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Determination of physiological constants in canines in relation to geographic location

Determinación de las constantes fisiológicas en caninos con relación a la situación geográfica

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ABSTRACT

The objective of the research was to determine the physiological constants in canines in relation to geographic location. Using a descriptive methodology, in a population of one hundred and eighty canines distributed: sixty canines in each of the localities under study, clinical records, general clinical examination and hematocrit examination were used. The results indicated that the geographical situation influences the physiological constants, because at higher altitudes there is an increase in the hematocrit values, respirations, increase of heart beats per minute in the areas of Guaranda and San Miguel, while at lower altitudes there was no increase in the parameters of the constants, favoring the geographical situation of the sector of Balsapamba. In conclusion, the geographic location affects the physiological constants.

Descriptors: animal diseases; animal behaviour; biological adaptation (Source: UNESCO Thesaurus).

RESUMEN

La investigación tiene por objetivo determinar las constantes fisiológicas en caninos con relación a la situación geográfica. Utilizando una metodología de tipo descriptiva, en una población de ciento ochenta caninos distribuidos: sesenta canes en cada una de las localidades en estudio, para ello se utilizó fichas clínicas, examen clínico general y examen de hematocrito. Los resultados indicaron que la situación geográfica influye en las constantes fisiológicas, debido a que a mayor altura existe incremento de los valores de hematocrito, de las respiraciones, aumento de latidos cardiacos por minuto en las zonas de Guaranda y San miguel, en cambio a menor altura no hubo un aumento en los parámetros de las constantes favoreciendo la situación geográfica del sector de Balsapamba. Concluyendo que la situación geográfica afecta a las constantes fisiológicas.

Descriptores: enfermedad animal; comportamiento animal ; adaptación biológica. (Fuente: Tesauro UNESCO).

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Research articles section

INTRODUCTION

The present research work determines the physiological constants that are parameters or pre-established values of the vital functions of the canine organism: heart rate, respiratory rate, pulsations per minute, temperature, capillary filling time and mucous membranes that vary in relation to the geographical situation. Geographical situation being understood as the vertical distance of a point on earth in relation to sea level considered as zero level is expressed in masl (meters above sea level) (Vargas-Pinto, *et al*. 2019), (Cainzos, 2018) (Moya-Salazar, *et al*. 2018).

Considering that platelets are the reservoir of growth factors and play an important role in several physiological processes, such as coagulation, angiogenesis, immune response and tissue repair. Platelet concentrates are classified into two groups according to their fibrin content: platelet-rich plasma (PRP) and platelet-rich fibrin (PRF). They are further divided according to their leukocyte content. PRP is plasma containing supra-physiological concentrations of platelets. The growth factors present in PRP play a crucial role in promoting local angiogenesis, regulation of cellular activity, stem cell homing, proliferation and differentiation of different stem cells and deposition of matrix proteins that contribute to tissue regeneration (Sharun, *et al*. 2021).

On the other hand; blood biochemistry and reference intervals help to differentiate between healthy and sick dogs, as well as provide information for prognosis, evaluation and follow-up; however, these intervals are usually obtained from adult animals. It is essential to understand that puppies and adults are physiologically different, which justifies the need to obtain age-specific biochemical reference intervals (Montoya-Navarrete, *et al*. 2021). It is also necessary to keep in mind that dogs with lower airway pathology presenting with respiratory distress often receive oxygen therapy as the first line of treatment, regardless of the underlying cause (Ramesh, *et al*. 2021).

This is explained by the fact that at higher altitudes there are variables such as a decrease in atmospheric oxygen concentration, a decrease in temperature and the opposite, at lower altitudes there is a higher oxygen concentration, and an increase in temperature at sea shores. To determine the physiological constants, heart rate data has been taken: beats per minute (HR), pulse, beats per minute (P), respiratory rate breaths per minute (PR), body temperature in degrees Celsius, and hematocrit in % (Ho) and Hemoglobin g/l (Hb) for analysis and verification (Vargas-Pinto, *et al.* 2016).

The research aims to determine the physiological constants in canines in relation to geographical location.

METHOD

The methodology used was descriptive research with a non-experimental field design. The data collection was carried out by approaching the study population, an individual clinical history was filled out in which the data of the place of the experiment was registered, as well as the data of the owner and amnesic data of the patient to later carry out the general clinical examination.

A sample of one hundred and eighty (180) canine patients of different sexes, breeds and ages from the cantons of Guaranda, San Miguel and the parish of Balsapamba in the province of Bolivar - Ecuador was established; these were used to take physiological constants in relation to the geographical situation in each of the places described.

The study patients were subjected to the taking of physiological constants such as heart rate, respiratory rate, pulse, capillary filling time, mucous membranes, temperature, in addition to a blood extraction which was taken by placing the patient on the sternal cubitus, extending the upper extremity forward, shaving, disinfecting, palpating the cephalic vein to perform the venipuncture for hematocrit test.

For the analysis of the information, the Microsoft Excel program was used, applying percentages, frequency and ranges. The results were represented in frequency tables, percentages and bar graphs of the different variables.

RESULTS

When determining the incidence of height in relation to the geographic location of the patients who came for consultation to the veterinaries of the three sectors under study. The following results were obtained:

Table 1. Variable heart rate of the three locations under study.

	FRECUENCIA			PORCENTAJE %		
	Guaranda	San Miguel	Balsapamba	Guaranda	San Miguel	Balsapamba
60-100 lpm	7	8	19	12	13	32
101-110 lpm	14	10	33	23	17	55
111-120 lpm	39	42	8	65	70	13
Total	60	60	60	100	100	100

Source: Own elaboration.

In Table 1, the heart rate evaluated in canines in study determines that in the canton of Guaranda the frequency is in the range of 111-120 bpm which represents 70% of the cases studied in relation to the city of San Miguel where the percentage is lower with 5% and a percentage of 13% in Balsapamba. In the parish of Balsapamba the frequency is in the range of 101-110 bpm, which represents 55% in relation to the other two localities, where the percentages are lower, and finally in the range of 60-100 bpm there is a similarity in the percentages between Guaranda and San Miguel, unlike Balsapamba, which has a higher percentage of 32%. Observing a higher heart rate in the localities of Guaranda and San Miguel and a lower heart rate in the parish of Balsapamba, this variability is due to the geographical situation, i.e. at higher altitudes there is an increase in heartbeats per minute and at lower altitudes there are fewer heartbeats per minute, adapting to the conditions of the environment.

Table 2 . Pulse variable of the three locations under study.

	FRECUENCIA			PORCENTAJE %		
	Guaranda	San Miguel	Balsapamba	Guaranda	San Miguel	Balsapamba
Normal	54	57	53	90	95	83
Alterado	6	3	7	10	5	12
Total	60	60	60	100	100	100

Source: Own elaboration.

Table 2 shows that in the canton of San Miguel, of the 60 dogs under study, ninety-five percent of the dogs had a normal pulse and five percent had an altered pulse, while between Guaranda and Balsapamba there was a minimal difference in the normal and altered pulse. These results allow us to interpret that there is a certain similarity in the normal pulse and a minimum percentage of altered pulse, this alteration is due to stress, fear of an unknown place that is not their habitat, absence of the owner, fear at the moment of the check-up, mobilization or transfer to the veterinary centers.

Table 3. Variable respiratory frequency of the three locations under study.

	FRECUENCIA			PORCENTAJE %		
	Guaranda	San Miguel	Balsapamba	Guaranda	San Miguel	Balsapamba
15-25 Rpm	18	15	46	30	25	77
26-40 Rpm	42	45	14	70	75	23
Total	60	60	60	100	100	100

Source: Own elaboration.

In Table 3, the information obtained shows that in Guaranda, of the sixty canines, 75% were in the 26-40 rpm range and 25% in the 15-25 rpm range. In San Miguel 70% were located in the range of 26-40 rpm and 30% in the range of 15-25 rpm while in Balsapamba 77% of the animals under study were located in the range of 15-25 rpm and 23% in the range of 26-40 rpm. From the results obtained, it can be determined that in Balsapamba the respiration per minute is lower than in Guaranda and San Miguel, having a certain similarity in percentages, but with a greater number of respirations per minute. Therefore, it can be deduced that the geographic situation, the weather and the climate influence the respiratory frequency of the dogs.

Table 4. Variable capillary filling time of the three locations under study.

	FRECUENCIA			PORCENTAJE %		
	Guaranda	San Miguel	Balsapamba	Guaranda	San Miguel	Balsapamba
1-2 Segundos	58	51	48	97	85	80
3-4 Segundos	2	9	12	3	15	20
Total	60	60	60	100	100	100

Source: Own elaboration.

In Table 4, it can be seen that in relation to the capillary filling time of the three localities 262 % of the canines investigated are in the range of 1-2 seconds and the difference of 38 % of canines were located in the range of 3-4 seconds. This means that the degree of hydration of the greater number of dogs is within the normal reference value, with only a minimum percentage in Guaranda and a difference of 5% between San Miguel and Balsapamba in the range of 3-4 seconds with the beginnings of dehydration, but this is considered normal due to the climate of the area, or due to the lack of water provided by the owner and the way it was mobilized and transferred to the veterinary center.

Table 5. Variable temperature of the three locations under study.

	FRECUENCIA			PORCENTAJE%		
	Guaranda	San Miguel	Balsapamba	Guaranda	San Miguel	Balsapamba
38-38.5C	46	50	10	77	83	17
38.6-39C	14	10	50	23	17	83
Total	60	60	60	100	100	100

Source: Own elaboration.

In Table 5, the data indicate that 121% of dogs between Guaranda and San Miguel presented a temperature in the range of 38-38.5 degrees Celsius and 79% were in the range of 38.6-39 degrees Celsius, while in Balsapamba 83% of the fifty dogs were in the range of 38.6-39 degrees Celsius and a minority number of 17% of dogs were in the range of 38-38.5 degrees Celsius.

According to the temperature analysis, the majority of the canine population under study in the Balsapamba sector is located in the range of 38.6-39 degrees Celsius, compared to the population of Guaranda and San Miguel, which had results in the range of 38-38.5 degrees Celsius. This alteration occurs due to the geographic location of the three localities, knowing that Guaranda is at an altitude of 2591 masl, San Miguel 2480 masl and Balsapamba at an altitude of 720 masl, which means that the higher the altitude the lower the temperature and the lower the altitude the higher the temperature.

Table 6. Variable hematocrit of the three locations under study.

	FRECUENCIA			PORCENTAJE%		
	Guaranda	San Miguel	Balsapamba	Guaranda	San Miguel	Balsapamba
35-40	3	12	36	5	20	60
41-45	22	21	26	37	35	38
46-52	35	27	1	58	45	2
Total	60	60	60	100	100	100

Source: Own elaboration.

In Table 6, the population under study is made up of one hundred and eighty dogs of both sexes where the following results are shown: the volume of red blood cells in relation to the sample evaluated, in the range of 35-40 % in Guaranda there are three dogs which represents 5 %, in San Miguel there are 12 dogs which is equivalent to 20 % and in Balsapamba thirty-six dogs which corresponds to 60 %, In the intermediate range of 41-45% in Guaranda and San Miguel there is a difference of 2% between them and in Balsapamba 38% of hematocrit and finally in the range of 46-52% in the canton of Guaranda there was a percentage of 58%, in the canton of San Miguel a percentage of 45% and in Balsapamba a percentage of 2% of red blood cell count.

In relation to the hematocrit percentage count, it can be analyzed that in the dogs of Guaranda there was a greater amount of red blood cells in a minority percentage in San Miguel and in Balsapamba it could be seen that there was no increase of red blood cells, maintaining the normal number of hematocrits.

These results are due to the altitude in relation to sea level, since at higher altitudes the organism needs to develop a greater amount of red blood cells to make up for the oxygen deficiency and to be able to adapt to the place, while at lower altitudes, as in Balsapamba, there is no need for an increase in red blood cells since at sea level there is greater oxygen saturation.

DISCUSSION

In relation to the results, (Vargas-Pinto, et al. 2017), in his research on heart rate and its variability in high altitude canines indicates that 94 canine in his study found that the heart rate was on average 112.5 ± 28.0 beats per minute at an altitude of 2600 meters. The current study coincides with (Vargas-Pinto, et al. 2017), in that for the taking of the heart rate phonendoscope was used and the values obtained were established in the range of 111-120 bpm at high Altitude locations.

In relation to the pulse variable the author (Romero-Labanda, 2018), mentions in his research conducted in two altitudinal floors of 6 m.a.s.l. in Machala and 2560 m.a.s.l. in Cuenca points out that blood pressure did not show variation. That in the analysis of the interpretation of the results of the investigation I do not present alteration in the pulse due to the geographic situation but by other factors, but in a minimum percentage for which I coincide with the results obtained by the mentioned author in his work of investigation.

With respect to the respiratory frequency variable according to (Rojas-Roa & García-Castañeda, 2015). It indicates in his research that 72% of the patients analyzed obtained an increase in the respiratory frequency, this can be generated by panting, excitement, anxiety, which increased the demand for oxygen, body temperature or stimulation of respiratory centers, in addition the dogs were exposed to high altitudes such as Bogotá (2650 meters above sea level); from what was stated, there is a relationship with the current research because the dogs had a greater demand for oxygen in the Guaranda canton and followed by San Miguel since they are at an altitude above 2000 meters above sea level.

Regarding the capillary filling time variable, the authors (Aldaz, 2017), in their research conducted in the Guaranda canton, Bolivar province, mention that the capillary filling time was mostly in the range of 1-2 seconds; while (Supe, 2015), points out in his research conducted in the San Miguel canton that the capillary filling time collected from each of the patients who came for consultation, 88% were in the normal state of 1-2 seconds, 9% in the range of 3 seconds. The data cited by the two authors (Aldaz, 2017) and (Supe, 2015) present similarity with the result of the present research, in that in the three sectors of analysis the highest percentage falls in the range of 1-2 seconds of the one hundred and eighty canines under study.

In another order; (Baquero, 2012). He indicated in his research on the constant temperature that in the canton Guaranda is in a range of 38.4-38.7 degrees Celsius and in the canton San Miguel a range of 38.4-38.5 degrees Celsius. Therefore, it is similar to the data obtained from their research because the results of the current research are similar with respect to the canton of Guaranda and San Miguel.

On the other hand, it is essential to develop programs to control the canine population based on responsible ownership, prioritizing public health, including education strategies, identification systems that allow owners to be held legally responsible, sterilization campaigns, capture of loose animals and adoption systems (Garibotti, et al. 2021).

CONCLUSION

Based on the results obtained, it can be pointed out that the geographic situation has a considerable influence on the physiological constants in the canines that attended the veterinary clinics of the three localities.

The main physiological constants were determined in the canines to consultation through methods of clinical examination and hematocrit test in blood which are: Heart rate, pulse, respiratory rate, capillary filling time, mucous membranes, temperature and hematocrit. The physiological values have been identified through the hematocrit in relation to the sample evaluated in dogs of both sexes that had a high percentage in the canton of Guaranda followed by a moderate percentage in San Miguel and in the parish of Balsapamba these values are constant.

When evaluating the physiological constants of the subjects under study, these vary according to the different levels of variation of the climate of the region depending on the altitude, which represent the physiological mechanisms of the organism to maintain the equilibrium of the internal environment.

It has been established that the altitude is a conditioning factor for the increase in the number of red blood cells due to the lack of oxygen in the canine's organism and they can adapt to their habitat, which does not happen at the seashore where there is a sufficient amount of oxygen. Determining that the higher the altitude, the lower the amount of oxygen and the lower the altitude, the higher the amount of oxygen.

Of the 120 patients analyzed, 87 showed an increase in the respiratory frequency and 81 patients showed an increase in the cardiac frequency per minute, increasing the oxygen demand mainly due to the altitude conditions.

In the subtropical region there was an increase in body temperature in the dogs due to the influence of the climate which is hot and dry where the altitude is lower than in Guaranda and San Miguel where the altitude is higher than 2000 meters above sea level and therefore there was no increase in the temperature of the dogs in these areas.

It was identified that there is a variation in the physiological constants between the highland and subtropical cantons due to the geographical situation.

It is noteworthy that, in direct relation to the researched topic, the evidence in scientific journals of periodical publication is scarce, being an important issue to promote among researchers in order to promote the strengthening of the state of the literature published in first order journals, being this a weakness to be overcome.

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CONFLICT OF INTEREST

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