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RESEARCH ARTICLE

SQUARE CLINICAL EPIDEMIC OF THE *DISTEMPER CANINE* AND THEIR INCIDENCE IN MONGREL DOGS INFESTED WITH THE STUMP VDC SA3 IN THE GUARANDA CANTON, BOLÍVAR PROVINCE, ECUADOR

***[1]Jorge Jagger Segura Ochoa, [2]Jaime Wilfrido Aldaz Cárdenas, [3]Rigoberto Fimia Duarte, [4]Juan Ramón García Díaz, [1]Jenny Janeth Segura Ochoa, [4]Rafael Armiñana García [1]Nancy Guadalupe Aldaz Cárdenas and [2]César Augusto Barberán Barberán**

[1]Veterinary Clinic "Canine and Felines". Guaranda, BolívarProvince, Ecuador
[2]Career of Veterinary Medicine and Career of Agronomic, Faculty of Agricultural, Natural Sciences and Environmental Resources. Bolivar State University, BolívarProvince, Ecuador
[3]Faculty of Technology of the Health "Julio Trigo López". University of Medical Sciences of Villa Clara, Cuba
[4]Faculty of Agricultural Sciences, University "Marta Abreu" of The Villas, Villa Clara, Cuba

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ABSTRACT

The objective of the investigation consisted on determining the epidemic clinical incidence of the *Distemper canine* in mongrel dogs infested with the stump VDC SA3 in the Guaranda Canton, Bolívar Province, Ecuador. The investigation was developed in the Veterinary hospital "Canine and Felines" of Guaranda, during the period understood among the years 2013 at the 2015. The study embraced a total sample of 1 970 canines for the clinical diagnosis of the illness, while in the case of the mestizo dogs, 24 canines was used, of 3 at 8 months of age and 2 to 10 kg of weight live; divided in two groups of 12 animals, six male and same quantity of females. A group was conformed by healthy animals and the other one by dogs affected by *Distemper*. They were kept in mind inclusion approaches, exclusion and of exit. The determination of the age of the animals, the race and the clinical diagnosis of the *D. canine*was carried out for the test of PCR. To each animal in the study was determined the profile hematoquímico, platelets, total proteins, glucose, urea, creatinine and uric acid. The obtained data were processed keeping in mind the pattern Box-Jenkins/ARIMA and he/she was carried out the estimate of the values of the parameters autoregressives. The descriptive statisticians of each variable were used and they were compared between healthy and sick by means of a t-Student test for independent samples. In the prosecution of the data the statistical package Statgraphics Centurion was used to see. XV.II. The affection for *Distemper canine* one of the main consultation reasons represented during the period 2013-2015. The illness had an endemic and seasonal behavior. The factors of risk associated to the *Distemper canine* were: the non-vaccination, the age, the sex, the summer, the residence in area perurban and the non-confinement of the animals. The entirety of the dogs presented hyperthermia and the anorexy was present in 11 of the affected dogs. You conclude that the clinical square in mestizo dogs infected with the stump SA3 of the VDC commits the conservation of species threatened due to its towering lethal drastically, where the incidence for *Distemper canine* is a problem of health in the population of canine of the Guaranda canton.

INTRODUCTION

The *Distemper canine*, also known as "Canine Moquillo" it is a virus infectocontagious taken place by a Paramixovirus of the generate *Morbilivirus* (Lamb & Kolakofsky, 2001). It is the multisystemic and lethal illness more diffused globally of the canine and other nine families of mammals (*Mustelidae, Procyonidae, Ursidae*, *Viverridae, Hyaenidae, Phocidae* and *Felidae*), ending up committing the conservation of species threatened due to their towering lethal drastically (Pardo*et al*., 2005). In America of the South it is present the illness and antibodies of the VDC have been detected in Brazil (Headley *et al*., 2012), Bolivia (Fiorello *et al*., 2006 and 2007; Bronson *et al*., 2008), Chile (Acosta-Jamett, 2009; Acosta-Jamett *et al*., 2011; Muñoz, 2013, in Argentina (Pinotti *et al*., 2012) and

****Corresponding author: Jorge Jagger Segura Ochoa***
Veterinary Clinic "Canine and Felines". Guaranda, BolívarProvince, Ecuador

Peru (Fiorella, 2014). In Ecuador, specifically in the Islands Tortoises, where the vaccination and the import of the dog are forbidden, the antibodies VDC was detected in dogs residents (Levy *et al*., 2008), in Guayaquil (Moyón, 2011) and in the city of Guaranda, county Bolívar (Sarute *et al*., 2014 & Panzera *et al*., 2014). At the moment they circulate in the world 11 stumps of the VDC and according to a study that compared all the existent stumps in South America, it was reaffirmed that in this continent, there are four stumps circulating EU1/SA1, SA2, SA3 and SA4 that have different geographical distribution and they appear spacely structured without apparent events of migration inside the continent (Sarute *et al*., 2014). As for the race, bigger incidence of the canine D. is reported in the mestizo animals (Landeros, 1988), but in another study, the same one didn't constitute a factor predisposed, I neither eat the sex (Brave, 2007). The influence of the sex on the presentation of the canine D. offers contradictory results; in some works he/she didn't meet association of the sex with the illness (Brave, 2007) and the presence of antibodies against the VDC (Fiorella, 2014). However, this virus has bigger prevalence in the males that in the females (63,08% and 36,92% respectively) and in the dogs of big size (40, 00%) and medium (42,31%), in connection with the small ones (17,69%) (Acosta-Jamett, 2009; Pinotti *et al*., 2012; Fiorella, 2014).

The hematology in the dogs with D. canine is not very specific, nevertheless the absolute and severe linfopenia prevails (Smith, 2000). Other alterations hematology are the compatible ones with the anemia, decrease of the total count of eritrocyte, hemoglobin and hematocryte (Moyón, 2011). The characteristic hemogram of the dogs infected with D. canine includes the leucopenia and linfopenia, the alteration more frequent hematology in this illness that it can be absolute and severe, common in the first week post infection and to prevail in very young dogs. They were also diagnosed in animals with *D. canine* diminished values of the total count of eritrocyte, hemoglobin and hematocryte, those that are compatible with the anemia (Smith, 2000; Moyón, 2011). The results are contradictory and not very conclusive on the impact of the vaccination, sex, race, size and time of the year in the prevalence of the *D. canine*and in the clinical square of this illness, because most of the works lack an appropriate experimental design to approach the problem, since they are made with obtained historical data of hospitals and veterinary clinics, where most of the times the illness was diagnosed without the confirmation by the complementary exams (Moyón, 2011; Pinotti *et al*., 2012; Fiorella, 2014). The age constitutes another factor of risk for the presentation of the *D. canine*; the illness is presented mainly in puppies from three to six months of age (Brave, 2007; Martella *et al*., 2008; Pinotti *et al*., 2012). However, other authors have found that the presence of antibodies for the VDC is independent of the group age of the dogs (Morales *et al*., 1997; Pérez *et al*., 2003; Fiorella, 2014). Another factor associated to the *D. canine*is the corporal condition (Brave, 2007). The previous considerations indicate the necessity to study the epidemic clinical behavior of the *D. canine*under the conditions controlled in the city of Guaranda, county Bolívar, Ecuador, where he/she was a new stump of VDC (INC-3) that prevails in the territory, in which climatic conditions, density and forms of life of the dogs different to the consulted publications exist.

The objective of the present investigation consisted on determining the epidemic clinical incidence of the *Distemper canine*in mongrel dogs infested with the stump VDC SA3 in the Guaranda Canton, Bolívar Province, Ecuador.

MATERIALS AND METHODS

Study Area

The investigation was developed in the Veterinary hospital "Canine and Felines" of the city of Guaranda, capital of the Canton of the same name and of Bolívar's Province, Ecuador. The canton is located among the 1° 34' 20" LN and the 78° 58' 10" LW, to a height of 2 668 msnm; in the center of the country, in the region interandine, specifically in the western mountain range of the Andes. It possesses a territorial extension of 1 898 km2, it limits to the north with the county of Cotopaxi, to the south with San Miguel's canton, to the east with the counties of Tungurahua and Chimborazo and to the west with the cantons of Chimbo, Caluma and Echeandía (Figure 1).

Figure 1. Administrative political Map of the Bolívar Province, Ecuador

Climate of the area where the investigation was developed

The temperature averages yearly it is of 15,2ºC; the maxims oscillate between 22 and 24ºC (July and August) and the minimum ones between 5 and 7ºC (December and January). The average of annual precipitation was of 980,3 mm, with a monthly average of 81,3 mm; the rainiest month was March, with 184,3 mm and the less rainy September, with 11,5 mm. The relative humidity, with an annual average of 70%.

Used animals

The study was carried out with a total sample of 1970 canines, for that which you/they were had in all inclusion approaches, of exclusion and exit and they registered all the data of the review and anamnesis of the animals that attended the consultation in the mentioned period. The size of the sample for the observational studies was calculated according to that recommended by Thrusfield (2005). In the case of the mestizo dogs 24 canine was used, of 3 at 8 months of age and 2 to 10 kg of weight live (PV); divided in two groups of 12 animals, six male and same quantities of females. A group was confirmed by healthy animals and the other one with dogs

affected by *Distemper*, caused by the stump of the VDC SA3. The size of the sample was calculated according to that recommended by Snedecor & Cochran (1994), considering the differences among groups for proportions and stockings of two normal distributions, according to the study, obtained starting from this author's previous determinations; he/she noticed a power of the test of 90% and a level of trust of 95%.

Inclusion approaches, exclusion and exit of the animals

Inclusion approaches: mongrel dogs; in the experiment one with an age understood between 0 and 12 months and in both among three eight of them. The whole animals were consulted in the Veterinary Hospital "Canine and Felines" of Guaranda, Bolívar, Ecuador, positive or not to *D. canine*.

Exclusion approaches: Animals that didn't fulfill the inclusion approaches

Exit approaches: They took fundamentally into account in the experiment two and they are the nonfulfillment of the preset medical indications, the euthanasia or the death of the animal in the first days or not attributable to the illness. In the two experiments of the investigation mestizo dogs were used with diagnostic positive of canine and healthy *D*. that were used like controls. The age of the animals fluctuated according to the study, in the first one, between zero and 48 months and in second among three eight months. In the determination of the age of the animals, the race and the clinical diagnosis of the *D. canine* was carried out the test of PCR according to established conditions (Panzera *et al*., 2014, Sarute *et al*., 2014), in the laboratories of the Evolutionary Genetic section, Institute of Biology, Ability of Sciences, University of the Republic Montevideo, Uruguay.

To each animal in the study was determined the profile hematochimic [hemoglobin (Hb), hematocryte (Hto), total count of eritrocyte (CTE), half corpuscular volume (VCM), hemoglobin corpuscular stocking (HCM), concentration of hemoglobin corpuscular stocking (CHCM), total count of leukocytes (CTL) and the differential (lymphocytes, neutrophiles, basophiles and eosinophiles). Also, the platelets will be determined, total proteins (PT), glucose, urea, creatinine and uric acid. They took 5ml of blood for puncture of the radial vein, according to the procedures described by Kaneko et to the one. (2008). for the analyses hematology 2ml will be deposited in tubes IDEXX VetTube™ (IDEXX LABORATORIES VetLab® USES) with EDTA (1mg/ml of blood), previously covered and sterilized. For the biochemical analyses 3 ml was placed in tubes without anticoagulant; later on they were centrifuged at 3 500g during 10 minutes, being obtained the sanguine serum, the one that was stored -2 ºC until their analysis. The grounds for the realization of the Kit Anigen took by means of a sterile hyssop that was introduced by the anus of the animal (rectal hisopaje).

The determinations hematologys [Hb, Hto, CTE, VCM, HCM, CHCM, CTL and the differential (lymphocytes, neutrophiles, basophiles and eosinophiles)] they were carried out in an analyzing IDEXX VetAutoread™, (IDEXX LABORATORIES VetLab® USES), according to the maker's procedures. The PT, glucose, urea, creatinine and uric acid were carried out in a biochemical analyzer of high technology of dry badge IDEXX VetTest® (IDEXX LABORATORIES VetLab® USES), according to the maker's procedures and the use of commercial kids. Determination of the occurrence of positive cases, incidence, mortality and lethal of the *D. canine* as well as presage of the incidence.The study was carried out with the retrospective data of the cases of *D. canine* consulted among the years 2013 at 2015, what allowed to determine the occurrence of positive cases, incidence, mortality and monthly lethal of the *D. canine* in this territory during the mentioned period, according to the procedures described by Thrusfield (2005); it could also be carried out presage. The incidence of the *D. canine*, starting from the total population of canine of the territory for the year 2016, by means of the adjusted pattern ARIMA.

Statistical Analysis

With the values obtained in these epidemic indicators he/she was defined a series of time for the incidence of the *D. canine*, the one that was constituted by an orderly group of observations Yt =1, 2, 3…, and he/she was adjusted a model Box & Jenkins (1970) or ARIMA (of English Car-Regressive Integrated Moving Average). Were the association measures determined [Odds ratio (OR), attributable Fraction in exposed (FAE) and attributable Fraction in the population (FAP)] and those of statistical significance (does it prove? ²)]. In these prosecutions the statistical package EPIDAT was used 3.1.
The descriptive statisticians of each variable were determined and they were compared between healthy and sick by means of a t-Student test for independent samples (I marry of the mongrel dogs). In all the statistical prosecutions the statistical package Statgraphics Centurion was used to see. XV.II. (Statistical Graphic Corp., it USES of 2006). With the obtained data he/she was carried out an observational analytic study of type case-control by means of the conformation of contingency charts 2x2 (Thrusfield, 2005).

RESULTS AND DISCUSSION

The *Distemper canine* represented one of the main consultation reasons in the Veterinary Hospital of Guaranda during the period 2013 at 2015. In the year 2013, the proportion of positive cases was significantly superior in the months of June to October, with regard to the other ones (P <0.05), results that they agree with those obtained by Fiorello *et al*. (2007); Bronson *et al*. (2008) & Pinotti et al. (2012), for this same entity, but in neighboring countries to Ecuador. In the years 2014 and 2015, the months in that superiors proportions of positive cases were diagnosed were June and July (P <0.05). The incidence of the *D. canine* had a great variability along the studied years; it was smaller in the months of November to April and superior of May to October and it reached the maxima values in the months of June and July, while the cases of the illness stayed during every month of the evaluated years, what indicates that the same one has an endemic and seasonal behavior, results that they coincide with those obtained by Panzera *et al*., 2014 & Sarute *et al*., 2014 in the city of Guaranda, Bolívar province (Table 1). The mortality of the illness in the territory, the same as the incidence, they had a marked biannual seasonal, with a high number of cases of sick and deaths between the months of May and October, with a presentation pick in the months of June and July (Table 2).

Table 1. Positive cases to *D. canine* with regard to the total of animals assisted in the Veterinary Hospital and their incidence of the illness in the years 2013 at 2015

Month	2013			2014			2015		
	CA	C+ n y (P)	I (%)	*CA*	C+ n y (P)	I (%)	*CA*	C+ n y (P)	I (%)
E	104	30 (0,29^{b})	0,20	111	35 (0,32^{bc})	0,21	122	29 (0,24^{c})	0,16
F	103	21 (0,20^{b})	0,14	98	25 (0,26^{c})	0,15	90	22 (0,24^{c})	0,12
M	108	23 (0,21^{b})	0,15	104	24 (0,23^{c})	0,15	84	23 (0,27^{c})	0,13
A	112	19 (0,17^{b})	0,13	119	17 (0,14^{cd})	0,10	93	18 (0,19^{c})	0,10
M	96	24 (0,25^{b})	0,16	132	28 (0,21^{c})	0,17	78	36 (0,46^{b})	0,20
J	116	65 (0,56^{a})	0,44	126	83 (0,66^{a})	0,51	96	47 (0,49^{b})	0,26
J	90	60 (0,67^{a})	0,40	109	55 (0,50^{b})	0,34	101	66 (0,65^{a})	0,37
A	67	51 (0,76^{a})	0,34	114	74 (0,65^{a})	0,45	98	50 (0,51^{a})	0,28
S	72	50 (0,69^{a})	0,34	107	42 (0,39 ^{b})	0,26	83	40 (0,48^{b})	0,22
O	97	72 (0,74^{a})	0,48	88	63 (0,72^{a})	0,38	106	41 (0,39^{b})	0,23
N	90	26 (0,29^{b})	0,17	96	16 (0,17^{c})	0,10	26	8 (0,31^{c})	0,04
D	80	20 (0,25^{b})	0,13	102	20 (0,21^{c})	0,12	28	9 (0,31^{c})	0,05

a,b,c,d Percentages with non-common letters in the superscript in the same column indicates significant statistical differences P <0.05 (Comparison of multiple proportions). CA: Number of cases attended in the Hospital. C+: Cases with diagnostic positive of AD. P: proportion. I: Incidence of the illness.

Table 2. Mortality and lethal of the cases of *D. canine* assisted in the Veterinary Hospital and incidence of the illness. Years 2013 at the 2015

Months	**YEARS**					
	2013		2014		2015	
	Mortality	Lethal	Mortality	Lethal	Mortality	Lethal
E	0,18	90,00 (27/30) (27/30)	0,20	94,29	0,16	96,55
F	0,13	95,24	0,15	96,00	0,12	95,45
M	0,14	91,30	0,13	91,67	0,12	95,65
A	0,12	94,74	0,10	100,00	0,07	66,67
M	0,15	91,67	0,15	85,71	0,19	94,44
J	0,41	93,85	0,49	96,39	0,25	95,74
J	0,38	95,00	0,32	96,36	0,35	96,97
A	0,34	98,04	0,43	94,59	0,27	96,00
S	0,32	96,00	0,23	90,48	0,22	97,50
O	0,48	98,61	0,37	96,83	0,17	73,17
N	0,16	92,31	0,09	93,75	0,04	100,00
D	0,13	95,00	0,11	90,00	0,04	88,89

The entirety of the dogs presented Hyperthermia (HT), a common symptom in the canine D. and the anorexy (AX) it was present in 11 of the dogs affected with *D. canine*, 92% of the same ones (it figures 2). Both symptoms are general and unespecific and they are the first ones that are detected during the sharp phase of the *D. canine*. To the hyperthermia and anorexy they continued him the breathing symptoms; 83% (10/12) of the animals that made sick they presented conjunctivitis (CV), ocular secretions (SO), jointly with cutaneous lesions (LC); 75% (9/12) they presented dysnea (DS) and nasal secretions (SN); these symptoms spread to appear in the phase subacute of the *D. canine*, continuing to the general symptoms and unespecific, results that they agree with those obtained by Grönee*t al*. (2004); Woma*et al*. (2009) & Acosta-Jamet*et al*., 2011. Less frequent than the breathing symptoms they were the digestive ones (it figures 2), 58% (7/12) of the animals it presented diarrheas (DR) and 67% (8/12) vomits (VT). The symptom that was observed in smaller percentage was the hyperqueratosis in the bearings you plant them, alone 17% (2/12) of the dogs; these symptoms frequently appear in animals with *D. canine*, that which coincides with the results reached by Moritz *et al*. (2000) & Martella *et al*. (2010).

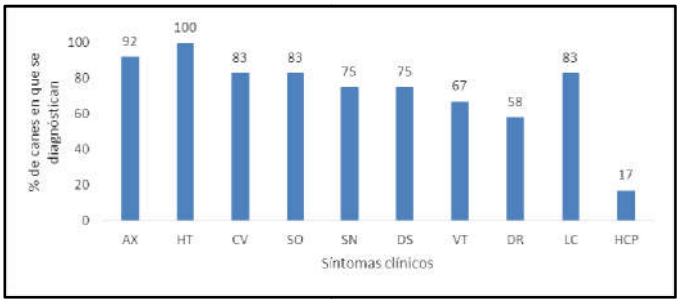

Figure 2. Clinical symptoms in dogs affected by the layer SA3 of the *Distemper canine*

Legend: AX: Anorexy. HT: Hyperthermia. CV: Conjunctivitis. SO: Ocular secretion. SN: Nasal secretions. DS: Dysnea. VT: Vomits. DR: Diarrheas. LC: Injure cutaneous. HCP: Hyperqueratosis of the bearings plants them

In the table 3 the profile hematologic of healthy dogs is exposed (group control) and with canine D., caused by the stump SA3 of the VDC. Notice you that you/they diminished significantly in the sick animals (p <0,05) with regard to the healthy ones, the hemoglobin, hematocryte, total count of eritrocytes (CTE), the hemoglobin corpuscular stocking

(HCM) and the half corpuscular volume (VCM). In this group the values of these parameters are inferior to those published, and compatible with the anemia that you/they experience the animals with *D. canine* (Tvedten, 2004; Kaneko *et al*., 2008; Rizzi*et al*., 2010). The results reached work presently are in correspondence with those obtained by other authors in dogs affected by the *D. canine* (Ezeib & Udegbunam, 2008; Salem, 2014). It was suggested that the VDC causes hypoplasia eritroide, causing decrease of the answer of the series eritrocítica or that the same one favors the production of inflammatory mediators that you/they can inhibit the eritrocitosis and to diminish the half-life of the eritrocytes.

necessities by the fabrics or the deviation of circulating neutrophiles for the marginal compartment due to the endotoxemia; also, they cause depletion of the maturation place and medullary storage, results that they coincide with those obtained by several authors in this respect (Greene &Appel, 2006; Goddard *et al*., 2008; Pratelli, 2011). The platelets diminished significantly in the dogs with *D. canine* caused by the stump SA3, what corroborates that the thrombocytopenia is presented early in course of the illness, although it didn't end up being as apparent as some authors publish who outline that the thrombocytes can descend of 30 x 109 (Greene, 2000; Beineke *et al*., 2009).

Table 3. Profile hematologic of healthy dogs and with *D. canine* caused by the stump SA3

Variables	Groups		±EE
	Control ($\overline{X}$)	*Distemper* ($\overline{X}$)	
Hemoglobin (Hb) (g/L)	128,41^{a***}	100,83^{b}	4,48
Hematocrit (Hto) (L/L)	0.35^{a**}	0.30^{b}	0.01
CTE (x10^{12})	4,44^{a***}	3.75^{b}	0.10
HCM (10^{-12}g)	28,88^{a*}	26,76^{b}	0,63
CHCM (g/L)	335,83^{a}	340,58^{a}	3,29
VCM (10^{-15}L)	79,91^{a}	81,38^{a}	1,16
Platelets (x10^{9}/L)	570,33^{a***}	366,16^{b}	27,88
CTL (x10^{9}/L)	9,87^{a***}	5,89^{b}	0,29
Lymphocytes x10^{9}/L	2,55^{a***}	1,33^{b}	0,03
Neutrophils x10^{9}/L	7,31^{a***}	4,56^{b}	0,29
R N/L	2,87^{a*}	3,43^{b}	0,17

** P< 0,05; ** P< 0,01; *** P< 0,001* (t-Student),

Table 4. Biochemical profile of healthy dogs and with *D. canine* caused by the stump SA3

Variables	Groups		±EE
	Control ($\overline{X}$)	*Distemper* ($\overline{X}$)	
PT (g/L)	57,82^{a*}	56,77^{b}	0,29
Glucose (mmol/L) (L/L)	4,53^{a***}	3,60^{b}	0,16
Aciduric (mmol/L)	47,01^{a}	43,61^{a}	2,21
Creatinine (mmol/L)	92,82^{a***}	115,95^{b}	2,11
BUN (mmol/L)	3,76^{a***}	8,68^{a}	0,18

** P< 0,05; *** P< 0,001* (t-Student),

The levels of total leukocytes were significantly inferior in the sick animals with canine, smaller *D.* that the reference intervals for the canine species that you/they fluctuate between 6 and 17x109/L (García-Navarrese, 2005). Of the CTL the most abundant were the neutrophils and lymphocytes, for what the decrease of these two types of cells is the responsible for opposing leucopenia (Tvedten, 2004; Kaneko *et al*., 2008; Rizzi*et al*., 2010). The value of the lymphocytesdiminished significantly (P <0,001) in the sick animals with *D. canine*, being diagnosed lymphopenie in 100% of the sick dogs. In the canine specie it is considered lymphopenie when their values descend below 1,5 x109/L (Kaneko *et al*., 2008; Rizzi*et al*., 2010; Pratelli, 2011). According to these authors, the lymphopeniein dogs affected by the VDC can be attributed to the loss, kidnapping or blockade of the circulation of the rich lymph in lymphocytesor to viral replication inside the nodules lymphocytes that it causes decrease of the lymphocytes (Brown *et al*., 2005; Von, 2006). The neutrophils was inferior (P <0,001) in the dogs with diagnostic positive of the *D. canine*. The neutropenia can be attributed to the increase of its

The relationship neutrophils-linfocits (table 1) it was bigger (p <0,05) in the animals with *D. canine*, although in all the animals in study and hefound inside the reference parameter for the same one (1,5-3,5) recommended by Cerón *et al*. (2007). The cause of that increase was because the neutrophils decrease and linfocits were not in same proportion. The biochemical indicators are exposed in the table 4. A significant decrease is appreciated in the animals with *D. canine*of the total proteins (PT) (p <0,05) and the glucose (P <0,001). On the other hand, in the dogs with this illness increased the uric acid significantly (p <0,05), and nitrogen ureic in blood (BUN) and the creatinine (P <0,001). Similar results are published in dogs infected by the VDC (Salem, 2014). The sanguine glucose in the animals controls is inside the normal values of glycemic for *canine* (3,85-6,60 mmol/L) settled down by Kaneko *et al*. (2008), I didn't seize in the dogs with AD that presented starvation for long periods of time, the one that could cause in them the decrease of the glycemic. Another important aspect that could have influenced in the decrease of the glucose was the sepsis that should present the animals,

which alters the metabolism of the glucose/glycogens (Cerón *et al*., 2007). The nitrogen ureic in the blood (BUN) (Blood Urea Nitrogen, for their initials in English) it is the quantity of nitrogen that circulates in form of urea in the sanguine torrent, product from the metabolism proteinaceous to hepatic level through the cycle of the urea. The values of the BUN in the controls are inside the reference range (1,66-4,98 mmol/L) published for it varies authors (Tvedten, 2004; Kaneko *et al*., 2008; Rizzi*et al*., 2010). The increase has been attributed from the BUN to the excessive destruction of proteins in feverish states, sepsis or for the due hemoconcentration generally to vomits and diarrheas (Landeros, 1988; Cuesta*et al*., 2007). These symptoms were found in the dogs infected by the VDC. The increase of the BUN in sanguine serum can cause renal damage that can be the cause of the increase of the creatinine and the uric acid in the animals with *D canine*. In the figure 3 the results of the seasonal indexes are exposed for the indicators in every month, climbed so that a station average it is similar to 100; notice you that there is a seasonal balance gives each indicator along the year. For the positive cases and the incidence, the smallest seasonal indexes were in the month of April (49,87 and 49,74 respectively) and the adults, in June and August (184,32 and 171,94), equally order. For the mortality the indexes 11 go from a minimum of 39, in April to a maximum of 178,53 in October. The lethal had smaller index in the month of May 95, 74 and a maximum of 103,1 in October. On the other hand, the form of fecal-oral-nasal transmission of the illness is favored by the high levels of precipitations and humidity that happen in these months. The rains propitiate the conditions for the contamination of the phreatic mantel that increases the level of contamination of the sources of supply of water, and they become infection sources and transmission roads. Do the high temperatures, as the currents of cold air, the rains and the high relative humidity in the atmosphere produce an effect stress so much in the puppies that make it more susceptible to microbial infections (Gombač *et al*., 2008).

With the values of the chronological series of the incidence the pattern and the equation were obtained that describe the presage of the behavior of this epidemic index for the year 2016, The adjusted pattern was ARIMA (2,0,2)x(2,0,2)6, with constant. In the table 5 the parameters of the same one can be appreciated.

For the presage of the incidence the pattern is represented in the following way:

Model: (1 - AR(1)*β - AR(2)*β**²)[(1- SAR(1)*β**6)P - μ] = (1- $MA_{(1)}$*β - MA(2)* β**²)(1- $SMA_{(1)*}$β**6)et.

Of the previous pattern the following equation was obtained, where I is the incidence expressed by percent: I(%) = μ + $SAR_{(1)}$I(t-6) + $AR_{(1)}$I(t-1) - [$AR_{(1)}$I(t-1)$SAR_{(1)}$I(t-6)] + μ [$AR_{(1)}$I(t-1) - $AR_{(2)}$ I(t-2)] + [$AR_{(2)}$I(t-2)$SAR_{(1)}$I(t-6)] + μ[$AR_{(2)}$I(t-2) - $MA_{(1)}$e(t-1) - $MA_{(2)}$e(t-2) - $SMA_{(1)}$e(t-6) + [$SMA_{(1)}$e(t-6) ($MA_{(1)}$e(t-1) + $MA_{(2)}$e(t-2)] + et + K.

In the pattern previous e(t) it is a random variable (white noise) with (μ= 0, σ= 0.10104y k= 1.3456, that it can be rejected of agreement with the value that he/she takes in the context of the data).

The autocorrelation coefficients for the residuals indicated that none of them surpassed the limits of 90% of dependability (it figures 4), what takes like one of the approaches of validation of the pattern (Grau, 2003), as well as three tests of randomness of the residuals (table 6) that allowed to determine that these constituted a random sequence or white noise, that that ultimately is a very important theoretical approach of validation of the pattern (Grau, 2003). The incidence of the *D. canine*shows biannual seasonal and the pattern predicts the same behavior pattern for next 12 months (Figures 5). This indicator, the pattern ARIMA (2,0,2)x(2,0,2)6, with constant, it shows a component regular autorregresivo of second order

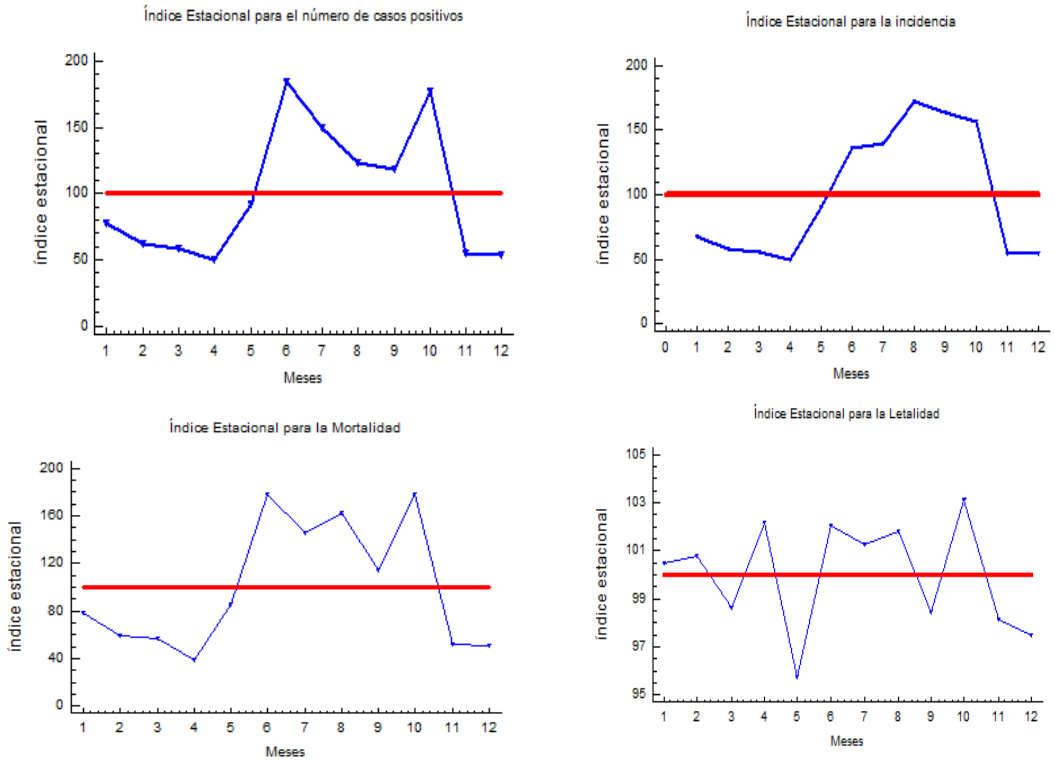

Figure 3. Seasonal indexes for the number of positive cases, incidence, mortality and lethal of the *D. canine*

that indicates a correlation between each current monthly value and the values of the two immediately previous months and one seasonal of second order, that which indicates that the correlation settles down between the current month and both previous, Also, the pattern presented components of half motive to regulate and seasonal of first and second order, respectively; that they indicate a relationship of the current situation with the immediately previous one and the precedent separated by a seasonal period of six months.

Table 5. They summarize of model ARIMA for the presage from the incidence to *D. canine* for the year 2016, starting from data obtained among the years 2013 and 2015

Variable	Parameter	Dear	Error Estd	Value-P
Incidence (%)	AR(1)	-1,65,947	0,135669	0,000000
	AR(2)	-0,771069	0,134715	0,000004
	MA(1)	-1,72,948	0,0348833	0,000000
	MA(2)	-1,02,059	0,0414578	0,000000
	SAR(1)	0,0899283	0,0712703	0,217816
	SAR(2)	0,775376	0,0638921	0,000000
	SMA(1)	1,19,125	0,0620531	0,000000
	SMA(2)	-0,707038	0,0917858	0,000000
	Media	0,366228	0,052903	0,000000
	Constante	0,169226		

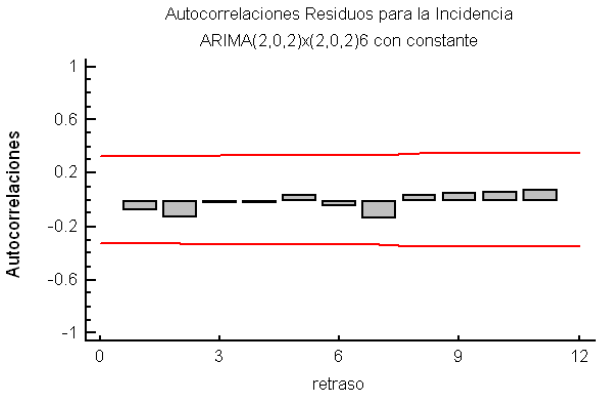

Figure 4. Autocorrelation coefficients that validate the pattern ARIMA (2,0,2)x(2,0,2)6, with constant to predict the *D. canine* for the year 2016, starting from the data obtained in the incidence among the years 2013 at 2015

Table 6. Tests of randomness for the residuals that validate the pattern selected in the presage of the incidence of the *D. canine* for the year 2016, starting from data obtained in the years 20013 at 2015

Test of randomness of residuals	Statistical significance
Run up or under the medium one	P = 0,865713
Run up and below	P = 0,735342
Box-Pierce proves	P = 0,576979

The pattern ARIMA (2,0,2)x(2,0,2)6 were simpler, he/she always offered the smallest value in the half square of the error (MSE) and the Approach of Information of Akaike (AIC), as well as the best result in the test of Kolmogorov-Smirnov, with which was proven high correspondence between the real data and the presage, with good results in the grade of adjustment of the two distributions (Figure 6).

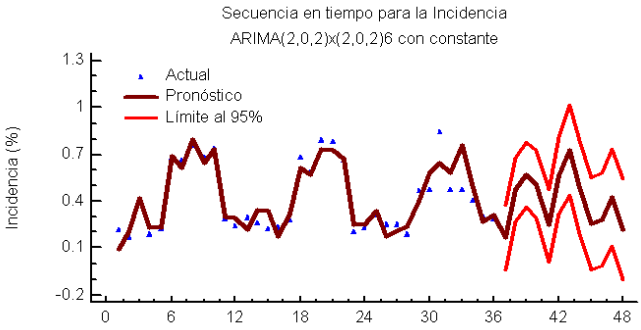

Figure 5. Sequence in the time for the presage of the incidence of the *D. canine*for the year 2016, starting from data obtained in the years 2013 at 2015

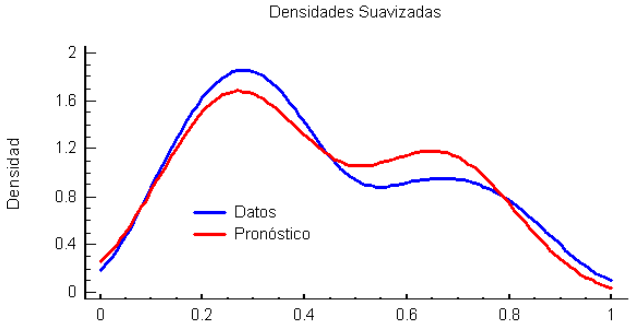

Figure 6. Correspondence among the real data of the incidence with those predicted by the models for the year 2016, starting from data obtained in the years 2013 at 2015

The statistical significances the test of Kolmogorov-Smirnov was P> 0,80, for what the hypothesis is not rejected, that the stocking of the differences is zero (Grau, 2003), on the other hand, the most important approach in validation of the pattern from the practical point of view, is that the error of the presage is acceptable (Grau, 2003); what is also completed in this work. The tendency of the incidence to maintain the same behavior pattern for next 12 months, it can obey to that stay the conditions for the presentation of the illness and the factors of risk of the same one that could be associated to the partial use of the vaccination, the intestinal parasitism and incorrect habits of holding in the territory and of feeding (Aldaz et al., 2015). The validation of a model and their declaration like appropriate for a given presage, it is based fundamentally on two aspects: the correlogramas of the residual ones that demonstrate if the errors constitute a white noise, and the test of Box - Pierce that should have a value P? 0,05 to assure the validity of the pattern for the significance of the parameters that you/they intervene in the same one (Lage *et al*., 1999; Grau, 2003; Sarute *et al*., 2014). You concludes that the clinical square in mestizo dogs infected with the stump SA3 of the VDC in the Guarandacanton, Bolívar province, Ecuador is characterized by hyperthermia, anorexia, breathing and digestive symptoms; where, the metabolic profile of mongrel dogs infected with the stump SA3 of the VDC the leucopenia prevails, linfopenia, significant decrease of the proteins serics and the glucose, as well as the increase of the BUN.

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