.86(1.13)	8.69(2.23)^{q}	9.76(1.65)^{r}	7.67(0.67)^{p}	8.36(2.18)^{x}	9.05(1.34)^{y}
C18:1n9	13.54(3.17)^{j}	16.86(1.29)^{k}	14.07(4.84)^{p}	15.73(0.92)^{q}	15.82(0.92)^{q}	14.51(3.40)^{x}	15.90(2.24)^{y}
C18:1n7	11.31(1.73)^{j}	10.38(0.84)^{k}	9.89(1.51)^{p}	10.24(1.05)^{q}	10.91(1.33)^{r}	9.93(1.48)^{x}	10.77(1.07)^{y}
C18:2n6-ei	2.97(0.80)^{k}	1.56(0.52)^{j}	2.41(0.78)^{q}	2.60(1.30)^{r}	1.79(0.60)^{p}	2.24(1.25)	2.30(0.64)
C18:3n3	4.73(1.36)^{k}	3.93(1.19)^{j}	5.03(1.28)^{r}	4.12(0.82)^{q}	3.83(1.54)^{p}	4.22(1.50)^{x}	4.44(1.15)^{y}
C20:1n9	0.29(0.33)^{k}	0.00(0.00)^{j}	0.34(0.37)	0.10(0.19)^{q}	0.00(0.00)^{p}	0.20(0.32)^{x}	0.09(0.21)^{y}
C20:2n6	0.35(0.19)^{k}	0.26(0.03)^{j}	0.25(0.02)^{pq}	0.24(0.04)^{p}	0.29(0.06)^{q}	0.28(0.05)	0.28(0.04)
C20:3n3	0.29(0.01)^{j}	0.39(0.03)^{k}	0.50(0.03)	0.52(0.03)	0.51(0.05)	0.45(0.05)^{x}	0.54(0.04)^{y}
C20:4n6 ()	1.41(0.35)^{k}	0.94(0.39)^{j}	1.34(0.16)^{q}	1.09(0.34)^{p}	1.09(0.64)^{p}	1.29(0.51)^{y}	1.06(0.32)^{x}
C20:5n3 (EPA)	4.24(0.86)^{k}	2.01(0.46)^{j}	2.85(0.93)^{p}	3.61(1.40)^{q}	2.91(1.53)^{p}	3.00(1.22)^{x}	3.25(1.44)^{x}
C22:6n3 ()	2.52(0.40)^{k}	0.95(0.14)^{j}	1.84(0.98)^{p}	1.79(0.83)^{p}	1.58(0.76)^{p}	1.76(0.91)^{x}	1.71(0.80)^{x}
DHA/EPA	0.62(0.04)^{k}	0.49(0.03)^{j}	0.62(0.03)^{q}	0.49(0.03)^{p}	0.57(0.020)^{pq}	0.52(0.02)^{x}	0.53(0.20)^{x}
Σ Saturated	26.79(3.90)	27.76(1.96)	28.11(3.35)^{q}	28.53(1.84)^{q}	25.19(1.11)^{p}	26.26(2.16)^{x}	28.29(2.84)^{y}
Σ Monoens	33.84(3.90)^{j}	36.01(2.74)^{k}	33.56(5.31)^{p}	36.17(1.83)^{q}	35.06(1.92)^{pq}	33.88(3.66)^{x}	35.97(3.08)^{y}
Σ n-3 HUFA	6.75(0.86)^{k}	2.95(0.35)^{j}	4.68(0.37)^{p}	5.39(0.48)^{q}	4.47(0.36)^{p}	4.75(0.21)^{x}	4.94(0.21)^{x}
ω- 3/ ω- 6	5.06(0.82)^{k}	3.63(0.46)^{j}	3.61(0.50)^{p}	5.03(0.49)^{q}	4.40(0.46)^{pq}	3.93(0.23)^{x}	4.76(0.22)^{y}

Means in a row within the same group followed by the different letter are significantly differences (P<0.05)