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Hematologic and Biological Contour of Barela Dromedary She-Camels in Relation to Pregnancy Reared under Pastoral Conditions

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Abstract

Pilot research performed about hematologic and biological outline of Barela she-camel (*Camelus dromedarius*) influenced by pregnancy under pastoral conditions in Thal desert. About thirty females were splitted into 2 groups, including group-1 of fifteen pregnant and group-2 of equal number of non-pregnant animals reared under pastoral conditions. They were offered grazing/browsing for about 4–5 hours on desert species and then some manger feeding of kitchen and crop wastes on their return to the housing premises. Water was offered twice a day usually. Some hematologic and biological indices like hemoglobin, red cells, white cells, PCV and glucose, cholesterol, triglycerides, total proteins, urea, creatinine were estimated on hematology and biochemistry analyzer. The data collected was checked for normality by applying Shapiro-Wilk test as ($p = 0.0988$ and $p = 0.0831$) showing normal distribution in both groups. Two sample *t* test (Welch test) applied for means comparisons. The results showed that hemoglobin concentrations ($p > 0.5759$) were 12.58 ± 0.62 and 13.18 ± 0.86 (g/dl) in G-1 and G2, respectively. The RBC ($p = 0.2669$), WBC ($p = 0.4868$) and PCV ($p = 0.5926$) concentrations were varied non-significantly between groups. The values of glucose ($p = 0.7173$), cholesterol ($p = 0.5220$), triglycerides ($p = 0.7085$), total protein ($p = 0.5809$), albumin ($p = 0.1492$) and globulins ($p = 0.1291$) were found to be higher in pregnant animals but varied non-significantly between groups. The levels of urea ($p = 0.8975$) and creatinine ($p = 0.8051$) were also non-significant but slightly higher in non-pregnant she-camels. The results depend on the context with other published studies and may serve as repository for further research in camel science.

Introduction

The camel is performing very impactful duty in the life of bedouins and nomads by uplifting their social and economic status in certain areas of world. It is playing eclectic function in marginalized areas of society; but still an ignored livestock specie in Pakistan (Faraz 2020). Faraz and co-workers have taken initiative to document productive parameters, constraints and reference values for hematologic and biological indices in natural biome (Faraz et al. 2018). The objectives of these studies are to elevate livelihood of desert civilizations who lacks any substitute mode of finances rather their existence on camel, small ruminants and backyard poultry raising (Faraz et al. 2019).

Hematologic and biological picture is indicator of health condition of animal; which is mutable by different geographical and physiological factors affecting pathology conditions of animals (Sarwar and Majeed 1997). Abebe et al. (2002) argued that in conjunction with hematologic profile, quantifiable indices of production like growth and milk production are also very important for appropriate assessment of feed intake, feed conversion efficiency and recommendation of drugs. However, hematologic study also provides evidence about animal health condition in general (Faye and Bengoumi 2018). Moreover, hematologic and biological profile could be an appliance for screening indefinite vitality of camelids (Faraz et al. 2021).

The breeding performance is of major concerns to cameleers as the declined reproductive capacity affects camel farming negatively. So, regular monitoring of camel herds for breeding issues is considered an important segment of health considerations (Kaufmann 2005). The reproductive rendition in camels is often poor under natural pastoral conditions (Eknah 2000). There are several factors like shortened breeding season, longer age at first calving, lower libido in males and delayed postpartum estrous which affect the reproductive performance of camels (Skidmore 2005). The change in the hematologic and blood biological profile serve as biomarker of metabolic, physiological and pathological state (Getnet et al. 2005) while the related measurable indices are extremely valuable for FCE and optimum drug dosing (Abebe et al. 2002).

Several investigators worked on hematology and biochemistry of camels as; Al-Busadah and Osman (2000) from KSA, Babeker et al. (2013) from Sudan, Jalali et al. (2018) from Iran. Nevertheless; available information needs further confirmatory and/ or intensive research to reach the solid conclusion (Faraz et al. 2018). Furthermore, published studies lack reference data about many vital parameters in diverse physiological conditions of Pakistani camels.

There is no research data has been published about the subject, hence; current study is of pilot in its nature, covers hematologic and biological parameters with reference to pregnancy of Barela camel. This will serve as basic repository for further probing in camel science.

Materials and Methods

Study Area

The desert Thal situated in Thal area of Tehsil Mankera of District Bhakkar under the agro-ecological zone-III. There are thin strips of sand edges in sandy deserts having sandbanks and arid to semi-arid semitropical continental atmospheric states. The average temperature fleers to 46 ºC at maximum and down from 5.50 to 1.30°C during winter. The average yearly precipitation is 150–350 mm in that area and it is increased in Southern to Northern regions (Rahim et al. 2011).

Experimental Animals and Management

Around 30 Barela she-camels kept in extensive management system (EMS) were selected by purposive sampling technique and allotted to 2 groups as G-1 having fifteen pregnant while G-2 with fifteen non-pregnant females. After examining, the healthy animals were selected for the trial. Deworming was practiced with Ivermectin injection dosing 1ml per 50 kg of live weight for internal and Ecoflece spray as 1cc per liter of water for external parasites control. The she-camels were allowed grazing and browsing in field area for 4–5 hours on daily basis; then fed some crop residues in rest of time while salt lumps were placed in mangers. Water was provided twice a day.

Sampling and Analysis

The she-camels bleed by jugular puncture in EDTA and Non-EDTA test tubes with proper procedure adopted for sampling. Hematologic and biological indices were studied with usage of standard kits on BC-2300 hematology analyzer manufactured by Mindray-Germany and DL-9000 biochemistry analyzer by Italy at CBRS lab. Duplicate testing was performed for Hb, RBC, WBC, PCV, glucose, cholesterol, triglycerides, total protein, urea and creatinine parameters. Collected data was checked for normality by applying Shapiro-Wilk test and showed normal distribution in both groups ($p = 0.0988$ and $p = 0.0831$). tow samples *t* test (Welch test) was used to compare means using SPSS (SPSS, 2008) software (Steel et al. 1997).

Results and Discussion

Hematologic Variables

Table 1 describes the hematologic parameters in Barela dromedary camels reared under extensive management system and showed the hemoglobin as 12.58 ± 0.62 vs 13.18 ± 0.86 g/dl ($p > 0.5759$), red blood cells as 9.92 ± 0.48 vs 10.73 ± 0.53 10^6/µl ($p = 0.2669$), white blood cells as 34.62 ± 1.81 vs 32.65 ± 2.13 10^3/µl ($p = 0.4868$) and PCV as 36.86 ± 2.28 vs 38.64 vs 2.37% ($p = 0.5926$) in pregnant and non-pregnant she-camels, respectively. All the values were differed non-significantly between groups. The hemoglobin, RBC and PCV concentrations were higher in non-pregnant females while WBC was higher in pregnant she-camels. The graphical representation of these parameters is shown in Fig. 1.

Table 1
Mean hematologic variables of Barela camel in relation to pregnancy in Extensive Management System

Parameters	Pregnant (n = 15)	Non-pregnant (n = 15)	t	p - value
Hemoglobin (g/dl)	12.58 ± 0.62	13.18 ± 0.86	0.5659 ^{NS}	0.5759
Red Blood Cells (10^6/µl)	9.92 ± 0.48	10.73 ± 0.53	1.1328 ^{NS}	0.2669
White Blood Cells (10^3/µl)	34.62 ± 1.81	32.65 ± 2.13	0.7048 ^{NS}	0.4868
Packed Cell Volume (%)	36.86 ± 2.28	38.64 ± 2.37	0.5413 ^{NS}	0.5926

Hemoglobin (Hb) concentration in literature data was reported as 13–16 g/dl which is found to be higher in camels than other domestic species while it is considered that the affinity for oxygen is higher in hemoglobin of camels (Ouajd and Kamel 2009). In 2017, Zaher et al. reported Hb value above 14 mg/dl in female camels which is slightly higher than current findings. In comparison to the results, the Hb reading was determined almost same as 12.43 g/100ml in pregnant and non-pregnant females (Elitok and Cirak 2018).

Adah et al. (2017) documented hemoglobin as 7.33 ± 0.35 g/dl in dromedaries of Nigeria which is bit lower than present results. In 2019, Islam and co-workers reported Hb concentration in dromedaries of Bangladesh as 10.4 g/dl while in Pakistani camels residing Thal desert as 11.78 g/dl (Ghafoor et al. 2018). While in 2018, Faye and Bengoumi authenticated hemoglobin reference range varied as 9.3–15.5 g/dl in dromedaries.

In 2019, Ebissy et al. verified Hb level as 10.62 ± 0.55 g/dl in female dromedaries during transition period. Lamraoui et al. (2024) reported that sex, age and production systems have no significant effect on hematologic parameters in *Sahraoui* dromedary camels. While, the Hb values found in this research are close to the documented reference range of 10.61–15.29 g/dl in dromedaries (Martin-Barrasa et al. 2023).

In 2007, Amin and co-workers working in Sudan mentioned the RBC concentration (10^6/µl) in dromedaries as 6.41 ± 0.15 in dry and 5.79 ± 0.14 in green season, respectively. The alleged means and range for RBC and WBC as 7.31 ± 0.58, 4.25–12.9 (10^6/µl) and 12.97 ± 0.99, 4.2–20.9 (10^3/µl) in Pakistani dromedary females. In contrary to current study results, Muhammad et al. (2011) assessed hematologic specifications under extensive managing in Nigerian dromedaries and noted higher ($p > 0.005$) Hb (14.3: 10.9 g/dl), RBC (7.02: 4.90 x10^2/l) and WBC (19.2: 15.7 x10/l) concentrations in pregnant animals while PCV (32.7: 38.9%) was found higher in non-pregnant animals.

While working in Thal desert in Pakistan on dromedary camels RBC count was observed as 7.25 ± 0.08 10^6/µl (Ghafoor et al. 2018) which is relatively lower than the reported RBC and WBC count as 9.48 ± 0.16 10^6/µl and 10.95 ± 0.81 10^3/µl in female dromedaries (Zaher et al. 2017). A bit lower WBC count was found as 10.54 ± 0.25 in pregnant and 11.28 ± 0.24 10^3/µl in non-pregnant dromedary females while range was reported as 7.5–22 in adult dromedaries (Elitok and Cirak 2018). On another hand, Ebissy et al. (2019) validated RBC and WBC count as 10.74 ± 0.42 10^6/µl and 9.96 ± 1.22 10^3/µl in female dromedaries during transition state; these findings are not in agreement with our study results.

Farooq and co-workers in 2011, mentioned mean value and range for PCV 32.83 ± 3.76 and 24–50% in dromedary females at Cholistan desert, Pakistan. Reported concentrations of PCV was to be 28.62 ± 0.31% in female dromedaries (Zaher et al. 2017). The PCV concentration was observed as 29.25 ± 0.13% in Pakistani dromedaries at Thal desert (Ghafoor et al. 2018). Elitok and Cirak (2018) listed PCV value as 26.88 ± 0.39 in pregnant and 27 ± 0.37% in non-pregnant dromedary females; while PCV percentage was 32.10 ± 1.44 in dromedary females during transition state (Ebissy et al. 2019).

The range was established as 8.45–13.65 10^6/µl in RBC count, 7.35–18.36 10^3/µl in WBC count and 26.62 ± 3.70% PCV in Canary Island dromedary camels. Regarding the hematologic parameters; no significant differences were observed regarding these parameters in pregnant and non-pregnant dromedary she-camels except WBC which was found higher in non-pregnant category (Martin-Barrasa et al. 2023).

Biological Indices

Table 2 documented the biological indices in Barela dromedary camels reared in pastoral system/EMS, and showed that the glucose was found to be 139.72 ± 5.58 vs 136.66 ± 6.38 mg/dl (p = 0.7173), cholesterol as 58.38 ± 2.82 vs 55.42 ± 3.59 mg/dl (p = 0.5220), triglycerides as 38.39 ± 3.62 vs 36.65 ± 2.85 mg/dl (p = 0.7085), total proteins as 7.83 ± 1.08 vs 6.92 ± 1.22 g/dl (p = 0.5809), albumin as 3.62 ± 0.38 vs 2.92 ± 0.28 g/dl (p = 0.1492), globulin as 3.92 ± 0.18 vs 2.82 ± 0.68 g/dl (p = 0.1291), urea as 45.66 ± 3.64 vs 46.33 ± 3.65 mg/dl (p = 0.8975) and creatinine as 1.45 ± 0.09 vs 1.48 ± 0.08 mg/dl (p = 0.8051) in pregnant and non-pregnant she-camels, respectively. All the values were differed non-significantly (p > 0.05) between groups. The graphical representation of these parameters is shown in Fig. 2.

Table 2
Mean biological indices of Barela camel in relation to pregnancy in Extensive Management System

Parameters	Pregnant (n = 15)	Non-pregnant (n = 15)	t	p - value
Glucose (mg/dl)	139.72 ± 5.58	136.66 ± 6.38	0.3657 NS	0.7173
Cholesterol (mg/dl)	58.38 ± 2.82	55.42 ± 3.59	0.6484 NS	0.5220
Triglycerides (mg/dl)	38.39 ± 3.62	36.65 ± 2.85	0.3777 NS	0.7085
Total Protein (g/dl)	7.83 ± 1.08	6.92 ± 1.22	0.5585 NS	0.5809
Albumins (g/dl)	3.62 ± 0.38	2.92 ± 0.28	1.4830 NS	0.1492
Globulins (g/dl)	3.92 ± 0.18	2.82 ± 0.68	1.5638 NS	0.1291
Urea (mg/dl)	45.66 ± 3.64	46.33 ± 3.65	0.1300 NS	0.8975
Creatinine (mg/dl)	1.45 ± 0.09	1.48 ± 0.08	0.2491 NS	0.8051

The concentration of glucose, cholesterol, triglycerides, total proteins, albumins and globulins were listed higher in pregnant females while urea and creatinine were found to be higher in non-pregnant females. Osman and Al-Busadah (2003) exclaimed that glucose concentration was observed higher in camels and may be this is the reason for elevated lactic acid contents in camel blood. While in contrary to this finding, lower significant glucose values were observed in grazed pre-pubescent camels under pastoral managing in Rajasthan (Saini et al. 2014). In 2015, Kelanemer and co-workers working on dromedary she-camels; documented mean levels for glucose as 0.91 ± 0.02 g/liter, cholesterol as 229.93 ± 1.31 mg/liter and triglycerides as 399.09 ± 1.87 mg/liter in pregnant group.

Zaher et al. (2017) found glucose level as 88.68 ± 1.66 mg/dl in female dromedaries; while reported range for this is 60 to140 mg/dl (Faye and Bengoumi 2018). Particularly, the glucose concentration (mg/dl) was 100.55 ± 1.03 in non-pregnant and 96.58 ± 1.53 in pregnant she-camels (Elitok and Cirak 2018). While, in transition state the glucose level was reported as 228.0 ± 5.21 mg/dl in Egyptian she-

camel (Ebissy et al. 2019). In other studies, reported glucose levels were observed as 114.9 mg/dl in Bangladesh (Islam et al. 2019) while 176 ± 10.7 mg/dl in lactating dromedaries in Egypt (Mohamed et al. 2019).

Saeed et al. (2009) studied comparison of biological parameters in serum of 28 pregnant and 32 non-pregnant dromedary camels and documented significantly lower albumin, blood urea nitrogen, cholesterol and total protein concentrations in pregnant camels while globulin, creatinine concentrations varied non-significantly. Muhammad et al. (2011) reported levels of blood urea as (6.03 vs 5.50 mmol/l), total proteins as (74 vs 70 g/l), serum globulin as (36 vs 31 g/l) and albumin as (38.67 vs 36 g/l), non-significant but higher in pregnant than non-pregnant she-camels, respectively. Ashwag et al. (2015) collected samples from 50 female dromedary camels, splitted in 2 groups of 25 each, results showed that there was significant elevation in levels as total protein was 7.9 ± 0.82 and 7.1 ± 0.53 g/dl and globulin was 4.4 ± 0.81 g/dl and 3.5 ± 0.49 g/dl, respectively in pregnant and non-pregnant class while albumin and cholesterol did not differ significantly between groups.

In recent study of Martin-Barrasa et al. (2023) in Canarian dromedaries, the reference range for certain biochemicals was found to be as lower levels for blood urea nitrogen, BUN/creatinine ratio, while higher levels for creatinine, albumin and cholesterol in pregnant females; the levels as for creatinine (1.50 ± 0.36 mg/dl), BUN (10.60 ± 6.08 mg/dl), total proteins (5.84 ± 0.56 g/dl), albumin (3.38 ± 0.47 g/dl), globulin (2.45 ± 0.28 g/dl), cholesterol (41.34 ± 28.60 mg/dl). The reported glucose was 1.21 ± 0.04 g/l, protein as 63.8 ± 73 g/l, urea as 432.54 ± 17.4 mg/l, triglycerides as 487.66 ± 86 mg/l, cholesterol as 318.7 ± 32 mg/l, lipids as 3 ± 0.31 g/l in breeding camelids (Kelanemar et al. 2025).

Proper kidney functions are determined by the levels of urea and creatinine which is excreted in routine and is a product of muscle metabolism (Brar et al. 2000). Higher urea levels were observed in grazing dromedaries under pastoral managing (Saini et al. 2014). In Algeria, the total protein (TP) and urea levels were 57.84 ± 0.46 g/l and 372.65 ± 1.83 mg/l in pregnant dromedaries (Kelanemer et al. 2015). The observed levels of TP and creatinine were 6.27 ± 0.13 g/dl and 1.12 ± 0.05 mg/dl in female dromedaries (Zaher et al. 2017). In literature review, Faye and Bengoumi 2018 documented the range for normal urea levels as 5–40 mg/dl and creatinine as 0.8-2 mg/dl in dromedaries.

In a very comprehensive study about pregnancy effect in dromedaries, the reported levels for TP were 5.95 ± 0.08, 7.85 ± 1.45 g/dl, for BUN 1.20 ± 0.06 and 6.43 ± 0.04 mg/dl and for creatinine as 15.48 ± 1.45, 1.42 ± 0.04 mg/dl in non-pregnant and pregnant class, respectively (Elitok and Cirak 2018). While the TP and urea were observed as 8.2 g/dl and 25.04 mg/dl in Bangladeshi dromedaries (Islam et al. 2019); TP as 5.8 ± 0.08 g/l and creatinine as 0.88 ± 0.07 mg/dl in Egyptian lactating dromedaries (Mohamed et al. 2019). Moreover, the TP values were found to be 5.92 ± 0.17 g/l, BUN as 17.09 ± 0.46 mmol/l and creatinine as 1.05 ± 0.11 mg/dl in Egyptian female dromedaries during transition state (Ebissy et al. 2019).

Conclusion

The blood biological picture could state ample knowledge about the physiological condition and general wellbeing of animals. This may serve as biomarker for the confirmation of pregnancy in camels. As the pregnancy detection is difficult in she-camels, mainly the cameleers assess this condition by tail cocking which is an indigenous belief. The pregnancy could be testified by using these indices on scientific lines. This study explicit the normal hematologic and blood biological values in Barela dromedary camel related to pregnancy in extensive conditions. The observed levels were in normal organic range as also in reported data while alterations are ascribed to several reasons like breed, age, gender, biological states which should be investigated in future studies.

Declarations

Ethical approval

The animal study was approved by Animal Ethics Committee Department of Livestock and Poultry Production, Bahauddin Zakariya University Pakistan.

Competing interests

No potential conflicts of interest have been reported by the authors.

Authors Contributions

Asim Faraz involved in research and writeup, Muhammad Shahid Nabeel and Faizan Saleem involved in research trial, Abdul Waheed was in charge of statistical procedures, Riaz Hussain Mirza shared in write up, Muhammad Hussain Ghazali reviewed the paper.

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Data Availability

All the data of study is presented in the manuscript.

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Figures

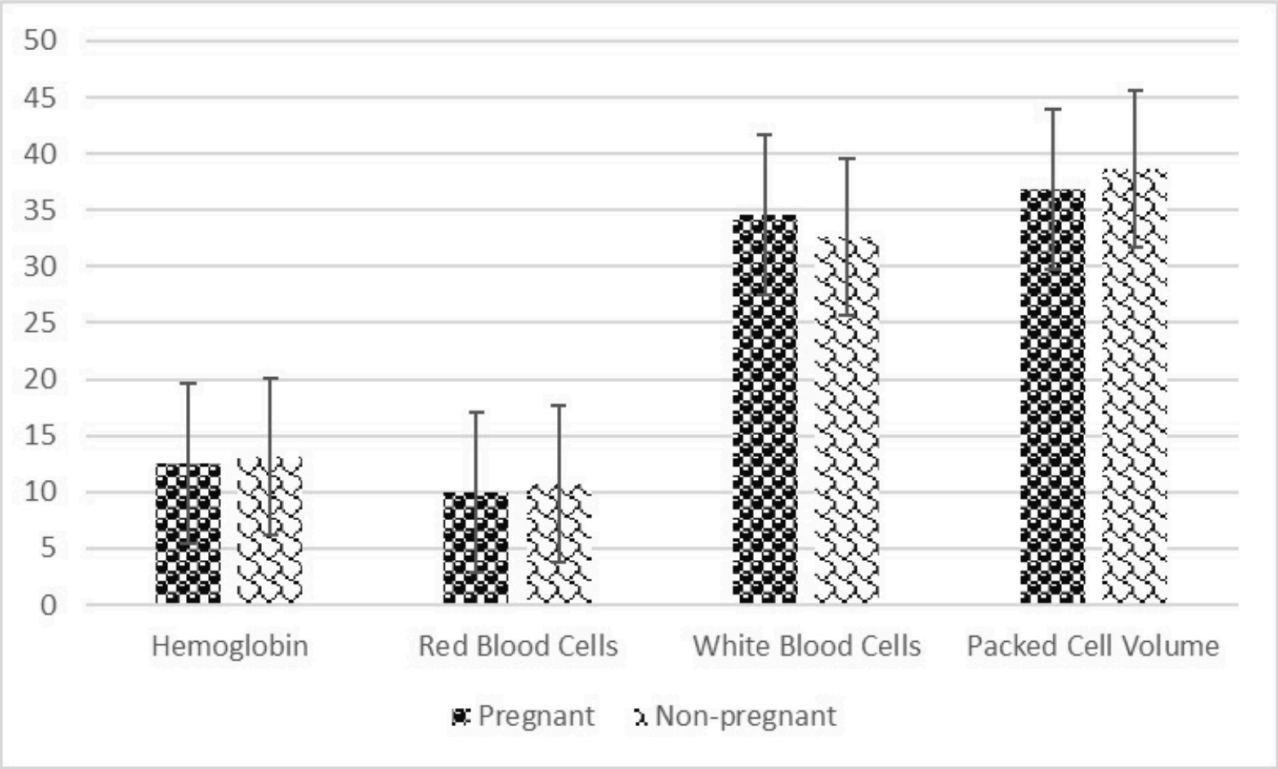
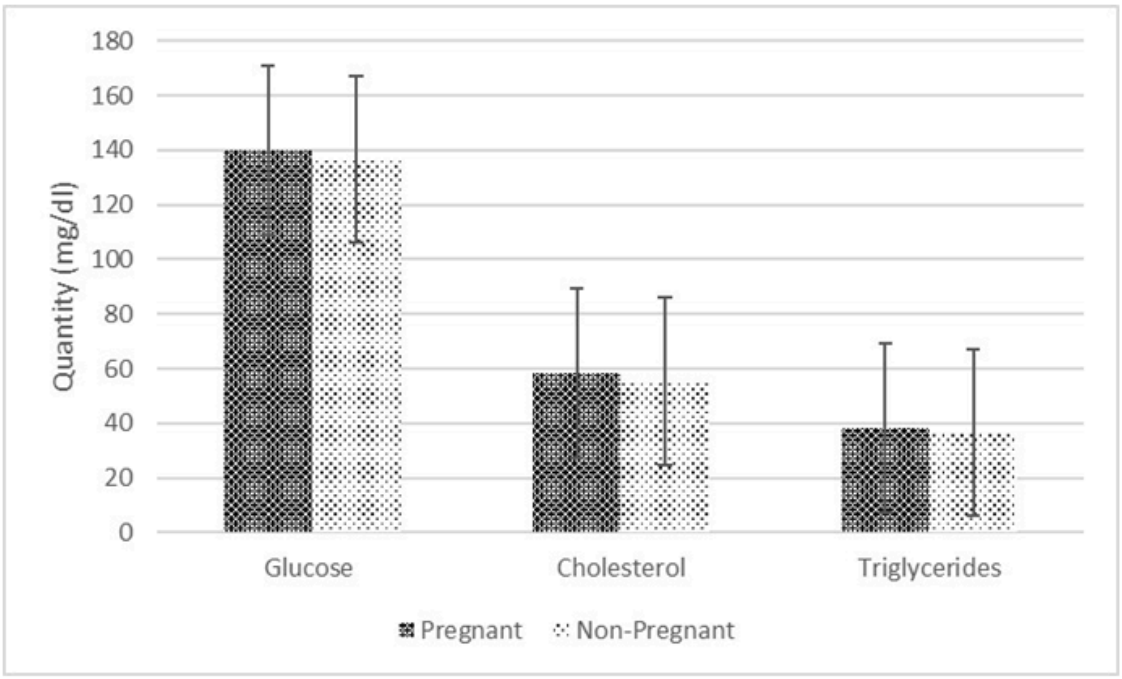


Figure 1

Hematologic variables in pregnant and non-pregnant Barela she-camels

a)



b)

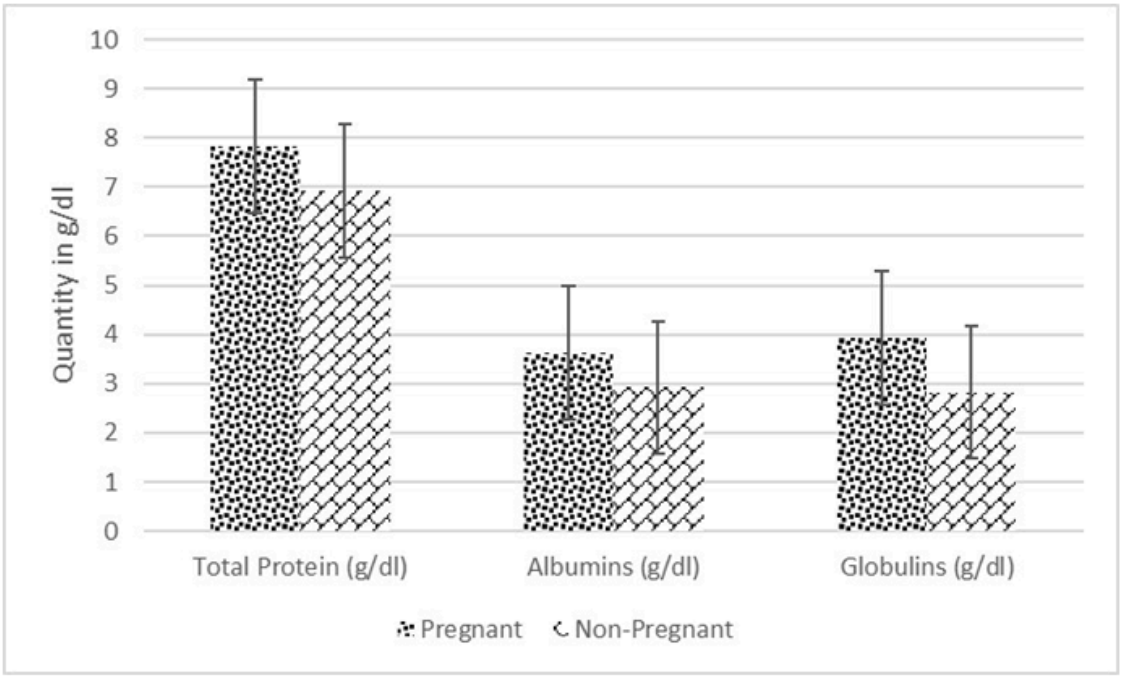


Figure 2

Biological indices in pregnant and non-pregnant Barela she-camels