

Temporal variations in haematological and biochemical indices of the Caspian kutum, *Rutilus frisii kutum*

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Abstract The pattern of haematology and blood biochemistry variations of healthy adult female kutum *Rutilus frisii kutum* (Cyprinidae) was investigated in the three reproductive states: maturing (autumn), pre-spawning (winter), and spawning (spring). Red blood cells, haemoglobin, and haematocrit were highest in autumn, whereas the highest values for white blood cells, mean corpuscular volume (MCV), and mean corpuscular haemoglobin (MCH) were observed in winter. With the exception of MCV and mean corpuscular haemoglobin concentration (MCHC), fish size had no effect on haematological and biochemical parameters. MCV was higher in larger fish, whereas the reverse trend was found for MCHC. Decreased levels of plasma glucose, cholesterol, and triglyceride in the pre-spawning period, when female ovaries were developing, may have been due to the combination of reproductive effects and food shortage in winter. Total protein levels were lower during the maturing period than during the pre-spawning period. The results of this study suggest that temporal variations in haematological and biochemical parameters of blood are significant and should be considered when these parameters are used to assess fish health status.

Keywords Kutum · Haematological parameters · Blood biochemical · Reproduction cycle · Season · Size

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Introduction

The assessment of haematological and biochemical parameters of blood can provide valuable information for evaluating the health status of many organisms, including fish (Coles 1986). Changes in the haematological parameters are utilised as reliable diagnostic indicators, reflecting physiological responses to various causative factors (Handy and Depledge 1999) and diseases (Coles 1986). Haematological parameters varied with regard to natural changes in environmental conditions associated mostly with seasonal variations (Luskova 1998). Likewise, differences in biochemical parameters such as blood glucose, protein, and cholesterol have been found during seasonal and diurnal variations (De Pedro et al. 2005).

The particular blood biochemistry of many animals like seal (Trumble et al. 2006), dolphin (Terasawa et al. 2002), badger (Domingo-Roura et al. 2001), and fish (Sandnes et al. 1988; Guijarro et al. 2003; De Pedro et al. 2005; Bayir et al. 2007) is associated with seasonal changes. Haematological and biochemical parameters of fish blood are also affected by several factors, such as age (Svetina et al. 2002), species and strain (Langston et al. 2002), photoperiod (Bani et al. 2009), and temperature (Langston et al. 2002; Magill and Sayer 2004). Stress (Cnaani et al. 2004; Silverira-Coffigny et al. 2004), nutritional states (Svetina et al. 2002; Lim and Klesius 2003), and reproductive cycles (Svoboda et al. 2001; Bayir 2005) can also have certain effects. It is widely acknowledged that blood transfers blood cells, elements, and energetic components in the whole bodies of animals. Gonad investment in large, fully matured individuals is intense and can affect blood parameters (Eliassen and Vahl 1982). Small maturing individuals or individuals in the first years of reproductive activity sensibly invest part of their available energy to