

\*

( // : // : )

*Salmo trutta caspius*

(FFF) ( // ± g)  
(FSF) (SSS) (FS) -  
(SF)  
FFF  
(P<0.05) SSS FS  
( ) FFF  
( )  
(P<0.05)  
FS ( mOsmol/kg) FFF  
(P<0.05) mOsmol/kg SSS mOsmol/kg

*Salmo trutta caspius* :

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(Toften *et al.*, 2003)

Furne Gurney *et al.*, 2003 )

( *et al.*, 2008;

Stradmeyer, 1994; )

(Usher *et al.*, 1991  
(*Salmo salar*)

(Milaja, 2006)

Stradmeyer, 1994)

(2003) Toften (McCarthy *et al.*, 1996; Evans *et*) Hyperosmoregulation  
(*al.*, 2005

Usher .

Jobling Jørgensen

( )

(Baldisserotto *et al.*, 2005)

(*Salmo trutta caspius*) Hypoosmoregulation

(Evans *et al.*, 2005)

(Oulad *et al.*, 2010)

Vijayan *et* )

(*al.*, 1996

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) SF FSF SSS FS FFF :

(  
(Falahatkar *et al.*, 2007)

mg l<sup>-1</sup>  
(Sudagar *et al.*, 2009 )

Pooling

+ ) / ±  
(Kiron *et al.*, 2004)  
×g (Fresh Water: FW)

±  
±  
± /  
± / pH

(Uchida *et al.*, 1996)  
)

( / / /

(S<sup>2</sup>) (F<sup>1</sup>)

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<sup>1</sup> Feeding  
<sup>2</sup> Starvation

...

Jenway ) ( )  
(pfp 7, England

( / mEq/L) FFF  
SSS FS  
/ /  
/ SF FSF  
(P<0.05) /  
)  
A .(

USA ) RA-1000  
(TECNICON  
(Krayushkina, 2006)  
(OsmoTech, England)  
(Krayushkina, 2006)

Leven

SSS FS  
SF FSF  
( A )  
(Jackson *et al.*, 2005)  
SPSS  
Excel

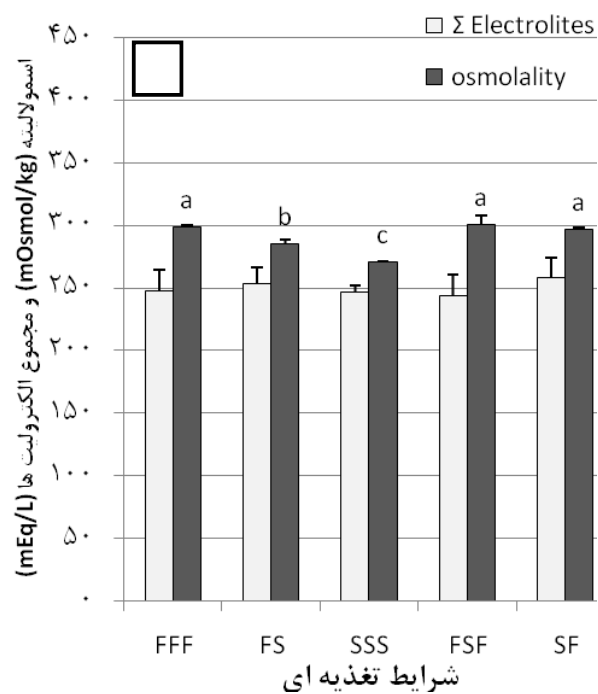
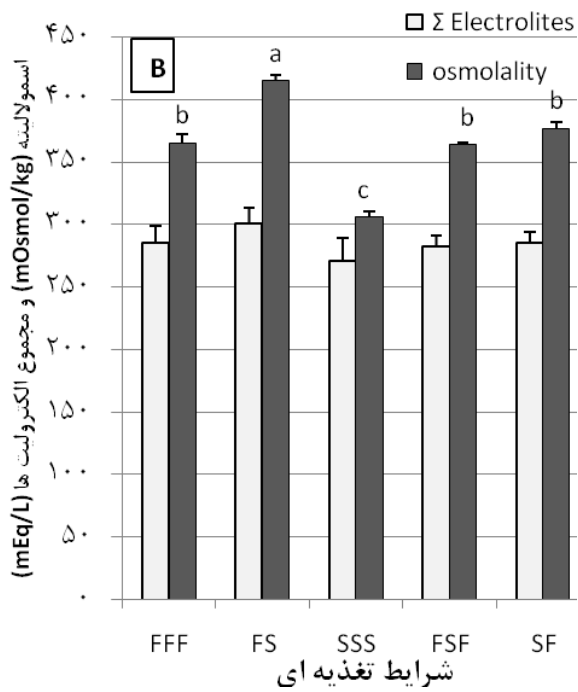
( B )  
(SSS FS)  
FSF) ( mOsmol/kg) FFF  
FS (SF  
SSS  
( B )

<sup>3</sup> Completely Randomized Design  
<sup>4</sup> One Way ANOVA

( )  
 SF FSF SSS FS FFF)  
 ( )  
 n= ) . ± (SW) (FW)  
 (P<0.05) .(

FSF	SF	SSS	FS	FFF	
±	± /	± /	± /	±	FW
± /	±	± /	± /	±	CSW
/ ± /	/ ± /	/ ± /	/ ± /	/ ± /	FW
/ ± /	/ ± /	/ ± /	/ ± /	/ ± /	CSW
/ ± /	/ ± /	/ ± /	/ ± /	/ ± /	FW
/ ± / <sup>b</sup>	/ ± / <sup>b</sup>	/ ± / <sup>a</sup>	/ ± / <sup>a</sup>	/ ± / <sup>c</sup>	CSW
/ ± /	/ ± /	/ ± /	/ ± /	/ ± /	FW
/ ± / <sup>b</sup>	/ ± / <sup>ab</sup>	/ ± / <sup>b</sup>	/ ± / <sup>a</sup>	/ ± / <sup>a</sup>	CSW

(P<0.05)



( )  
 SF FSF SSS FS FFF)  
 :A ( )  
 n= ) . ± (SW) :B (FW)  
 (P<0.05) .(

...

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(Taylor and Grosell, 2006)

( ppt)

Jürss *et al.*, )

(Kültz and Jürss, 1991) (1987

Na<sup>+</sup>K<sup>+</sup>-ATPase

Na<sup>+</sup>K<sup>+</sup>-ATPase

(1991) Jürss Kultz .

(Stefansson *et al.*, 2009)

(1996)

Vijayan .

(Tseng and Hwang, 2008)

( B A )

Ferreire .

(2005)

Stubhaug *et al.*, )

(1986)

( )

Dabrowski

(2006; Lim and Webster, 2001

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Liebert and )

(Schreck, 2006; Stefansson *et al.*, 2009

(Levings *et al.*, 1994; Andreassen *et al.*, 2001)

(FSF SF)

(Emadi, 2010; Fallah, 2009)

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## The Effect of Starvation and Refeeding Periods on Iono-osmoregulation of 2+ Caspian Trout

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(Received: 23/05/2011, Accepted: 17/06/2012)

### Abstract

Effects of different nutritional conditions on iono-osmoregulation in juvenile of Caspian trout (*Salmo trutta caspius*) parrs were studied. Following adaption to the new environment, 750 Caspian trout parrs (12.5±1 g) were kept under the treatments of six weeks of full feedings (FFF), three weeks of feeding-three weeks of starvation (FS), six weeks of starvation (SSS), two weeks of feeding-two weeks of starvation-two weeks of re-feeding (FSF) and three weeks of starvation-three weeks of re-feeding (SF). Fish were fed with rainbow trout commercial feed three times a day up to satiation. There was no significant difference in serum sodium, chloride, potassium and magnesium between treatments, but serum osmolality decreased from 299 mOsmolkg<sup>-1</sup> in FFF to 286 and 271 mOsmolkg<sup>-1</sup> in FS and SSS (P <0.05), and re-feeding, after starvation periods, compensated the osmolality reduction to the similar levels in FFF. Five days after transferring the parrs to Caspian Sea (salinity: 13 gL<sup>-1</sup>), serum magnesium reached to 3.55 and 3.40 mEqL<sup>-1</sup> in FS and SSS respectively (P <0.05), in comparison to FFF group (2.36 mEqL<sup>-1</sup>). Serum potassium showed also irregular significant difference between treatments (P <0.05), while chloride and sodium presented no significant difference. Serum osmolality levels increased to a maximum of 415 mOsmolkg<sup>-1</sup> in FS and were decreased to a minimum of 306 mOsmolkg<sup>-1</sup> in SSS (P<0.05), compare to FFF (366 mOsmolkg<sup>-1</sup>). We concluded that starvation has negative effects on ion regulatory capacity of Caspian trout parrs and although re-feeding can increase this capacity but effects of long period starvation cannot be compensated.

**Keywords:** *Salmo trutta caspius*, Starvation, Refeeding, Osmoregulation.