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Lognormal distribution of *Toxocara canis* (n/e/g/f) at the street dogs

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Abstract

Dogs (especially puppies) are the main carriers of *T. canis* which accidently can infect and humans. Larvae of *T. canis* migrate causing the syndrome of larva migration. Tirana is a developing country which favors the growth of street dogs especially in the peripheral part. The number of street dogs in Tirana is about 2300 (± 250). Most of the times they risk the health of children which lives near populated areas or parks. We have picked up more samples in populated areas than in less populated areas. The database was made from the first of December of 2012 to December of 2013 and it includes information from fecal of 67 puppies from 1 to 6 months, 62 dogs from 6 to 12 months and 69 dogs over 12 months. These samples were examinees at the Petlife Hospital, Tirana, Albania. A brief history regarding age, with examination and information where dogs mostly lived and fed were written down. All the information was processed from the statistic program S.S.P.S 17 for Windows.

Keywords: Lognormal distribution mean, dog, eggs, *T. canis.*

1. Introduction

The canids are the definitive host for the *Toxocara canis*. Many animals such as mice, rabbits and monkeys can serve as paratenic hosts. Humans are accidental hosts. *Toxocara canis* has a complex life cycle [1]. The eggs of *Toxocara canis* are excreted in the feces of definitive host. Eggs develop into the infection stage, L3. The life cycle of *Toxocara canis* is different in puppies than in dogs over six months of age [1]. *Toxocara canis* can be transmitted to pups by transmammary transmisssion from larvae that were in their mothers milk. This is the least common form of transmission [11]. Prenatal transmisssion is the second form of transmission. Infected pups are born with larvae already in their bodes. Stage two larvae (not yet infective) migrate from tissue in the pregnant mother. The larvae travel across the placenta and through the umbilical cord to the fetal liver [5]. The larvae remain in the liver until birth. Once the pup is born the larvae resume their migration to the lungs of the newborn. Another form of transmission is direct transmission. This is the only transmission to humans. In this form of transmission the new host directly ingests the eggs from the feces of another infected canid. *Toxocara canis* larvae migrate from the gut(where they were ingested) to the small intestine of newborns. *Toxocara canis* also migrates to the lungs from the intestiness [2]. They move up the bronchial tree and the trachea to the pharynx, here they are swallowed by the newborn to finally reach the intestine. In the intestine the larvae mature [10]. Only a small number of the larvae infecting the host actually undergo migration to the trachea. The majority of larvae continue to migrate through the lungs and the pulmonary veins of the host. The larvae migrate to the heart and there they are distributed to the somatic tissues via the peripheral circulation [11]. The last form of transmission is paratenic host transmission and many hosts contain the non-infective larvae of *Toxocara canis*. When one of these animals is eaten by another host transmission takes place [6]. The risk of exposure to humans in the Tirana is very high. The disease is most common in children between the ages one and three. Ingesting embryonated eggs from the feces of dogs and other canids spreads the diease. Often street dog goes a walk in the park, street, houses etc. and deposit egg-bearing feces. The young child is at an age where everything is picked up and tasted, including the contaminated soil [7]. The eggs of *Toxocara canis* are most commonly ingested this way. The eggs once excreted from the definitive host can survive for 10-20 days in the external environment [10].

2. Material and methods

Samples were evaluated for *T.canis* eggs. A total of 198 fecal samples comprising male and female dogs (n = 91 and n = 107) were examined. Faeces for analysis were obtained for each individual dog. Each sample consisted of 5-10 g faeces. They packed individually in plastic cups and marking the date of sampling. Coproscopic examinations was conducted in Petlife Hospital, Kombinat- Tirana under McMaster method using $ZnCl_2$ solution density of 1.3. As sun as possibly after collection the samples were processed using fecal floatation technique described by Soulsby, 1982 [5].

Methodology

Were taken 2 g faeces and mixed with 60 ml of solution ZnCl 2. Mc Master lama placed on desk naked and left in silence for 2-3 minutes, then counted the eggs or larvae found in the squares of the three cameras , their sum is divided by two and multiplied by 200 [9]. The eggs were identified under the microscope by their spherical appearance with thin outer shell and *Toxocara canis* the slight depression. Eggs are round with thick screens, with dimensions of 90 x 75 μ and small granules on the surface [9]. Results of work during a year were collected and were processed statistically. We have calculated mean , the error of the mean, variance, standard deviation, asymmetry, kurtosis values and distribution of *Toxocara canis* positive n/e/g/f [3; 8].

3. Results and discussion

Results of statistical processing are reflected in the following tables and graphs.

Statistical data of positive *T. canis* n/e/g/f showed diversity according to the age. Results of statistical analysis identified no differences with respect to n/e/g/f for scared *T. canis* by animal sex. These changes were evident respect to the age: for ages 1-6 months 3641 is the mean, for age 6-12 months is 1209 and for age greater than 12 moths is 936. Statistical data processing by age noticed a difference in relation to n/e/g/f to *Toxocara canis*.

As shown in graph 1 cub age plays an important role in *Toxocara canis* n/e/g/f. It is trivial that the age play a significant role for *Toxocara canis* n/e/g/f. The graph shows that the content of *Toxoara* is too big to 1-6 months and decreases for 6-12 months and drastically decreases to over 12 months. Acarids living in dog organism about a year. This is why we discover ascaridiosis been positive for every season of the year. Features of acarids biological cycle make it difficult to note the seasonal impact on the level of infestation of dogs [9].

Table 1. The results of statistical processing for coprosccopic headings according to the age.

	Only contaminated Toxocara canis n/e/g/f	*Only contaminated Toxocara canis n/e/g/f age 1 to 6 months*	*Only contaminated Toxocara canis n/e/g/f age from 6.1 to 12 months*	*Only contaminated Toxocara canis n/e/g/f age over 12 months*
N Valid	118	67	36	15
Mean	2555.25	3640.90	1209.44	936.00
Std. Error of Mean	340.30	553.45	206.58	183.046
Median	1200.00	2000.00	700.00	600.00
Mode	600.00	800.00[a]	600.00	600.00
Std. Deviation	3696.63	4530.21	1239.45	708.93
Variance	1.367E7	2.052E7	1536239.68	502582.86
Skewness	2.979	2.196	2.16	0.865
Std. Error of Skewness	0.223	0.293	0.39	0.580
Kurtosis	9.753	4.703	5.629	-0.438
Std. Error of Kurtosis	.442	.578	.768	1.121
Range	19800.00	19800.00	5800.00	2200.00
Minimum	200.00	200.00	200.00	200.00
Maximum	20000.00	20000.00	6000.00	2400.00

a. Multiple modes exist. The smallest value is shown.

Puppies infested arise when their mothers are infested by acarids. The fact that 100 % of puppies that we tested proved to be infested shows that their mothers have been infested 100% by acarids [7]. Reasons for puppies to notice an infestation level high so I wanted to be in the way of infestation, age and mode of feeding them. When a female dog infests taking invasive eggs, larvae that hatch in the intestine during their migration enter-hepatic-cardio-pulmonary blood pass through the uterus and fetuses infects

located there (if it bares female dog) so in this case all puppies will arise infested [2]. Part of female larvae infested dog to pass through the blood and breast milk pass through the digestive of puppies [11].

Histogram of values of *Toxocara canis* NGF

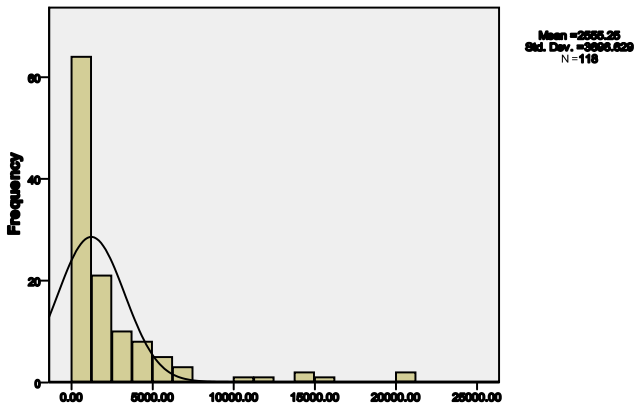

Figure 1. Frequency distribution of *T. canis* n/e/g/f.

Table 2. Statistics of logarithm values of *Toxocara canis* n/e/g/f.

		Only logarithmic values of contaminated Toxocara canis n/e/g/f	*Only logarithmic values of contaminated Toxocara canis n/e/g/f age from 1 to 6 months*	*Only logarithmic values of contaminated Toxocara canis n/e/g/f age from 6.1 to 12 months*	*Only logarithmic values of contaminated Toxocara canis n/e/g/f age over 12 months*
N	Valid	118	67	36	15
Mean		3.1060	3.2736	2.9035	2.8429
Std. Error of Mean		.04653	.06415	.06598	.09292
Median		3.0792	3.3010	2.8406	2.7782
Mode		2.78	2.90[a]	2.78	2.78
Std. Deviation		.50547	.52510	.39589	.35988
Variance		.256	.276	.157	.130
Skewness		.293	-.030	.274	-.107
Std. Error of Skewness		.223	.293	.393	.580
Kurtosis		-.541	-.664	-.675	-1.135
Std. Error of Kurtosis		.442	.578	.768	1.121
Range		2.00	2.00	1.48	1.08
Minimum		2.30	2.30	2.30	2.30
Maximum		4.30	4.30	3.78	3.38
Percentiles	25	2.7782	2.9031	2.6021	2.6021
	50	3.0792	3.3010	2.8406	2.7782
	75	3.4771	3.6628	3.2425	3.2041

a. Multiple modes exist. The smallest value is shown.

From the collected infested positive *Toxoara canis* n/e/g/f dogs we constructed the frequency distribution of these values (figure 1).

From figure 1 look at the frequency distribution histograms of values *T. canis* n/e/g/f has a positive asymmetry. Standard deviation also is very high (3696.63) compared to the average (2555.25) [3]. Clearly, this histogram shows that we have not normal distribution of *T. canis* n/e/g/f [8]. If we calculate the logarithm of *T. canis* values will we take the table no. 2 statistics of these values [11].

Also with SPSS 17 program we produced normal approximation graph and box plot which are presented in figure 2 and fig. 3.

Logarithm contaminated *Toxocara canis* GF

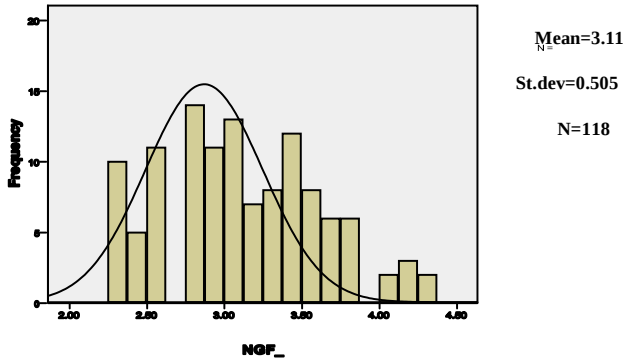

Figure 2. Logarithm of *T.canis.*

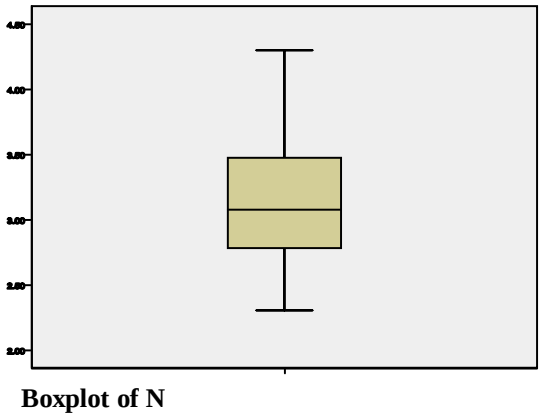

Figure 3. Box plot logarithm of *T.canis.*

From figures 2 see that the logarithm values of *Toxocara canis* n/e/g/f have a normal distribution with mean 3.106 and 0.255 dispersion, i.e., N (3.106,0.255). Using these values we are seeking to verify the initial hypothesis:

H0: The population of dogs has distribution N (3.106,0.256).

Versus H_1: The population of dogs has not distribution N (3.106,0.256) [3].

The procedure for verification of this hypothesis is Hi - square criterion. Logarithmic values were standardized according to the usual process of standardized values ($z_i = \frac{x_i - \bar{x}}{S}$) where :

$\bar{x}$ is the mean

S is the standard deviation

It is known that size has $\chi^2 = \sum_{i=1}^{k} \frac{(f_i - p_i)^2}{p_i}$ has Chi-square distribution with k-1 degrees of freedom where

k- number of classes (12)

i_f – number of observed values lie in the class

P_i - the expected values lie in the class with the assumption that we have normal distribution [10].

In the construction of standardized values we used two estimates (the mean and standard deviation) so for the value of the degrees of freedom (k - 1) at χ^2 criterion we should subtract the two other units. Since the number of samples is 118 we have allocated to k = 12 different classes tending to be completed for each class the conditions n * Pi > 5 [3, 10].

Theoretically value χ^2 has 9 degrees of freedom (12-1-2 degrees of freedom).

Table 3. Calculated χ^2 value.

Interval	*Observed numbers lie in this interval* i_f	*Theoretically probability of this interval* P_i	*Theoretically numbers lie in this interval (* $118 * P_i$ *)*	$\frac{(if - Pi)^2}{Pi}$
(-2.0 ÷ -1.5]	10	0.044	5.199	4.433
(-1.5 ÷ -1.2]	5	0.048	5.695	0.085
(-1.2 ÷ -0.9]	11	0.069	8.141	1.004
(-0.9 ÷ -0.6]	14	0.090	10.642	1.059
(-0.6 ÷ -0.3]	11	0.108	12.725	0.234
(-0.3 ÷ 0.0]	13	0.118	13.913	0.060
(0.0 ÷ 0.3]	10	0.118	13.913	1.101
(0.3 ÷ 0.6]	11	0.108	12.725	0.234
(0.6 ÷ 0.9]	10	0.090	10.642	0.039
(0.9 ÷ 1.2]	8	0.069	8.141	0.002
(1.2 ÷ 1.5]	7	0.048	5.695	0.299
(1.5 ÷ 2.5]	8	0.061	7.151	0.101
Total	118			$\chi^2 = 8.651$

The analysis of Chi-square analysis is shown in table nr. 3. For critical value α = 0.05 or 95% level of security χ^2 (9) theoretical value is 16.919 . Since this theoretically value is greater than the calculated value of χ^2 (χ^2 = 8.651) allows us to affirm that we have no reason to reject the hypothesis of lognormal distribution of *Toxocara canis* n/e/g/f .

It is easy to calculate 95 % confidence interval for the mean values by the usual formula:

$$\overline{X} \pm t_{\alpha/2}(N-1) \cdot \frac{S}{\sqrt{N}}$$ where

N is the number of samples

$\alpha/2$ is the critical value of bilateral ($\alpha/2$ = 0.025 or 2.5 %)

$t_{o/2}$ (N - 1) is tabulated value of student distribution with N -1 degrees of freedom .

(In our case $t_{\alpha/2}(117) = t_{0.025}(117) = t_{0.025}(\infty) = 1.96$)

The 95 % confidence interval of the mean is (3.0148 ÷ 3.1972) [8].

4. Conclusions

To draw optimal conclusions about contamination of dogs with *Toxoara canis* (n/e/g/f) must do the logarithm of values drawn from coprosccopic examination of dogs faces with McMaster method.

The 95 % confidence interval of the mean for logarithmic values of *Toxocara canis* (n/e/g/f) is within the limits (3.0148 ÷ 3.1972).

From 118 fecal samples (positive) for *Toxocara canis* (n/e/g/f) can express the hypothesis that *Toxocara canis* (n/e/g/f) has a lognormal distribution.

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