Eurasian Journal
of Veterinary Sciences

www.eurasianjvetsci.org

RESEARCH ARTICLE

Relation of some biochemical parameters in Van (Turkey) cats with sex, age, eye colour and hair length

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Geliş:17.10.2017, Kabul: 25.12.2017
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Van kedilerinde bazı biyokimyasal parametreler ile cinsiyet, yaş, göz rengi ve tüy uzunluğu arasındaki ilişkiler

Eurasian J Vet Sci, 2018, 34, 1, 19-24
DOI:10.15312/EurasianJVetSci.2018.175

Öz

Amaç: Van kedileri, doğu Türkiye kaynaklıdır ve ulusal kültürel varlıkların bir parçasıdır. Van kedilerinin en belirgin özelliği, gözlerinin renkleridir (diskromatopsi). Bu çalışmanın amacı, Van kedilerinde plazma aspartat aminotransferaz, alanin aminotransferaz aktiviteleri, total protein, albümin, glikoz, trigliserit, LDL kolesterol, HDL kolestrol, kan üre / nitrojen ve kreatinin düzeylerini saptamak ve bu parametrelerin cinsiyet, yaş, göz rengi ve tüy uzunluğu ile ilişkisini araştırmaktır.

Gereç ve Yöntem: Bu çalışmada, standart kedi yemi ile beslenen, sağlıklı, 47 adet Van kedisi (Van Kedi Evi, Yuzuncu Yil Üniversitesi, Van) kan plazması kullanıldı. Kediler, cinsiyet (dişi-erkek), yaş (1-2; 3-4; 5'in üzerinde), göz rengi (amber-amber, amber-mavi, mavi-amber, mavi-mavi, soldan sağa açıklanan gözler) ve tüy uzunluğu (kısa; uzun) temel alınarak gruplara ayrıldı. Plazma biyokimyasal parametreleri ticari kitlerle kolorimetrik olarak spektrofotometre ile belirlendi.

Bulgular: Cinsiyete ilişkin olarak parametreler arasında fark yoktu. Kısa tüylü kedilerde uzun tüylü kedilere göre albumin düzeyleri daha yüksekti ($p<0.05$). Göz rengi açısından değerlendirildiğinde, mavi-mavi gözlü kedi plazma glikoz düzeyleri diğer göz rengi gruplarına göre çok daha yüksekti ($p<0.001$). Yaş gruplarında, 1-2 yaşındaki kedilerde kreatinin düzeyleri diğer yaş gruplarına göre daha düşüktü ($p<0.05$).

Öneri: Sonuçlarımız, Van kedilerinin plazma biyokimyasal parametrelerinin bazılarının göz rengi, yaş ve tüy uzunluğu ile ilişkili olabileceğini göstermiştir. Ayrıca Van kedilerinden elde edilen bu biyokimyasal bulguların, klinik tanıda yarar sağlayacağı düşünülmektedir.

Anahtar kelimeler: Van Kedileri, Biyokimyasal Parametreler, Göz Rengi, Tüy Uzunluğu

Abstract

Aim: Van cats originate from eastern Turkey and they are a part of the national cultural assets. The most striking characteristic feature of the Van cats is the colour of their eyes (dischromatopsy). The aim of this study was to determine plasma aspartate aminotransferase, alanine aminotransferase activities, total protein, albumin, glucose, triglyceride, total cholesterol, LDL cholesterol, HDL cholesterol, urea/nitrogen, and creatinin levels and the relation of these parameters with sex, age, eye colour and hair length in Van cats.

Materials and Methods: Healthy blood plasma, 47 Van cats (Van Cat House, Yuzuncu Yil University, Van), fed with standart cat food, were used. Cats were divided into groups based on sex (female-male), age (1-2; 3-4; above 5), eye colour (amber-amber, amber-blue, blue-amber, blue-blue, eyes described from left to right) and hair length (short; long). Plasma biochemical parameters were determined colorimetrically by spectrophotometry, with commercial kits.

Results: There was no difference between the parameters regarding with sex. Albumin levels were higher in the short-haired cats compared to the long-haired cats ($p<0.05$). As regards eye colours, blue-blue eyed cat plasma glucose levels were much higher from than in the other eye colour groups ($p<0,001$). In age groups, creatinin levels were lower ($p<0.05$) in 1-2 year-old cats compared to the other age groups.

Conclusions: Our results indicate that some of the plasma biochemical parameters of the Van cats may be related to their eye-colours, age and hair length. It also can be considered that the biochemical parameters obtained in the Van cat may be useful for the clinical diagnosis.

Keywords: Van cat, Biochemical parameters, Eye-colour, Hair length

Introduction

Van cat which originate from eastern Turkey is a part of our national cultural assets. The most striking characteristic feature of the Van cats is the colours of their eyes. Some of them have different colour of one eye from the other (dischromatopsy) (Gure 1993). In contrast to the other cat species, the Van cats like swimming and playing in water. However, this species is facing with the danger of extinction. Some preventive measures have been taken in order to protect this species (Anonymous 1). Biochemical parameters will be revealed within the scope of protection of the Van cats and important information will be obtained in terms of diagnosis and prognosis of diseases including physiological state changes (pregnancy etc.). Since, to determine the biochemical values of races are more difficult, species specific reference values are generally used. However, it is considered that the most appropriate approach is to determine the reference intervals in such a way as to represent the race (Arıkan et al 2001, 2003, Nisbet 2006, Altunok et al 2007, Macun et al 2010, Şimşek et al.2015b, Özkan et al 2016).

Biochemical studies of this race have been limited to a few studies in the literature review (Arıkan et al 2003, Macun et al 2010, Altunok et al 2011). In a study on blood groups, A blood group was found to be 40% and B blood group was found to be 60% in the Van cats (Arıkan et al 2003). In the same study, the percentages of blood groups A and B in the Angora cats were determined as 53.6% and 46.4%, respectively and it was revealed that there are differences between races. In another study of genetically differentiating the Van cats from other cat breeds, Altunok et al (2011) reported that phosphogluconate dehydrogenase, malic enzyme and esterase D loci are different between Van cats and other cat breeds. Macun et al (2010) determined the some biochemical parameters of the Angora and Van cats during their gestation and lactation period. The ALT, AST activities, glucose, cholesterol, albumin, Pi and Mg levels were within the reference range but total protein, globulin and Ca levels were above the reference range according to other cat breeds. When examined in terms of biochemical parameters such as serum AST, ALT, lactate dehydrogenase (LDH), creatine kinase (CK) activities, glucose, urea, creatinine, , potassium (K), chlorine (Cl) and sodium (Na) levels in female, male, and under 1 year old kittens were determined within the same reference range as other cat breeds (Sönmez and Ağaoğlu 2010). Akkan et al (2005) reported that serum activities of AST, ALT, ALP, and levels of bilirubin in the Van cats were the same reference values of other cat breeds. Yörük (2000) determined the total cholesterol, triglyceride and total protein consantrations as mg/dl by the colorimetric method and also the levels of VLDL, LDL and HDL as percent (%) by electrophoretic method in 10 Van cats. Altunok et al (2007) determined that some trace element levels in the male cats were different from than in the female cats in this study of the Van cats and also levels of aluminum, copper, manganese, strontium and zinc were higher in blue-blue eyed cats than in the other different coloured eyed cats ($p<0.05$).

Although some biochemical parameters were revealed (Macun et al 2010, Sönmez and Ağaoğlu 2010, Karaca 2009, Söyler 2006, Özkan et al 2016) in the Van cats, it was observed that these parameters were not related to age, gender, eye colour and hair length in the literature reviews except Altunok et al (2007) and Özkan et al (2016). It is reported that blood biochemical parameters may change under different factors such as sex, age, race, climate, stress, and pregnancy (Eksen et al 1992, Awah and Nottidge 1998, Strasser et al 2001, Altunok et al 2007, Uslu et al 2012, Şimşek et al 2015a,b). In different age groups of cattle, plasma ALT, AST and alkaline phosphate (ALP) activities were found different (Sharma and Bisoi 1995). In Angora cats, and plasma creatinine levels reported to increased with age. In Kangal dogs, cholesterol levels were lower and total protein levels were higher in adults compared to puppies (Çınar et al 2010). Also, Arıkan et al (2001) reported that biochemical parameters differ within different race of sheeps.

Therefore, the aim of this study was to investigate the relationship of plasma aspartate aminotransferase, alanine aminotransferase activities, total protein, albumin, glucose, triglyceride, total cholesterol, LDL cholesterol, HDL cholesterol, blood urea/nitrogen, and creatinin levels with age, gender, eye colour and hair length in the Van cats.

Materials and Methods

To determine selected biochemical parameters of the Van cats, 47 healthy animals were used (Van cat house, YuzuncuYıl University, Van, Turkey). The cats were fed with standard canned food (LA-CAT, Israel). Cats were divided into four groups based on age (1 - 2; 3 - 4; and > 5 years old), sex (female; male), eye colour (amber-amber; amber-blue; blue-amber and blue-blue, eyes described from left to right) and hair length (short; long). Blood samples were collected from each cats in the morning (10:00 a.m.) by puncture of the cephalic vein.

Plasma (EDTA) samples were separated by centrifugation (3000 rpm, 15 minutes), and stored at -80 °C until analysis. Plasma aspartate aminotransferase (AST), alanine aminotransferase (ALT) activities, total protein, albumin, glucose, triglyceride, total cholesterol, LDL cholesterol, HDL cholesterol, blood urea/nitrogen, and creatinin levels were determined colorimetrically (UV 2100 UV–VIS Recording Spectrophotometer Shimadzu, Japan) with commercial kits (Human Diagnostics Worlwide, GmbH, Germany).

Statistics

All the values are expressed as mean ± SE. The results of groups were analyzed by Student's t-test (sex and hair length groups) and ANOVA (age and eye colour) with posthoc Duncan multiple range tes t (SPSS for Windows, release 12.0). In all cases, probability of error less than 0.05 was chosen as the criterion of

statistical significance.

Results

Biochemical parameters and the relations of these parameters with the variables (sex, age, eye colour and hair length) in the Van cats are given in Table 1, 2, 3 and 4.

As regards sex, there was not any statistically significant difference in the parameters (Table 1). When assessed for age, creatinin levels were lower ($p<0,05$) in 1-2 year-old group compared to 3-4 year-old and above 5 year-old cats (Table 2). Blue-blue eyed cats had much higher ($p<0,001$) plasma glucose levels than in the other eye colour groups (Table 3). Plasma albumin levels were higher ($p<0,05$) in the short haired cats compared to the long haired cats (Table 4). There was not any statistically significant difference between the other biochemical parameters and the variables.

Discussion

In the present study, some biochemical parameters of the Van cats in relation to their sex, age, eye colour and hair length have been shown in the tables 1, 2, 3, and 4.

Table 1. Biochemical parameters of the Van cats according to the sex differences (Mean ±SE)

Sex	Female n=31	Male n=16	Total n=47	References
AST (U/L)	21.55 ±2.13	20.20±2.17	21.10±1.58	26-43 (Kaneko 1997), 10-100 (Anonymous 2)
ALT (U/L)	20.66±1.54	19.42±1.51	20.25±1.14	6-83 (Kaneko 1997), 10-100 (Anonymous 2)
Total Protein (g/dl)	7.23±0.15	6.70±0.24	7.05± 0.013	6.3-10.3g/dl (Lehmann et al. 1997, Eliotta and Barber 1998, Reynolds et al. 2010)
Albumin (mg/dl)	2.93±0.07	2.78±0.09	2.88±0.05	2.6-3.9 mg/dl (Reynolds et al. 2010)
Glucose (mg/dl)	116.92±10.81	94.45±6.99	109.43±7.68	73-134 (Kaneko 1997),61-170(Anonymous 2, Reynolds et al. 2010)
Triglyceride (mg/dl)	49.22±6.25	50.11±8.39	49.52±4.96	35-62 mg/dl (Lehmann et al. 1997)
Total Cholesterol (mg/dl)	71.19±6.83	68.48±5.90	70.29±4.92	69.50-180 mg/dl(Eliotta and Barber 1998)
LDL (mg/dl)	40.67±3.16	39.88±4.23	40.41±2.51	11-59 (Demacker 1997, Watson 1995)
HDL (mg/dl)	19.56±2.37	25.70±3.63	21.61±2.01	71-148 (Demacker 1997, Watson 1995)
				37.40 (Mosallanejad et al. 2016)
BUN (mg/dl)	20.91±0.95	19.81±1.05	20.55±0.72	20-30 (Kaneko 1997)
Creatinin (mg/dl)	1.25±0.05	1.032±0.09	1.28±0.05	0.9-1.9 (Kaneko 1997)

There was not any statistical significant differences ($p>0.05$)

Table 2. Biochemical parameters of the Van cats according to the age of years differences(Mean ±SE)

Age	1-2 years n=21	3-4 years n=17	>5 years old n=9
AST (U/L)	21.45±2.27	23.65±3.19	16.04±2.17
ALT (U/L)	19.40±1.64	20.28±2.31	22.16±1.94
Total Protein (mg/dl)	7.10±0.22	6.94±0.21	7.13±0.24
Albumin (mg/dl)	2.92±0.09	2.80±0.09	2.91±0.09
Glucose (mg/dl)	120.90±14.53	104.74±7.33	90.50±12.14
Triglyceride (mg/dl)	59.26±9.70	42.23±4.74	38.94±3.18
Total Cholesterol (mg/dl)	72.34±9.76	64.30±4.33	75.47±6.68
LDL (mg/dl)	37.96±3.96	38.24±4.08	49.74±4.34
HDL (mg/dl)	23.81±3.76	18.25±2.37	22.09±3.02
BUN (mg/dl)	20.95±1.20	19.04±1.10	21.82±1.29
Creatinin (mg/dl)	1.15±0.06 a	1.39±0.07 b	1.40±0.12 b

Differences in the same row are statistically significant ($p<0.05$)

Table 3.Biochemical parameters of the Van cats according to the eye colour differences(Mean ±SE) Eye colours (left eye - right eye)

Eye Colour	Amber-Amber n=13	Amber-Blue n=12	Blue-Amber n=12	Blue-Blue n=10
AST (U/L)	18.45±1.86	26.13±4.51	17.77±2.54	22.56±3.52
ALT (U/L)	18.96±1.90	21.29±2.98	20.94±1.78	18.93±2.85
Total Protein (mg/dl)	7.10±0.19	6.68±0.22	7.50±0.26	7.02±0.34
Albumin (mg/dl)	2.81±0.04	2.79±0.13	2.93±0.08	2.95±0.17
Glucose (mg/dl)	114.47±10.52[a]	84.66±4.74 [a]	83.99±3.83 [a]	162.87±27.91 [b]
Triglyceride (mg/dl)	45.87±2.58	50.93±10.50	39.53±7.51	67.05±18.28
Total Cholesterol (mg/dl)	77.19±14.63	70.06±7.46	67.91±6.70	66.42±9.64
LDL (mg/dl)	39.75±3.30	39.71±5.80	45.88±5.23	36.29±6.46
HDL (mg/dl)	19.57±2.15	20.00±3.28	25.35±3.80	22.37±7.44
BUN (mg/dl)	21.75±1.33	19.50±0.67	18.45±1.76	22.69±1.98
Creatinin (mg/dl)	1.39±0.09	1.20±0.08	1.26±0.12	1.24±0.09

Differences in the same row are statistically significant ($p<0.001$)

Table 4.Biochemical parameters of the Van cats according to the hair length differences(Mean ±SE)

Hair-length	Short-haired n=32	Long-haired n:15
AST (U/L)	20.71±1.97	21.96±2.71
ALT (U/L)	19.99±1.31	20.81±2.30
Total Protein (mg/dl)	7.10±0.18	6.95±0.13
Albumin (mg/dl)	2.95±0.07[a]	2.71±0.05 [b]
Glucose (mg/dl)	112.90±9.87	101.74±11.75
Triglyceride (mg/dl)	53.90±6.97	39.81±3.00
Total Cholesterol (mg/dl)	72.99±6.83	64.31±4.65
LDL (mg/dl)	40.87±3.11	39.38±4.33
HDL (mg/dl)	23.02±2.73	18.49±2.23
BUN (mg/dl)	20.55±0.96	20.58±0.94
Creatinin (mg/dl)	1.27±0.06	1.32±0.06

Differences in the same row are statistically significant ($p<0.05$)

Determination of AST and ALT activity informs about liver and soft tissue damage. In this study plasma activities of AST and ALT were consistent with the levels of those reported by Sönmez and Ağaoğlu (2010) and Macun et al (2010), whereas Özkan et al (2016) reported higher levels of ALT levels in Van cats. There was not any association between the variables (sex, age) and AST, ALT activities, which was in good agreement with Özkan et al (2016) who reported unchanged AST and ALT activities between sex and age in Van cats.

As regards total protein and albumin levels, it was found that levels were slightly lower from than in Macun et al (2010) who reported in the Van cats, whereas the results of this study were in good agreement with Özkan et al (2016) and cat reference values reported by Reynolds et al (2010). There was not any correlation between total protein and variables in this study, but it was observed that albumin levels in the short-haired group were higher than in the long-haired group ($p<0.05$). There was not any literature on the relationship between hair length and albumin levels. It is suggested to investigate this relation detailed.

In the literature, there is discrepancy in plasma glucose levels, such as; plasma glucose levels were 109,43±7,68 mg/dl in our study, Sönmez and Ağaoğlu (2010) reported plasma glucose levels as 86-87 mg/dl and Özkan et al reported as 58.0±3.2 mg/dl.

Nevertheless, our results were consistant with the values reported in cats (Kaneko 1997, Anonymous 2, Reynolds et al 2010). In the present study, it was determined that plasma glucose levels were not related to the variables except eye colour, that is; glucose levels were found higher in the Van cats with blue-blue eyed than in the other eye colour groups ($p<0.001$). There was not information about the relationship between eye colour and plasma glucose levels. Similar to this novel result, Altunok et al (2007) determined that the concentrations of serum Al, Cu, Mn, Sr and Zn in the blue-blue eyed cats were higher than the cats with amber-amber, amber-blue and blue-amber coloured eye ($p<0.05$). Further studies may be established to elaborate the carbohydrate metabolism in the Van cats and to elucidate the link between carbohydrate metabolism and genes that determine eye colour.

It is important to reveal plasma lipid profile in terms of the investigation of obesity and follow-up of metabolic syndrome in cats. In the present study, plasma triglyceride levels were compatible with Yörük (2000), whereas total cholesterol levels were sligtly lower. Nevertheless, total cholesterol levels were consistent with the reference values reported in cats (Reynolds et al 2010).

Although, Yörük (2000) represented blood VLDL, LDL ve HDL levels by electrophoretic method and reported to 10.15%, 20.05%, 69.67%, respectively, there was not any study reporting plasma HDL and LDL levels as mg/dl in the Van cats. For this reason, we believe that, it is important to establish blood lipid profile of the Van cats in terms of follow-up of related diseases. While LDL levels were compatible with the values reported for the other cat breeds (Kaneko 1997), HDL levels were lower than the other cat breeds (Demacker 1997, Watson 1995, Mosallanejad et al 2016). The low HDL levels in the Van cats may be a spesific level for the race of the Van cats. It is suggested that the subject of the low HDL levels in the Van cats should be investigated with more detailed studies.

Blood urea/nitrogen and creatinine levels are two important parameters used to follow-up of kidney diseases. In this present study, the blood urea/nitrogen values obtained in the Van cats were consistent with the values stated by Özkan et al (2016), whereas levels were slightly lower than the levels reported by Sönmez and Ağaoğlu (2010) in the Van cats. The blood urea/nitrogen values and the variables in this study were not correlated which the result was in good agreement with the above researchers (Sonmez and Ağaoğlu 2010, Özkan et al 2016). Creatinin levels were consistent with values reported in the Van Cats (Macun et al 2010, Özkan et al 2016) and the other cat breeds (Kaneko 1997). Özkan et al (2016) reported higher ($p<0,001$) creatinin levels in male Van cats compared to females, furthermore, 12-24 month and 24 to more-month male cats had higher creatinin levels compared to female cats at the same ages. In our study, creatinin levels were not different between the sexes, whereas the levels were higher in 3 year-old cats than in 1-2 year-old cats ($p<0.05$). The study (Şimşek et al 2015b), established for the determination of age relationship with urea and creatinine levels in the Angora cats, showed that blood urea levels did not change with age and plasma creatinine levels which increased with age. In our study, we also could not find any relationship with BUN and the variables, whereas creatinine levels of over 3 year-old cats were higher than in 1-2 year-old cats ($p<0.05$). It was obtained that, the results of parameters (blood urea/nitrogen and creatinin levels) in our study were consistent with the study in the Angora cats (Şimşek et al 2015a).

Conclusion

Some biochemical parameters (plasma HDL, LDL levels) in the Van cats were presented for the first time. Plasma glucose levels in the blue-blue eyed cats were found higher than in the other eyed cats. Albumin levels of the short-haired cats were higher than in the long-haired cats and creatinin levels were higher in the old cats than young cats. It can be suggested to investigate these relations in the Van cats and verify with more observations based on a greater number of cats. It also can be considered that the biochemical parameters obtained in the Van cat may be useful for the clinical diagnosis.

Acknowledgements

This study was approved by the Selcuk University Local Ethic Committee (29.03.2016/2016-34) and supported by SUBAP (Project Number: 16401063). We appreciate to the personnel of the Vat Cat House, Van, Turkey. The abstract of this study was published in the '1st International Veterinary Biochemistry and Clinical Biochemistry, 12-14 April 2018/Hatay/TURKEY' congress book.

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