

# Peridomiciliary risk factors and knowledge concerning visceral leishmaniasis in the population of formiga, Minas Gerais, Brazil

## *Fatores de risco peridomiciliares e conhecimento sobre leishmaniose visceral da população de Formiga, Minas Gerais*

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**ABSTRACT:** *Introduction:* Leishmaniasis represents an important burden of diseases in tropical countries, with significant levels of morbidity and mortality where they occur, including in Brazil. In this context, popular participation in prophylactic actions can be decisive for the success of the control strategies. *Objective:* For this reason, this study aimed at investigating the population's knowledge concerning leishmaniasis and the occurrence of peridomiciliary risk factors associated with the population of Formiga, Minas Gerais. *Methods:* A household questionnaire with a sample of 427 individuals was conducted between May and July 2011. *Results:* Only 7.5% of the residents presented knowledge regarding leishmaniasis, most of them being women (OR = 3.15; 95%CI 1.30 – 7.65). The prevalence of peridomiciliary risks was 95%. A statistically significant association was found between higher education levels and less peridomiciliary risk factors (OR = 0.45; 95%CI 0.28 – 0.72) and between the place of residence and a higher number of risk factors (OR = 0.84; 95%CI 1.19 – 2.85). *Conclusion:* The results demonstrate that the population has low levels of knowledge about leishmaniasis. Moreover, the majority of respondents are subject to some peridomiciliary risk factor, which may contribute to the maintenance of the disease cycle in the city.

**Keywords:** Leishmaniasis. Knowledge. Population at risk. Risk factors. Disease prevention. Health promotion.

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**RESUMO: Introdução:** As leishmanioses representam uma importante carga de doença nos países tropicais, apresentando índices significativos de morbimortalidade nos locais onde ocorrem, incluindo o Brasil. Nesse contexto, a participação popular nas ações profiláticas pode ser determinante para o êxito das estratégias de controle. **Objetivo:** Por isso, o presente estudo teve o objetivo de investigar o conhecimento da população sobre as leishmanioses e a ocorrência de fatores de risco peridomiciliares associados à população no município de Formiga, Minas Gerais. **Métodos:** Foi realizado um inquérito domiciliar com uma amostra de 427 indivíduos entre maio e julho de 2011. **Resultados:** Apenas 7,5% dos moradores mostraram conhecimento sobre as leishmanioses, sendo principalmente as mulheres (OR = 3,15; IC95% 1,30 – 7,65). A prevalência de riscos peridomiciliares foi de 95%. Associação estatisticamente significativa foi encontrada entre maior escolaridade e menos fatores de risco peridomiciliares (OR = 0,45; IC95% 0,28 – 0,72) e entre o local de residência e maior número desses fatores de risco (OR = 1,84; IC95% 1,19 – 2,85). **Conclusão:** Os resultados demonstram que há baixo nível de conhecimento sobre as leishmanioses por parte da população. Além disso, a maioria dos respondentes está sujeita a algum fator de risco peridomiciliar, fato que pode contribuir para a manutenção do ciclo da doença no município.

**Palavras-chave:** Leishmaniose. Conhecimento. População em risco. Fatores de risco. Prevenção de doenças. Promoção da saúde.

## INTRODUCTION

Leishmaniasis is a complex of diseases caused by the protozoa belonging to the genus *Leishmania* Ross, 1903 and it is transmitted by phlebotomus (Diptera, Psychodidae: Phlebotominae). They are spectrum diseases that can manifest as ulcers, which is the case of Tegumentary Leishmaniasis (TL), or systemically and highly lethally, like in the Visceral Leishmaniasis (VL). In its zoonotic transmission pattern, they have various types of wild hosts (foxes, possums, rodents) and domestic hosts (dogs, cats), in addition to humans<sup>1</sup>.

The complexity for diagnosis, treatment, and control, along with the fact that the illness is associated with poverty, makes leishmaniasis a group of neglected diseases that are in second place for mortality and in fourth for morbidity among the tropical diseases<sup>2,3</sup>. Worldwide, it is estimated that between 200 and 400 thousand of visceral cases and between 700 thousand and 1.2 million of cutaneous cases occur annually<sup>4</sup>. In Brazil, it is estimated that 30 thousand new cases of TL are reported annually, with an incidence rate of 18.5 cases for every 100 thousand habitants<sup>5</sup>, while for VL, between 2001 and 2010, 33,473 new cases were registered, with an average fatality rate of 6.5%<sup>6,8</sup>.

In Brazil, leishmaniasis have been modifying their transmission patterns and acquiring an urban, peri-urban, and reemerging pattern in recent years. The new epidemiologic transmission patterns combine numerous factors (coexistence of different vector species, reservoirs, and etiological agents, in addition to environmentally modifying human actions), which make the planning of effective action to control the disease a challenge to the public health policies in the country<sup>9,10</sup>. Because of this, especially in the case of VL, in addition to fighting the vector, treating human cases, and eliminating the household reservoir, the control policies also incorporated strategies focused on environmental management and in raising public awareness<sup>11</sup>.

This last aspect, when developed within the control strategies, can contribute to a successful control program in which there is room for public acceptance and participation in the prophylactic actions proposed<sup>12-14</sup>. Studies show that raising public awareness regarding the morbidity problem can possibly turn into the effective participation in the sanitary actions applied in a community<sup>15</sup>. Therefore, in the case of the leishmaniasis, understanding the knowledge, attitudes, and practices of a population regarding the disease can contribute to the creation of preventative/corrective actions, which are truly efficient and long-lasting<sup>16</sup>.

However, studies concerning the population's knowledge regarding leishmaniasis are rare in scientific literature<sup>14,17-23</sup>. Some papers show that populations affected by leishmaniasis are unaware of important concepts about the disease, in terms of transmission, treatment, and even prevention<sup>17-21</sup>. Furthermore, health education does not yet receive the necessary incentive to mobilize preventative actions in Brazil, whether individual or collective<sup>24</sup>. Given the importance of this factor for the success of control programs, it is necessary to become aware of the knowledge of the community that has been affected by leishmaniasis, a fact that can contribute to an improvement in the quality of life and health of the population.

For the city of Formiga, Minas Gerais, due to the absence of an official prevention and control program of VL, popular knowledge has become a key to the formulation of a proper planning to the local reality of the county. Until now, there were no actions target to VL, with such practices being restricted to official informational newsletters from the Ministry of Health, available at some basic health services. The city presents few cases of VL — 2 in 2011 and 1 in 2012, but with high fatality rate — 50% in 2011. However, the mechanisms for the transmission of the disease in the area are still unknown, as is the knowledge regarding the population affected by leishmaniasis. Because of this, the present study had the objective of investigating VL and the occurrence of peridomestic risk factors associated with the population of the municipality of Formiga, Minas Gerais, Brazil.

## **SUBJECTS AND METHODS**

### **STUDY DESIGN AND POPULATION**

A household questionnaire was conducted between May and July of 2011 with proportionate stratification probability sampling according to sex and age in the municipality of Formiga, Minas Gerais. The information utilized to estimate the size of each stratum was the 2010 Demographic Census (Censo Demográfico 2010), from the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE).

It was assumed that the occurrence of cases for this disease would influence the knowledge of the population regarding this illness. Thus, four districts from the municipality were chosen for comparison: Novo Horizonte, Centro, Nossa Senhora de Lourdes, and Lajinha. The first two were selected because they contained the highest number of human and/or

canine cases of leishmaniasis; the last two, the lowest number of cases for the disease, according to information from the City Health Department. The minimum sample was calculated so as the maximum error of the estimate would be  $\pm 5\%$ , with a confidence of 95%, generating a sample of 398 people. To deal with potential losses, 10% was added to this number.

The questionnaires were conducted in the households by trained interviewers. The instrument utilized was formulated and validated by Margonari et al. in 2012<sup>21</sup>. The inclusion criteria for the study were being over 15 years old and living in the districts cited above. These criteria were based on the fact that the knowledge, the actions, and the living habits of the family context are under cyclical and multivectorial influence, interfering in the health status of each member<sup>25</sup>. The family, as a unit of care, is influenced by the cultural environment and the socioeconomic conditions in which it is included. Thus, the respondent, even if young (15 years old) at the moment of the interview, is capable of functioning as a proxy for the conditions and perceptions of the nuclear family, as well as influencing behavioral changes.

## KNOWLEDGE REGARDING LEISHMANIASIS

Leishmaniasis presents a complex epidemiologic cycle in which various factors combine to determine the disease's transmission. Therefore, the assessment of the knowledge that an individual holds regarding this illness should be multidimensional<sup>26</sup>. Thus, an indicator was constructed for "Knowledge regarding leishmaniasis," obtained through the combination of four questions from the questionnaire. The question "Do you know how it is transmitted?" had the following possible answers: a) Phlebotomus, b) A sick dog, c) I don't know, and d) Others, with only the first answer being considered appropriate. The question "Do you know which animal can have leishmaniasis?" presented the following options: a) Dog, b) Cat, c) Rat, d) Chicken, e) I don't know, and f) Others, with answers a, b, and/or c being considered correct. The question "Do you know how to prevent the disease?" had the following options: a) Cleaning the site/yard, b) Sacrificing the sick dogs, c) Using mosquito repellent, d) Avoiding stagnant waters, e) Avoiding anyone sick with leishmaniasis, f) I don't know, and g) Others, wherein the answers a, b, and/or c were considered correct. Finally, the question "What would you do regarding a human under the suspicion of having leishmaniasis?" had the following options: a) Take this person to a hospital, b) To look for a health agent from city hall, c) Nothing, d) I don't know, and e) Others, with answers a and b being considered correct. The individuals were classified into two groups, considering that only those who answered all of the questions correctly had knowledge concerning leishmaniasis.

## PERIDOMICILIARY RISK FACTORS

The scientific literature reports numerous environmental and peridomiciliary factors that can influence the occurrence of vectors and reservoirs and, consequently, of cases

of the disease: the presence and type of vegetation, altitude, plantations and monocultures (coffee, bananas), watercourses, and the presence of domestic dogs, among others<sup>27-31</sup>.

In this study, the following peridomestic risk factors were considered: having a pet, the presence of hematophagous insects, the presence of rodents, the presence of an vacant lot, watercourses and green areas near the residence, regular waste collection, presence of a yard with a plantation, and regular cleaning of the house area. The response options were yes or no type. Later, a dichotomous indicator was constructed titled "Peridomestic Risk Factor," based on the average and median values for risk factor (3). Thus, the households were classified into "0" ( $\leq 3$  factors) and "1" (over 4 factors).

The independent variables correspond to the socioeconomic and demographic characteristics of the population obtained in the questionnaire. The covariables utilized were sex, age (15 to 39 years old and  $\geq 40$  years old), education level (none up to primary education, secondary education, tertiary education), family income in minimum wage salaries ( $< 1$ , between 1 and 2.99, between 3 and 4.99,  $> 5$ ), the number of residents per household ( $\leq 4$  residents and  $\geq 5$  residents), and the district (Novo Horizonte/Centro and Nossa Senhora de Lourdes/Lajinha).

## DATA ANALYSIS

The data were analyzed through descriptive analysis with estimates of averages, frequencies, and percentages. First, the population was described according to its socioeconomic and demographic characteristics and regarding its knowledge of some aspects relative to the epidemiologic cycle of leishmaniasis. Next, the individuals were compared so as to verify differences regarding their knowledge on leishmaniasis and the presence of peridomestic risk factors, according to their socioeconomic and demographic characteristics. In the crude analysis, the odds ratios (ORs) and their respective values at a confidence interval of 95% (95%CI) were calculated for each independent variable. Then, the model was adjusted for all of these variables. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS 13.0 for Windows – IBM Corporation).

## ETHICAL ASPECTS

Participation in the study was voluntary and the application of the questionnaire occurred following the signing of the Consent Term. The study was approved by the Ethics Committee of the Divinópolis Educational Foundation n° 10/2011.

## RESULTS

In total, 427 individuals who reside in the municipality of Formiga were interviewed. Table 1 shows the profile of the population sampled in the study area. The majority of interviewees were

female (54.6%), young people between the age of 15 and 39 years old (50.1%) and with up to a primary education level (46.4%). The average income was between 1 and 3 minimum wage salaries (65.5%) and the number of inhabitants in the household was up to 4 (75.1%) for the majority of those who were interviewed. The number of respondents per district was 122 for Centro, 108 for Lajinha, 101 for Nossa Senhora de Lourdes, and 106 for Novo Horizonte (Table 1).

Table 1. Socioeconomic characteristics of the study population from the municipality of Formiga, Minas Gerais.

Socioeconomic characteristics of the population of Formiga	n (%)
<b>Gender</b>	
Male	194 (45.4)
Female	233 (54.6)
<b>Age (years)</b>	
15 to 39	213 (50.1)
≥ 40	212 (49.9)
<b>Education level (completed years)</b>	
None to primary	194 (46.4)
Secondary education	151 (35.4)
Tertiary education	74 (17.3)
<b>Income (in minimum wage salaries)</b>	
< 1.0	15 (3.5)
1.0 – 2.99	275 (65.5)
3.0 – 4.99	88 (21.0)
≥ 5	42 (10.0)
<b>Number of residents in the household</b>	
≤ 4	314 (75.1)
≥ 5	104 (24.9)
<b>Residing district</b>	
Centro	112 (26.2)
Novo Horizonte	106 (24.8)
Lajinha	108 (25.3)
Nossa Senhora de Lourdes	101 (23.7)

It was observed that merely 32 people (7.5%) adequately replied to the questions concerning transmission, prevention, and attitude toward a human case. The responses regarding these questions are shown in detail in Table 2.

Table 3 shows the result of the crude and adjusted analysis of the association between knowledge regarding leishmaniasis and the population's characteristics. The result of the comparison between the knowledge regarding the disease and the district surveyed was not significant. The only variable that significantly influenced the population's knowledge concerning leishmaniasis was sex; in the municipality of Formiga, the women presented a 3.1 times higher chance of being aware of the disease in comparison with men.

Regarding the peridomestic risk factors, it was observed that 94.8% of the respondents reported the presence of a risk factor. Only 5.2% of the respondents did not report the presence of peridomestic risk factors. When analyzed according to the dichotomous indicator "peridomestic risk factors," 258 (60.4%) presented up to three risk factors and 169 (39.6%) presented over four factors.

Table 4 shows the result of the crude and adjusted analysis of the association between the peridomestic risk factors and the population's characteristics. Individuals with a higher education level presented a lower chance of residing in dwellings with more peridomestic risk factors (OR = 0.45;

Table 2. Response of the interviewees for the questions most relevant to the epidemiologic cycle of the leishmaniasis present in the questionnaire applied to the population of the municipality of Formiga, Minas Gerais.

Knowledge of the population	n (%)
How is leishmaniasis transmitted?	
Phlebotomine sandflies	85 (20.0)
Incorrect responses	340 (80.0)
What animal can present the disease?	
Dog/cat/rat	207 (48.5)
Incorrect responses	220 (51.5)
How can you avoid it?	
Clean the place/sacrifice sick dogs/use repellents	200 (47.1)
Do not know/incorrect responses	225 (52.9)
Attitude regarding a human case of leishmaniasis	
Incorrect responses	39 (9.2)
To look for a health agent	67 (15.7)
Take the person to the hospital	320 (75.1)

95%CI 0.28 – 0.72). Regarding the place of residence, the respondents from the districts with cases of the disease — Novo Horizonte and Centro — had an 80% higher chance of residing in a household with over four peridomiciliary risk factors (OR = 1.84; 95%CI 1.19 – 2.85). The remaining characteristics did not seem to influence the level of exposure to the risk factors investigated.

In addition, the association between the knowledge concerning leishmaniasis and the presence of peridomiciliary risk factors was analyzed, with no association being found ( $p = 0.837$ ), data not shown in table.

Table 3. Crude and adjusted analysis between the knowledge concerning leishmaniasis and the characteristics of the study population of the municipality of Formiga, Minas Gerais.

Characteristics	Knowledge concerning leishmaniasis		OR (95%CI)	
	Yes	No	Crude	Adjusted
	n (%)	n (%)		
<b>Gender</b>				
Male	7 (3.6)	187 (96.4)	Ref.	Ref.
Female	25 (10.7)	208 (89.3)	3.21 (1.36 – 7.60)	3.15 (1.30 – 7.65)
<b>Age (years)</b>				
15 – 39	18 (8.5)	195 (91.5)	Ref.	Ref.
≥ 40	14 (6.6)	198 (93.4)	0.77 (0.37 – 1.58)	0.68 (0.30 – 1.56)
<b>Educational level (completed years)</b>				
None to primary	13 (6.6)	185 (93.4)	Ref.	Ref.
≥ Secondary education	18 (8.0)	207 (92.0)	1.24 (0.59 – 2.60)	0.74 (0.31 – 1.76)
<b>Income (in minimum wage salaries)</b>				
≤ 4.99	25 (6.6)	353 (93.4)	Ref.	Ref.
≥ 5	6 (14.3)	36 (85.7)	2.35 (0.91 – 6.11)	2.02 (0.67 – 6.13)
<b>Number of residents in the household</b>				
≤ 4	21 (6.7)	293 (93.3)	Ref.	Ref.
≥ 5	11 (10.6)	93 (89.4)	1.65 (0.77 – 3.55)	0.58 (0.25 – 1.33)
<b>Place of residence</b>				
Nossa Senhora de Lourdes and Lajinha	11 (5.3)	198 (94.3)	Ref.	Ref.
Novo Horizonte and Centro	21 (9.6)	197 (90.4)	1.91 (0.90 – 4.10)	2.22 (0.96 – 5.16)

OR: *odds ratio*; 95%CI: confidence interval of 95% obtained through logistic regression and adjusted by the variables described in the table (406 individuals participated in the analysis).

Table 4. Crude and adjusted analysis between the peridomiciliary risk factor and the characteristics of the study population of Formiga, Minas Gerais.

Characteristics	Peridomiciliary risk factors		OR (CI95%)	
	0 a 3	≥ 4	Crude	Adjusted
	n (%)	n (%)		
Gender				
Male	113 (58.2)	81 (41.8)	Ref.	Ref.
Female	145 (62.2)	88 (37.8)	0.85 (0.57–1.25)	0.87 (0.57 – 1.30)
Age (years)				
15 – 39	130 (61.0)	83 (39.0)	Ref.	Ref.
≥ 40	127 (59.9)	85 (40.1)	1.01 (0.71 – 1.55)	0.78 (0.50 – 1.23)
Educational level (completed years)				
None to primary	105 (53.0)	93 (47.0)	Ref.	Ref.
≥ Secondary education	151 (67.1)	74 (32.9)	0.55 (0.37 – 0.82)	0.45 (0.28 – 0.72)
Income (in minimum wage salaries)				
≥ 4.99	166 (57.2)	124 (42.8)	Ref.	Ref.
≥ 5	88 (67.7)	42 (32.3)	0.84 (0.43 – 1.62)	1.07 (0.52 – 2.18)
Number of residents in the household				
≥ 4	188 (59.9)	126 (40.1)	Ref.	Ref.
≥ 5	63 (60.6)	41 (39.4)	0.97 (0.62 – 1.53)	0.92 (0.56 – 1.49)
Place of residence				
Nossa Senhora de Lourdes and Lajinha	74 (35.4)	135 (64.6)	Ref.	Ref.
Novo Horizonte and Centro	95 (43.6)	123 (56.4)	1.41 (0.95–2.08)	1.84 (1.19 – 2.85)

\*OR: *odds ratio*; 95%CI: confidence interval of 95% obtained through logistic regression and adjusted by the variables described in the table (406 individuals participated in the analysis).

## DISCUSSION

In Brazil, the leishmaniasis control program includes the role of the population in disease control actions. However, the knowledge and perception of the community is almost always ignored during these preventative and control actions in the country. In the case of the study area, this aspect becomes evident, as merely 7.5% of those who were interviewed had some knowledge concerning leishmaniasis. If on one hand studies show that having

some knowledge about the disease can minimize the risk of its occurrence<sup>12,19</sup>, on the other, this type of knowledge is often fragmented and does not allow the population to understand and acknowledge all of the components of the epidemiological chain of transmission<sup>20-22</sup>.

In fact, what is observed in many educational health practices is that the established knowledge ends up not resulting in change of behavior, once such information does not generate social representation capable of permeating the daily lives of these individuals<sup>32,33</sup>. The understanding that the change in behavior is associated with the cultural context of the population can produce, in a more satisfactory manner, a process of empowerment and articulation of the necessary knowledge to the construction of a new and long-lasting health practice. Hence, the community's perception should be known and worked with in order to revert it into better awareness concerning the disease and attitude toward prevention<sup>23</sup>.

Among the characteristics of the population, the female sex was shown to have an association with knowledge concerning the illness in question. An explanation for this finding can be the fact that women are known to pay more attention to health issues, manifesting their attentiveness within the family, in various situations with their children, partners, parents, and grandparents<sup>34</sup>. This care is often based on accumulated experience (health service appointments) or in learning this experience from other women in the family so this knowledge is put into practice to prevent the disease and guarantee the family's health<sup>34</sup>.

However, other factors can also influence the health knowledge and practices, for example, social class and education level. According to Boltanski<sup>35</sup>, these factors are capable of limiting the spread of medical knowledge, influencing the frequency and quality of the physician-patient dialogue. The results of the present study point to an association between higher education level (secondary school) and the presence of a lower number of peridomiciliary risk factors. It is possible that the educational level reflects in better socioeconomic conditions and, consequently, in better habitational conditions, reducing exposure to peridomiciliary risk factors.

It should be noted the fact that 94.8% of the population studied lived in locations with the presence of at least one risk factor and that 39.6% reported the presence of over four of these factors; it was observed a significant association between place of residence and the presence of a higher number of risk factors. This association would have been expected, as the districts that registered the highest number of cases would probably present higher vulnerability to the occurrence of the disease. The influence of these peridomiciliary characteristics and how they are related to the risk of leishmaniasis occurrence are well demonstrated — the presence of a pet, henhouse, fruit trees, and remaining forests, among others<sup>27,31</sup>. These factors can attract the vector and favor its reproduction in the areas surrounding the residence due to the possible accumulation of organic matter. It is therefore of great importance that both the residence as its annexes (backyard, kennel, henhouse) are kept clean in order to prevent the proliferation of phlebotomine sandflies.

In the present study, the association between the knowledge of the population concerning the leishmaniasis and the presence of peridomiciliary risk factors did not present significant statistical results. Probably the studied population is unaware that the control of the

disease also depends on reducing the risk factors in the peridomestic environment. This fact becomes even more evident when it is observed that 94.8% of the residents have at least one peridomestic risk factor in their homes. The absence of an association between the knowledge and the presence of these factors in the peridomestic area indicates, furthermore, that the inhabitants are unaware of the risks to which they are subject to. It is possible that, despite presenting some level of knowledge concerning the disease, this awareness is so incipient that it does not result in any behavior changes in the population.

Education can be of help in reverting this scenario. However, so that the appropriate knowledge can reflect in appropriate and effective prevention practices, the knowledge — correct reproduction of content, the attitude — opinion of an individual concerning the content, and the practice — action carried out, should go hand in hand with the population's reality<sup>36</sup>. Thus, health education should be conceptualized as a concrete sanitary measure that can lead to the failure or success of a control program and, consequently, can influence the risk of exposure of the population<sup>18</sup>.

In this context, capacity building for health and education professionals should be considered. The first group is responsible for disseminating scientific knowledge and making it more accessible to the public, requiring, therefore, a permanent education, so that they are capable of following the evolution of endemic diseases<sup>26</sup>. Conceptual flaws or discrepancies by health professionals concerning leishmaniasis, as observed by other authors regarding transmission<sup>17</sup> and the common name for leishmaniasis<sup>26</sup>, can reflect on the quality of information that reaches the population. On the other hand, the primary education teachers, as they maintain a close contact with children and adolescents, can collaborate in transforming students into disseminators of the information received in the classroom. Study conducted in Divinópolis, Minas Gerais, regarding teacher's perception of leishmaniasis demonstrated that these professionals are not knowledgeable about this disease<sup>37</sup>, however, they are willing to raise awareness among their students, highlighting school as a favorable space to spread this knowledge<sup>37</sup>.

These processes should be continuous and periodically advertised as they often represent the only source of popular information<sup>38</sup>. With the active participation of the community, it is possible to reduce the conditions that facilitate the transmission of leishmaniasis in the region. In addition, the disease issue can be explored in a health promotion perspective, in which the public policies favor the personal and collective skills focused on the improvement of life and health quality of the population.

## FINAL CONSIDERATIONS

The present study identified, for the first time, that the population of the municipality of Formiga was unaware of important concepts concerning leishmaniasis and that the female sex was associated with knowledge regarding the disease. These results indicate that it is important to educate and empower the population so that it can effectively contribute to

the control and prevention of the disease in the region, where cases of human leishmaniasis have frequently been registered. In the same sense, the discovery of peridomiciliary risk factors in the majority of houses surveyed, as well as the association between the place of residence and the higher number of these factors, points to the possibility of the cycle of the disease remain active in the municipality, a fact that should be followed up on by the local epidemiological surveillance.

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