Out of 16 plant species both recorded as eaten by a tame adult impala (Monro 1979) and presented to the lambs in the present study, 10 species were rejected by the lambs (among them *Grewia flavescens*, an important food plant to Monro's impala). However, it should be borne in mind that the feeding habits of Monro's tame impala may not be the same as those of wild individuals. In a similar study on the feeding habits of a young tame lesser kudu *Tragelaphus imberbis* and a gerenuk *Litocranius walleri*, it was found that they rejected some plant species known to be eaten by wild kudu and gerenuk (Leuthold 1971). Of the 54 species offered to the tame lesser kudu, at least 45 were eaten by wild individuals. The tame kudu rejected two species known to be rejected by wild kudu, but also rejected 10 other species normally eaten (among them several important food plants). The situation was similar with the gerenuk which rejected several plants commonly eaten in the wild. Leuthold (1971) concludes from his observations that specific feeding habits are formed on the basis of both an innate selecting mechanism and learning. The data from the present study support these ideas.

Some plants may be preferred more than others because of their higher nutrient content. For example Monro (1979) found that his tame impala preferred the pods of *Acacia tortilis* to those of *Acacia nilotica*, *A. tortilis* pods having twice the protein concentration of those of *A. nilotica*. From the behaviour of the young impala it appears that the selection process includes not only looking at the plant, but also the senses of smell and taste. Several of the plants offered to the lambs had a definite odour, detectable even to the human nose and these plants were usually rejected (*eg. Pavetta assimilis, Vitex mombassae, Lippia javanica*). For example, those impala that tasted certain plants that were otherwise rejected on smell by the remainder of the group, apparently learnt from the experience and rejected the plants when they were presented a second time. Leuthold (1971) suggests that young antelope may also learn from watching the feeding habits of the older members of the herd.

The feeding habits of the young impala changed as they matured. At two months of age they were released into a 1-ha camp containing indigenous vegetation. Initially they ate only the plant species they had spontaneously accepted in the pen, but in a short time began to include *Vitex rehmannii*. By the time the impala were six months old however, the trees in the camp were losing their leaves at the onset of winter and the area was showing signs of over-utilization. At this stage the impala were observed eating small quantities of *Dombeya rotundifolia, Pappea capensis, Combretum zeyheri, Mundulea sericea* and even *Peltophorum africanum* (all previously ignored species). These observations suggest that changes in food availability and quality may force young antelope to try new plants and thus increase their knowledge of food items.

In conclusion this study supports the ideas of Leuthold (1971) that feeding habits in young antelope are formed on the basis of both innate behaviour and learning; and that lambs probably learn from older members in the herd. In addition, changes in food quality and quantity may force impala to try new plants previously ignored. However, it must be emphasized that the feeding habits of hand-reared impala may not be the same as those of wild impala, but may merely be a result of the diet imposed on them by their keeper. It would be extremely valuable for future food selection studies if the differences between hand-reared and wild impala could be determined.

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Some blood parameters of the Chinese grasscarp *Ctenopharyngodon idella* (Valenciennes)

J.J. Pieterse, G.L. Smit, K.J. van Vliet, H.J. Schoonbee and J. Hattingh

J.J. Pieterse* and K.J. van Vliet
Department of Biological Sciences, Technikon Pretoria, Pretoria 0001
G.L. Smit and H.J. Schoonbee
Research Unit for Fish Biology, P.O. Box 524, Johannesburg 2000
and J. Hattingh
Department of General Physiology, School of Dentistry, University of the Witwatersrand, Johannesburg 2001
*To whom correspondence should be addressed

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Ctenopharyngodon idella was introduced from West Germany into South Africa in 1975 as an aquatic vegetation feeder to compliment *Tiliapia rendalli* (Boulenger) which is intolerant of winter water temperatures below 12–14 °C (Schoonbee, Brandt & Bekker 1978). The former species has been successfully spawned artificially for two seasons and preliminary studies indicate that these fish can control aquatic vegetation by daily ingesting up to five times their body weight of aquatic plants (Schoonbee *et al* 1978). It is hoped that the haematological profile provided in this study may contribute to the knowledge of the physiology of the grasscarp.

Twenty two-year-old specimens (10♂ and 10♀) of *Ctenopharyngodon idella* were collected from the Fisheries Research Station at Marble Hall and acclimatized for a period of eight weeks in our aquaria at a temperature of 19 ± 1 °C. Fish were transferred to individual aquaria 24 h before experimentation began in order to minimize possible stress effects. Individual fish were anaesthetized with 100 mg/l neutralized Benzocaine hydrochloride (Ferreira, Smit, Schoonbee & Holzapfel 1979). Blood was sampled anaerobically by cardiac puncture with disposable syringes containing 4 mg/ml heparin as anticoagulant. Glucose, total plasma protein (TPP), urea, adenosine triphosphate (ATP) and lactate dehydrogenase (LDH) were determined with commercial biochemical test combinations (Boehringer Mannheim). Blood pH, pCO_2 and pO_2 were measured with an IL Model 213 Acid-base Analyzer at room temperature. Plasma sodium (Na) and potassium (K) values were determined with an IL 343 Flame Photometer. Red cell counts (RBCC), haematocrit (Ht), and haemoglobin values were established with an Fn Coulter Counter and mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) calculated as described by Dacie & Lewis (1975). Erythrocyte sedimentation rate (ESR) was determined according to a micro-method and fish were weighed to the nearest gram on an Ohaus balance. Results were analysed on a Sperry Univac 90/60 computer employing BMDP programs.

The values obtained for the various blood parameters are listed in Table 1. No significant differences between the blood values for males and females were obtained and the results listed present pooled values. Mass of individual fish showed no correlations with the blood parameters measured. Values for individual parameters generally showed a wide variation. Significant correlations were observed between blood pH and pCO_2 ($r = -0{,}83$), as well as with pO_2 ($r = 0{,}59$). RBCC correlated with Ht ($r = 0{,}71$) and Hb ($r = 0{,}71$) and Ht also showed some correlation with Hb ($r = 0{,}61$). A significant relationship was also established between MCH and MCHC ($r = 0{,}90$).

Grasscarp can be classified as a warm water fish and although it prefers this kind of water it is capable of surviving temperature extremes. The results obtained in the present investigation can therefore be compared to those of other warm freshwater fish species, such as the common carp and *Sarotherodon mossambicus*, studied under similar laboratory conditions (Smit, Hattingh & Burger 1979). No other results obtained under these conditions are available.

There are relatively few reports on blood pH, pCO_2 and pO_2 values for freshwater fish. These values generally show a wide variation. Comparison of the values obtained in the present investigation to those of carp and tilapia (Smit *et al.* 1979) indicate lower blood pH and higher blood pCO_2 values for the grasscarp. This is possibly related to the higher general activity of this species which possibly explains the higher LDH values. Blood pO_2 levels are lower. Together, these results suggest a difference in the inherent metabolic rate of the grasscarp when compared to *Cyprinus carpio* and *Sarotherodon mossambicus* under similar environmental conditions.

Fish haematocrits vary between 20 – 35% (Korzhuev 1964). The values recorded for *C. idella* also fall within this range. The mean of 20,5 ± 1,8% is similar to that obtained for tilapia but is lower compared to the values obtained for common carp (Smit *et al.* 1979). Ht correlated well with RBCC and Hb, thereby emphasizing the expected relationship between these parameters.

Hb values showed a mean of 8,6 ± 2,2 g%. This is higher than the values reported for carp and tilapia under similar conditions (Smit *et al.* 1979) and may be related to the general metabolic activity of this species and its preferred aquatic environmental temperature.

RBCC values generally show significant interspecies differences (Clark, Whitmore & McMahon 1979, Smit *et al.* 1979). The RBCC values obtained in this study were lower than those for carp and tilapia. Together with Ht and Hb values, this results in different MCV and MCHC values amongst the fish species compared.

Blood glucose values have been shown to be an important diagnostic tool for the identification of stress (Hattingh 1976, Smit & Hattingh 1978). The values obtained in this study fall within the same range as those reported for other fish species with a mean of 38,4 ± 9,3 mg%. TPP levels compared well with those reported for carp but were somewhat lower than the values reported for tilapia (Smit *et al.* 1979). Blood urea levels indicated a 'normal' range.

ATP levels were relatively low compared to the other species. Since the fish were acclimatized in well-aerated aquarium water, this relatively low ATP level may be indicative of adaptation to warmer environments. Other red cell organo-phosphates, however, could also be involved and should be investigated for their particular functions in fish erythrocytes.

Table 1 Haematology of *Ctenopharyngodon idella*

	Mean	*SD*	*SE*	Range (n = 20)		Mean	*SD*	*SE*	Range
pH	7,34	0,06	0,018	7,11 – 7,42	Glucose mg%	38,4	9,26	3,52	25,00 – 47,9
pCO_2 mm Hg	8,5	0,78	0,26	7,6 – 16,3	Urea mg%	2,4	0,67	0,22	1,40 – 3,6
pO_2 mm Hg	14,9	0,99	0,32	3,4 – 6,2	ATP mg%	62,9	11,19	3,67	45,11 – 76,1
Ht %	20,5	1,85	0,61	17,4 – 25,8	LDH units/l	325,2	98,95	32,96	186,74 – 461,7
Hb g %	8,6	2,17	0,71	5,5 – 11,9	TPP g %	2,9	0,40	0,12	2,40 – 3,6
RBCC × 10^6/mm^3	1,6	0,17	0,05	1,4 – 1,8	K mmol/l	2,4	0,27	0,08	1,50 – 2,9
MCV μm^3	124,9	6,91	2,30	113,7 – 149,1	Na mmol/l	197,0	13,74	4,46	183,0 – 217,0
MCH pg	51,7	9,99	3,28	38,7 – 57,2	ESR mm/h	1,5	0,46	0,15	1,00 – 2,0
MCHC %	41,4	8,26	2,74	31,6 – 55,3	Mass g	631,5	127,45	42,64	403,0 – 849,0

LDH values showed a wide range and were higher than those obtained for carp and *S. mossambicus*. This suggests a relatively large anaerobic capacity for this species which may be of importance during the warm season of the year. Plasma electrolyte levels agree with those reported for other freshwater fish species (Smit *et al.* 1979).

The results obtained in this study suggest that *Ctenopharyngodon idella* is more suitable than carp or tilapia for fish production purposes during autumn and summer. This conclusion is based on the acid-base status, Hb, derived values as well as ATP and LDH values. In addition, as the species may be more effective in combating aquatic vegetation resulting from agricultural and industrial effluents during the warm season of the year, it is possible that the cost of feeding is greatly reduced. This would enhance the suitability of the species as a cheap source of animal protein.

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