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ORIGINAL ARTICLE

Reference data of haematology and serum biochemistry in adult wild-caught Libyan jird (*Meriones libycus*) from central Saudi Arabia

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Abstract The baseline haematological and biochemical data for adult individuals of the Libyan jird (*Meriones libycus*) collected during March/April 2012 from Janadriya area near Riyadh in central Saudi Arabia were determined during this study. Blood samples were collected from 46 animals (21 males and 25 females) using sterile capillary tubes from the orbital sinus and evaluated for haematological and biochemical parameters using HM5 haematology analyser and VS2 Vetscan biochemistry analyser. Haematological parameters investigated did not reveal any sex-associated clinically significant differences with the exception of the platelet counts and the plateletcrit which was found to be significantly higher in males compared to the females ($p < 0.05$). There was no significant intersex differences in the biochemical parameters investigated with the exception of the Blood Urea Nitrogen (BUN) and the BUN/Ctreatinine ratio values being significantly higher in males compared to females ($p < 0.05$). Haematological and serum biochemical parameters presented in this study are considered representative for healthy adult wild-caught *M. libycus*. Such data may provide valuable information for veterinarians and scientists using adult Libyan jirds in research on diseases or other experimental studies.

1. Introduction

The Libyan jird, *Meriones libycus*, Lichtenstein, 1823, is one of the most widely distributed wild rodents. It has a vast range extending from North Africa (Morocco and Mauritania) spanning Arabia and eastwards to Sinkiang in China (Harrison and Bates, 1991; Roberts, 1997). There are several subspecies within the species *M. libycus* but they have not been fully characterised and they were all based on old data and on geographic distribu-

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tion without concrete molecular data (Wilson and Reeder, 2005). In Arabia, the subspecies *M. libycus erythrourus* occurs east of the Euphrates while specimens from the west of the Euphrates are referred to as *M. libycus syrius* (Ellerman, 1948; Harrison, 1956; Hatt, 1959; Petter et al., 1957).

Apart from genetic and morphological information, haematological data are of great value while working on the wild mammalian species both on temporal and spacial variations. Haematological and biochemical analyses have always been used as biomonitoring indicators for the general condition of the animals and any pathology as a result of infectious organisms or toxic material. There is no available report on the normal haematological values of *M. libycus* apart from the work conducted by Madjdzadeh et al. (2011) that work reported on only the red blood corpuscles and white blood cell counts together with few biochemical parameters of *M. libycus* together with other wild rodents in Iran. No such study providing baseline is available from the Arabian Peninsula and Africa which constitutes the geographical range of this species. Therefore, the purpose of the present study was to establish clinically normal haematological and serum biochemical values in adult wild-caught apparently healthy Libyan jirds from the arid environment of Saudi Arabia. Information generated as a result of this study would be useful for clinicians, laboratory animal veterinarians, and biological research scientists.

2. Materials and methods

2.1. Animals and trapping

A total of 46 (21 males and 25 females) adult jirds identified as *M. libycus* were trapped during March/April 2012 using a cage traps (Strauss et al., 2008) from the Janadriya area Fig. 1 near Riyadh city, capital of the Kingdom of Saudi Arabia (24° 57′ 03 80″ N 46° 49′ 22 59″ E). Males weighed 122.4 ± 31.9 g and females weighed 137.5 ± 22.8 and the latter were not pregnant at the time of sample collection. All animals handled appeared clinically healthy and they were checked for dehydration and any abnormalities. All animals were checked for external parasites and faecal samples were taken from each animal and examined for parasites products using standard floatation and sedimentation techniques (Anonymus, 1986; Soulsby, 1982). Animals, after the blood sampling, were released in the same place from where they were trapped originally. There were no ethical issues involved while handling and sampling these animals.

2.2. Blood collection

Each individual was placed in a glass beaker with cotton soaked in diethyl ether and left only for a short time till the animal appeared easy to handle. A sterile capillary tube was inserted into the orbital sinus (retro-orbital plexus) and blood was collected according to the method outlined by Hoff (2000). Blood (300–400 μl) was collected into two tubes one with EDTA as an anti-coagulant and the other one without anti-coagulant for haematological and biochemical analyses respectively. The second tube without additive was allowed to clot at room temperature and serum was collected after centrifuging it at 3000*g* for 10 min.

2.3. Blood analysis

The EDTA sample was analysed immediately after collection using VetScan HM5 (Abaxis Veterinary Diagnostics, Union

Figure 1 A map showing the location of Janadriya area (24° 57′ 03 80″N 46° 49′ 22 59″E) in central Saudi Arabia where *Meriones libycus* were caught and released after blood collection.

City, CA 94587, USA) for erythrocyte (Red blood corpuscles) counts (RBC), haemoglobin (HB), haematocrit or packed cell volume (PCV), leucocyte (white blood cell) counts (WBC), lymphocytes, monocytes, granulocytes, platelet counts (PLT), mean platelet volume (MPV), plateletcrit (PCT), platelet distribution width (PDW) and erythrocyte indices were calculated from the values of RBC, HB and PCV which included mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV) as indicated in Jain (1986).

Serum biochemistry was performed using the biochemistry analyser VetScan VS2 (Abaxis Veterinary Diagnostics, Union City, CA 94587, USA). The biochemical parameters determined included: albumin (ALB), alkaline phosphatase (ALP), alanine transaminase (ALT), amylase (AMY), total bilirubin (TBIL), blood urea nitrogen (BUN), calcium (Ca), phosphorus (P), creatinine (CREAT), glucose (GLU), sodium (Na), potassium (K), total protein (TP) and globulin (GLOB). ALB:GLOB and BUN:CREAT ratios (B:C ratio) were calculated from the values obtained for these parameters.

2.4. Statistical analysis

Haematological and biochemical parameters (mean ± SD) were compared between male and female specimens using Student's *t*-test (Sokal and Rohlf, 1981) at 95% level of significance using the computer program Sigmastat (Sigma Statistical Software, Version 2.03, SPSS Inc.).

3. Results

All rodents sampled for the present study appeared healthy and no parasites products (ova, cysts, or larvae) were demonstrated in the standard floatation/sedimentation techniques. No external parasites were found on the animals sampled and none of them appeared dehydrated.

Haematological and biochemical data obtained from the males and females *M. libycus* are presented in Tables 1 and 2, respectively.

There were some differences in the haematological profiles between males and females but such differences were not significant. There were no significant differences in both the erythrocytic and leucocytic parameters; however, significant differences between males and females were noticed in the thrombocytic parameters especially the platelet counts (PLT) and plateletcrit (PCT). The PLT and PCT were both higher in males compared to female's *M. libycus* ($p < 0.05$) as indicated in Table 1.

Similarly there were also some differences between males and females in the biochemical parameters but such differences were not significant. However, there was a significant difference in the levels of the blood urea nitrogen (BUN). Serum BUN levels were higher in males compared to the females ($p = 0.026$) as shown in Table 2. The B:C ratio has directly followed the same trend and it was significantly higher in males when compared to females ($p = 0.043$).

4. Discussion

The Libyan jird (*Meriones libycus*) and other wild mammals living under desert conditions can be a reservoir for hosts of zoonotic diseases. Reference blood parameters values are important to understand the health status and disease situations in these rodents. Therefore, the present study was carried out to present baseline information on the haematological and biochemical parameters for wild-caught adult Libyan jird (*M. libycus*) for the first time. Data presented here are available for

Table 1 Hameatological reference range values for male and female adult apparently healthy Libyan jird (*Meriones libycus*) caught from the wild in Saudi Arabia.

Parameter	Unit	Males		Females		*T*-test *P* value
		Mean ± SD	Range (Min–Max)	Mean ± SD	Range (Min–Max)	
WBC	10^9/l	12.8 ± 7.7	2.6–24.5	13.0 ± 5.1	4.3–21.7	0.468
Lymphocytes	10^9/l	6.3 ± 4.5	1.2–13.5	7.1 ± 3.5	2.0–13.7	0.328
Monocytes	10^9/l	0.4 ± 0.3	0.1–1.1	0.5 ± 0.5	0.1–1.5	0.311
Granulocytes	10^9/l	6.0 ± 4.1	0.5–11.9	5.3 ± 2.2	1.8–9.2	0.312
Lymphocytes	%	47.8 ± 23.7	3.5–87.6	53.7 ± 11.6	38.6–68.8	0.232
Monocytes	%	3.8 ± 2.2	1.5–9.1	4.4 ± 3.7	0.7–10.6	0.315
Granulocytes	%	45.6 ± 18.5	9.9–68.8	41.9 ± 11.1	27.2–60.6	0.287
RBC	10^{12}/l	8.8 ± 1.3	6.8–11.2	8.8 ± 0.9	7.3–10.5	0.483
HGB	g/dl	12.4 ± 1.3	9.3–14.2	12.1 ± 1.4	9.4–14.0	0.332
HCT	%	39.9 ± 5.1	31.8–47.3	39.4 ± 3.9	31.8–45.7	0.391
MCV	fl	45.9 ± 4.3	38.0–54.0	45.0 ± 3.0	41.0–52.0	0.282
MCH	pg	14.2 ± 1.2	12.6–16.0	13.8 ± 0.9	12.9–15.5	0.185
MCHC	g/dl	31.1 ± 2.0	27.8–34.4	30.8 ± 1.5	27.7–33.1	0.326
RDWc	%	20.4 ± 1.6	18.3–23.8	20.1 ± 1.9	16.6–22.8	0.346
PLT	10^9/l	754.5 ± 239.1	421–1322	601.2 ± 184.3	199–955	0.049*
PCT	%	0.6 ± 0.2	0.3–0.8	0.5 ± 0.1	0.2–0.6	0.037*
MPV	fl	7.9 ± 1.1	6–9.3	7.6 ± 0.9	6.2–9.7	0.289
PDWc	%	34.9 ± 3.9	27.9–38.9	33.2 ± 2. 7	27.9–38	0.125

* Significant difference and the level of significance <0.05. WBC = white blood cells, RBC = Red blood corpuscles, HB = haemoglobin, HCT = haematocrit or packed cell volume, MCV = mean corpuscular volume, MCH = mean corpuscular haemoglobin, MCHC = mean corpuscular haemoglobin concentration, PLT = platelet counts, MPV = mean platelet volume, PCT = plateletcrit, PDW = platelet distribution width.

Table 2 Serum biochemical reference range values for male and female adult apparently healthy Libyan jird (*Meriones libycus*) caught from the wild in Saudi Arabia.

Parameter	Unit	Males		Females		*T*-test *P* value
		Mean ± SD	Range	Mean ± SD	Range	
ALB	g/L	33 ± 4	27–41	33 ± 6	20–41	0.465
ALP	U/L	95.5 ± 66.4	28–207	67.9 ± 28.7	37–124	0.110
ALT	U/L	69.6 ± 25.7	44–110	69.1 ± 25.4	25–132	0.478
AMY	U/L	1066.3 ± 294.9	650–1552	893.4 ± 305.8	417–1613	0.080
TBIL	µmol/L	0.21 ± 0.05	0.1–0.3	0.21 ± 0.04	0.1–0.3	0.453
BUN	mmol/L	22 ± 4.4	16–29	18.1 ± 5.2	12–27	0.026*
CA	mmol/L	2.5 ± 0.1	2.2–2.7	2.5 ± 0.1	2.2–2.6	0.305
PHOS	mmol/L	3.2 ± 0.6	2.6–4.5	3.2 ± 0.7	1.8–4.4	0.382
CRE	µmol/L	28.9 ± 9.8	17.7–44.2	31.2 ± 9.9	17.7–44.2	0.281
GLU	mmol/L	7.1 ± 2.8	4.1–12.6	5.7 ± 1.2	3.7–7.9	0.081
NA	mmol/L	145.9 ± 4.5	138–151	144.9 ± 5.9	136–159	0.318
K	mmol/L	5.9 ± 0.37	5.3–6.6	5.9 ± 0.7	3.8–6.8	0.428
TP	g/L	61.1 ± 8	52–73	61 ± 8	41–79	0.439
GLOB	g/L	28 ± 8	16–41	28 ± 6	20–44	0.468
ALB:GLOB	ratio	1.3 ± 0.4	0.8–2.3	1.2 ± 0.3	0.8–1.9	0.410
BUN/CREAT	ratio	74 ± 27	40–135	56 ± 20	24–95	0.043*

* Significant difference and the level of significance <0.05. ALB = albumin, ALP = alkaline phosphatase, ALT = alanine transaminase, AMY = amylase, TBIL = total bilirubin, BUN = blood urea nitrogen, Ca = calcium, P = phosphorus, CREAT = creatinine, GLU = glucose, Na = sodium, K = potassium, TP = total protein, GLOB = globulin.

use in comparative veterinary or clinical studies related to this species in Saudi Arabia.

The presented data showed similarities between the Libyan jird and other rodents in most parameters studied with some differences in others (Weber et al., 2002; Madjdzadeh et al., 2011). In order to establish baseline information it is important to use healthy animals, however, it is not easy to determine the health status of individuals while studying wild populations. In this situation, however, all the animals appeared clinically healthy without obvious dehydration or gastro-intestinal or external parasites.

Gender-specific variation in haematological parameters has been reported in some animal species such as dorcas gazelle (Bush et al., 1981); moufflon (Hawkey et al., 1984); several strains of mice (Swoyer et al., 1987); feral horses (Plotka et al., 1988) and reindeer (Catley et al., 1990). While no variation was reported between male and female adult pronghorn antelope (*Antilocapra americana*). In the present study there were no significant differences in the haematological parameters with the exception of platelet counts and plateletcrit which were found to be significantly higher in males as compared with female subjects. The pathological consequences of decreased platelets (thrombocytopenia) are well recognised, however, the significance of increased platelets (thrombocytosis) is not well documented (Hawkey and Bennett, 1988; Hawkey et al., 1990). Hawkey et al. (1990) attributed thrombocytosis in 141 samples to be associated with disease conditions; however, three samples were from healthy house mouse (*Mus musculus*) and one from an Indian elephant (*Elephas maximus*). It is probable that thrombocytosis is a feature of mouse and Indian elephant and has nothing to do with disease and it cannot be compared with Libyan jirds due to marked genetic and behavioural differences. However, thrombocytosis observed in the male *M. libycus* could be a natural feature for this particular species and it is likely associated with androgens (Shahidi, 1973). Adham et al. (2011) reported thrombocytopenia in *M. libycus* collected from a polluted area and an un-polluted area in both males and females. It is likely that the low values reported by Adham et al. (2011) may have resulted from the effect of pollution or the microhabitat on the platelets values of animals studied.

In the biochemical values there was no significant differences between males and females except for BUN and B:C ratio as both parameters appeared significantly higher in males when compared with females. It was not easy to explain this variation of BUN values between males (22 ± 4.4 mmol/l) and females (18.1 ± 5.2 mmol/l) although they were collected from the same location. BUN value was found to be correlated with dietary protein and protein utilisation in cervids and it appears stable and unaffected by the handling methods and reproductive status of animals (Le-Resche et al., 1974). It is probably that the Libyan jird follows the same rule. BUN together with creatinine are used to evaluate renal function and as long as there was no increase in the creatinine values, therefore, it is likely that the increase in the BUN is probably extrarenal and most likely due to nutritional causes (Torell et al., 1974). Possible causes of differences in BUN values between males and females could be due to some intrinsic factors related to protein metabolism. The increase in the B:C ratio in males is following the increase in the BUN values although there was no significant difference in the creatinine values between both sexes. The B:C ratio in both males and females was greater than 20:1 and this is an indication that the causes of this increase are likely to be of dietary origin and have no clinical significance in this animal species. Increased B:C ration in humans is associated with upper gastrointestinal tract bleeding (Felber et al., 1988). However, increased B:C ratio in dogs infected with babesiosis was proven to be of extrarenal causes (de Scally et al., 2006).

Males showed increase in the level of amylase than females but the difference was not significant. The pancreatic amylase secretion adapts to the level of concentrate in the diet, this limitation is probably due to low amylase content of the pancreatic secretions (McAllister et al., 1994). The glucose levels in

males appeared slightly higher than the females but the difference was not significant, however, values reported from *M. libycus* in the present study were similar to the values reported earlier by Madjdzadeh et al. (2011) in *M. libycus* and *M. persicus* from Iran. Unlike what has been reported in the present study, glucose levels indicated by Adham et al. (2011) from *M. libycus* collected from an un-polluted area in Saudi Arabia were found to be higher in females. These differences may be attributed to the effect of anaesthesia as it has been reported previously that several anaesthetic agents can cause severe hyperglacaemia (Saha et al., 2005).

In conclusion, the present study presents baseline haematoligcal and biochemical information for apparently healthy Libyan jird (*M. libycus*) from central Saudi Arabia. The data will allow for further comparison with wild-caught Libyan jird or other rodents in Saudi Arabia and to assess health condition of Libyan jirds especially in laboratory experimental infections. Further work will explain the reasons for lower blood glucose levels from wild jird populations compared to other populations and it will also allow understanding the changes in the BUN levels from rodents in different environments.

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