Research Article

Population-based Study of 24 Autoimmune Diseases Carried Out in a Brazilian Microregion

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ABSTRACT

In Brazil, epidemiological data on autoimmune diseases are scarce due to the lack of a specific policy of attention to this group of diseases. This study aimed to estimate the general and relative prevalence of the diseases presented, as well as to know the sociodemographic profile of the identified cases. This cross-sectional study was conducted with an epidemiological survey of patients with confirmed diagnosis of autoimmune diseases from primary health care in the Aguas Formosas microregion, Minas Gerais, Brazil. We have included all new and old cases found of individuals of both sexes and all ages, including those who died and emigrated during this period. A total of 407 carriers and 24 different autoimmune diseases were identified. The prevalence of autoimmune diseases in this region was 673.6 cases per 100,000 inhabitants [95% confidence interval (CI): 609.8–742.4]. Highest prevalence was identified for Hashimoto's thyroiditis 140.6 cases per 100,000 (95% CI: 112.4–173.9), followed by vitiligo 132.4 cases per 100,000 (95% CI: 105.0–164.8), and rheumatoid arthritis 105.9 cases per 100,000 (95% CI: 81.6–135.3). The sex ratio was higher in females (69%), the most affected age group was over 60 years (30.5%), with greater predominance in the urban area (81.3%). Our data showed the general and relative prevalence of the identified diseases, allowing to know the sociodemographic profile of the identified cases and the epidemiological trend of these morbidities in a low-income Brazilian region.

1. INTRODUCTION

Autoimmune Diseases (ADs) are a complex and heterogeneous group of diseases characterized by the loss of immunological tolerance to their own antigens and consequent tissue destruction by autoantibodies [1]. Although there are approximately 80 AD types and at least 40 additional diseases with autoimmune basis, many are considered relatively rare. They account for a cumulative overall prevalence of 3–5% of the world population and their effects on morbidity and mortality are quite high, representing a serious global public health problem [2].

Several studies [3–6] on the prevalence and incidence of ADs have been conducted in the past 30 years. One of these concluded that the average annual percentage of the prevalence of 11 ADs increased worldwide, reaching a range of 7.9–12.5%. It was concluded that the highest annual increase was observed in rheumatic diseases, followed by endocrinological, gastrointestinal, and neurological diseases [6].

There is a lack of current prevalence data from different areas of Europe and North America for many autoimmune disorders [7]. Few epidemiological studies estimating the prevalence of ADs were conducted in Latin America, especially in Brazil [8]. Of course, more studies are needed to know the general and relative

prevalence rates of ADs in all regions of Brazil, even more considering that epidemiological studies point to an increase in their prevalence in developing countries [9].

In Minas Gerais state, the prevalence of these diseases is unknown [10]. Even with insufficient statistical data, it is believed that there is a significant increase in the prevalence of ADs throughout the country [10]. Among the factors that explain the insufficiency of these data are the difficulties in epidemiological, clinical, and therapeutic analyzes, as well as the lack of preparation of some health professionals, requiring a joint effort of the medical professionals and other researchers in the search, discussion, and dissemination of results on the etiology, specific therapeutics, and reliable epidemiological studies on these nosologies [11].

In this sense, the present study is relevant because this is the first survey carried out in this region and it estimated the respective prevalence of the main autoimmune morbidities that affect the microregion of Águas Formosas, Minas Gerais, Brazil, thereby helping to understand its epidemiological profile to subsidize the adoption of policies in this field.

2. MATERIALS AND METHODS

2.1. Study Design and Scenery

This is a cross-sectional, descriptive, and exploratory study with a quantitative approach. The research was carried out in

the microregion of Águas Formosas, located in the northeast of the state of Minas Gerais. The estimated population is 60,413 inhabitants [12], with a geographical area of approximately 4,150,700 km² [12]; being composed of eight municipalities: Águas Formosas, Bertópolis, Crisólita, Fronteira dos Vales, Machacalis, Pavão, Santa Helena de Minas, and Umburatiba (Table 1). The region is part of the Atlantic forest biome with tropical climate and well-defined seasons. It has riverside population, indigenous population, and their socioeconomic indicators are low [13].

2.2. Method of Data Collection and Technique used

The epidemiological survey of ADs was carried out in the 26 primary health care units of the microregion, through the review of medical records and active search conducted from January to December 2016. The results are based on the total number of cases followed, newly discovered or diagnosed. In this work, all prevalent cases, including those who died and/or emigrated, are included in the analyses.

For the general prevalence calculation, the entire set of identified cases was used and, for the calculation of the relative prevalence of each disease, the subsets were multiplied by the constant 100,000 to estimate the punctual prevalence of these diseases in this microregion.

For this, the numerator referred to the number of people diagnosed of all ages registered in the epidemiological survey and the denominator was the population at risk of becoming ill, adopting as based on population estimates [6].

Subsequently, a literature review of the electronic databases was carried out in addition to the inclusion of studies found from these references. The search terms used referred to the prevalence of the 24 diseases identified. The research was approved by the Local Research Ethics Committee.

2.3. Statistical Analysis

Prevalence data were expressed as cases per 100,000 inhabitants and 95% confidence intervals (CIs) were calculated according to the Poisson distribution. The Fisher chi-square test was used to verify the differences in prevalence according to sex. The study used counts, proportions, and rates through the statistical software STATA version 15.0 (StataCorp, College Station, TX, USA).

3. RESULTS

3.1. Population Distribution and Prevalence by Municipality

Overall, 407 individuals with ADs were identified in the groups evaluated. The estimated prevalence was 673.6 cases per 100,000 inhabitants, distributed among the eight municipalities in the region (Table 2).

The municipalities of Machacalis (1106.8 per 100,000 inhabitants), Umburatiba (993.4 per 100,000 inhabitants), and Crisólita (957.6 per 100,000 inhabitants) had the highest prevalence of ADs.

3.2. Relative Prevalence of Identified Diseases

The relative prevalences of the 24 ADs identified in the general population of the evaluated region were estimated (Table 3). The study showed the highest prevalences for Hashimoto's thyroiditis, vitiligo, rheumatoid arthritis, psoriasis, Graves' disease, type 1 diabetes mellitus, and systemic lupus erythematosus.

Table 2 | Population distribution and prevalence of autoimmune diseases according to municipalities in the Águas Formosas microregion, 2016

Municipality	Population (*N*)*	Cases**	Prevalence cases/100,000 inhabitants	95% CI
Águas Formosas	19,363	89	459.6	369.1–565.6
Bertópolis	4671	28	599.4	398.3–866.4
Crisólita	6579	63	957.6	735.8–1225.2
Fronteira dos Vales	4743	31	653.6	444.1–927.7
Machacalis	7228	80	1106.8	877.6–1377.5
Pavão	8724	55	630.4	474.9–820.6
Santa Helena de Minas	6387	34	532.3	368.7–743.9
Umburatiba	2718	27	993.4	654.6–1445.3
Total	60,413	407	673.6	609.8–742.4

*Brazilian Institute of Geography and Statistics (2016); **Cases identified in the period from January to December 2016; CI, confidence interval.

Table 1 | Distribution of the sociodemographic characteristics of the cases identified among small municipalities and their respective general prevalence

Municipality	Land area**	Population*	Population density**	Altitude***	Latitude	Longitude
Águas Formosas	819,8	19,363	23,61	273	−17° 04′ 56″	−40° 56′ 09″
Bertópolis	427	4,671	10,93	278	−17° 03′ 47″	−40° 34′ 28″
Crisólita	973	6,579	6,76	282	−17° 14′ 14″	−40° 54′ 43″
Fronteira dos Vales	319,8	4,743	14,83	314	−16° 53′ 29″	−40° 55′ 29″
Machacalis	330,8	7,228	21,85	285	−17° 04′ 38″	−40° 42′ 59″
Pavão	601,4	8,724	14,50	228	−17° 25′ 40″	−40° 59′ 56″
Santa Helena	277,9	6,387	22,98	312	−16° 58′ 59″	−40° 41′ 08″
Umburatiba	368,5	2,718	7,37	238	−17° 15′ 21″	−40° 34′ 22″

*Population estimate according to the Brazilian Institute of Geography and Statistics (2016). **Per square kilometer. ***Per square meter.

3.3. Distribution of the Sociodemographic Profile of the Sample

Regarding the absolute frequencies observed, women, people aged 60 years and over, brown skinned, and people from urban areas presented the highest proportions (Table 4).

Table 3 | Prevalence of autoimmune diseases in the Águas Formosas microregion, 2016

Autoimmune diseases	Cases	Prevalence cases/100,000 inhabitants	95% CI
Hashimoto's thyroiditis	85	140.6	112.4–173.9
Vitiligo	80	132.4	105.0–164.8
Rheumatoid arthritis	64	105.9	81.6–135.3
Psoriasis	44	72.8	52.9–97.8
Graves' disease	39	64.5	45.9–88.3
Type 1 diabetes mellitus	30	49.6	33.5–70.9
Systemic lupus erythematosus	26	43.0	28.1–63.1
Endemic pemphigus foliaceus	07	11.5	4.7–23.9
Lichen planus	05	8.2	2.7–19.3
Idiopathic ulcerative colitis	05	8.2	2.7–19.3
Ankylosing spondylitis	03	4.9	1.0–14.5
Sjögren's syndrome	03	4.9	1.0–14.5
Multiple sclerosis	02	3.3	0.0–11.9
Rheumatic polymyalgia	02	3.3	0.0–11.9
Scleroderma	02	3.3	0.0–11.9
Psoriatic arthritis	02	3.3	0.0–11.9
Crohn's disease	01	1.6	0.0–9.2
Celiac disease	01	1.6	0.0–9.2
Antiphospholipid syndrome	01	1.6	0.0–9.2
Alopecia areata	01	1.6	0.0–9.2
Addison's disease	01	1.6	0.0–9.2
Myasthenia gravis	01	1.6	0.0–9.2
Immune thrombocytopenic purpura	01	1.6	0.0–9.2
Polymyositis	01	1.6	0.0–9.2

CI, confidence interval.

3.4. Relative Prevalence According to Sex

When we evaluated the prevalence of diseases in relation to sex, there was statistical significance ($p < 0.001$) for Hashimoto's thyroiditis, rheumatoid arthritis, Graves' disease, and systemic lupus erythematosus, showing the female sex to be with higher predominance of ADs (Table 5).

4. DISCUSSION

When comparing the general prevalence of ADs in the microregion (0.67%) with the worldwide prevalence (3–5%) [1], it is possible to infer that the microregional estimate is underestimated as the data evaluated were only from the public health network and did not use hospital data and the private health service network, and there may have been some quantitative impairment due to the lack of record of cases by the local health services.

In this study, the municipalities of Machacalis, Umburatiba, and Crisólita presented the highest prevalence. Although there is no specific public policy on ADs in the country and the noninclusion of these morbidities in their national compulsory notification list [3], environmental factors that could determine a greater number of cases were not identified as the counties evaluated share the same microclimate.

Our observations allow comparing the present epidemiological survey with the population-based study of 12 ADs carried out in Sardinia, Italy [14]. It is verified that Hashimoto's thyroiditis was the most prevalent organ-specific disease in both studies. Regarding systemic diseases, vitiligo, rheumatoid arthritis, and psoriasis prevailed in the current study by order, whereas in the Italian study, the order of prevalence was psoriasis, rheumatoid arthritis (also in second position), and ulcerative colitis, demonstrating considerable similarity of prevalence between the studies despite the geographical and demographic differences between these regions.

Table 4 | Absolute frequencies and percentages of autoimmune diseases according to sociodemographic characteristics in the Águas Formosas microregion, 2016

	Municipalities of the Águas Formosas microregion								
	Águas Formosas	Machacalis	Crisólita	Pavão	Santa Helena	Fronteira dos Vales	Bertópolis	Umburatiba	Total (%)
Cases	89	80	63	55	34	31	28	27	407 (100)
Sex									
Male	30	18	19	29	6	9	6	9	126 (31)
Female	59	62	44	26	28	22	22	18	281 (69)
Age group (years)									
7–14	3	4	4	5	2	1	1	3	23 (5.7)
15–29	7	6	8	4	4	4	5	2	40 (9.8)
30–44	20	24	18	12	6	8	4	6	98 (24.1)
45–59	28	24	21	17	9	6	8	9	122 (29.9)
60+	31	22	12	17	13	12	10	7	124 (30.5)
Ethnicity									
Black	5	5	4	2	2	3	3	1	25 (6.1)
Brown	60	54	52	44	22	25	21	25	303 (74.4)
White	24	21	7	9	10	3	4	1	79 (19.5)
Residence zone									
Urban	81	75	33	41	29	28	22	22	331 (81.3)
Rural	8	5	30	14	5	3	6	5	76 (18.7)

Table 5 | Prevalence of autoimmune diseases according to sex in the Águas Formosas microregion, 2016

Autoimmune diseases	Women (N = 29,602)			Men (N = 30,811)			p-value*
	Cases	Prevalence cases/100,000 inhabitants	95% CI	Cases	Prevalence cases/100,000 inhabitants	95% CI	
Hashimoto's thyroiditis	77	260.1	205.3–325.1	8	25.9	11.2–51.2	<0.001
Vitiligo	43	145.3	105.1–195.7	37	120.1	84.6–165.5	0.434
Rheumatoid arthritis	51	172.3	128.3–226.5	13	42.2	22.5–72.2	<0.001
Psoriasis	17	57.4	33.4–91.9	27	87.6	57.8–127.5	0.177
Graves' disease	31	104.7	71.2–148.7	8	25.9	11.2–51.2	<0.001
Type 1 diabetes mellitus	11	37.2	18.6–66.5	19	61.7	37.1–96.3	0.203
Systemic lupus erythematosus	22	74.3	46.6–112.5	4	12.9	3.5–33.2	<0.001
Endemic pemphigus foliaceus	3	10.1	2.1–29.6	4	12.9	3.5–33.2	1.000
Líchen planus	3	10.1	2.1–29.6	2	6.5	0.0–23.5	0.681
Idiopathic ulcerative colitis	2	6.8	0.0–24.4	3	9.7	2.0–28.5	1.000
Ankylosing spondylitis	2	6.8	0.0–24.4	1	3.3	0.0–18.1	0.617
Sjögren's syndrome	2	6.8	0.0–24.4	1	3.3	0.0–18.1	0.617
Multiple sclerosis	0	0.0	0.0–12.5	2	6.5	0.0–23.5	0.500
Rheumatic polymyalgia	1	3.4	0.0–18.8	1	3.3	0.0–18.1	1.000
Scleroderma	2	6.8	0.0–24.4	0	0.0	0.0–11.9	0.240
Psoriatic arthritis	1	3.4	0.0–18.8	1	3.3	0.0–18.1	1.000
Crohn's disease	0	0.0	0.0–12.5	1	3.3	0.0–18.1	1.000
Celiac disease	0	0.0	0.0–12.5	1	3.3	0.0–18.1	1.000
Antiphospholipid syndrome	1	3.4	0.0–18.8	0	0.0	0.0–11.9	0.490
Alopecia areata	0	0.0	0.0–12.5	1	3.3	0.0–18.1	1.000
Addison's disease	1	3.4	0.0–18.8	0	0.0	0.0–11.9	0.490
Myasthenia gravis	0	0.0	0.0–12.5	1	3.3	0.0–18.1	1.000
Immune thrombocytopenic purpura	1	3.4	0.0–18.8	0	0.0	0.0–11.9	0.490
Polymyositis	1	3.4	0.0–18.8	0	0.0	0.0–11.9	0.490
Total	272	918.9	812.9–1034.8	135	438.2	367.4–518.6	<0.001

*Fisher's Chi-square test was used to verify differences in the prevalence of autoimmune diseases according to sex; CI, confidence interval.

The prevalence of Hashimoto's thyroiditis was lower than in all studies consulted (300/2000 per 100,000) [15,16], perhaps because the microregion has protective factors such as low latitude and high temperature. The prevalence of vitiligo was higher than the estimate found in the only Brazilian prevalence study (40 per 100,000) [17], which may be explained by the ease of clinical diagnosis of the demographic regions of the disease with higher phototypes, such as the microregion. The estimated prevalence of rheumatoid arthritis in the region was lower than all the national studies consulted (200/1000 per 100,000) [10,18], but with a higher prevalence than the province of Tucumã, Argentina (100 per 100,000) [19]. Surely this microregional index would be higher if the disease were considered to be compulsorily reported, which also suggests that it may not be properly diagnosed [16].

Regarding psoriasis, the results identified the microregion's prevalence to be lower than those of studies conducted in Latin America (3000 per 100,000 in Mexico, 2000 per 100,000 in Venezuela, and 4200 per 100,000 in Paraguay) [20]. This disease has a variable prevalence in different countries from 6.5% (6500 per 100,000) in Germany to a rate of 11.8% (11,800 per 100,000) in the city of Kazachye, located in the arctic region of the former Soviet Union [21], perhaps this lower prevalence can be explained by the climate factor of the microregion in relation to other cooler and wetter regions, as protective factors such as hot and dry climate are recognized as variables that can affect its prevalence, and other intervening factors, as a greater propensity of Caucasians to the disease and technical difficulties in the differential diagnosis.

As regards Graves' disease, its prevalence was below the worldwide prevalence rate (1151.5 per 100,000) inhabitants [16]. The prevalence in the microregion is possibly lower due to the higher disease propensity in Caucasians. Also, it is believed that the addition of high levels of iodine in drinking water and table salt has an impact on its occurrence and distribution, as in Brazil, iodine content in table salt is officially controlled in commercial products and may be found in lower concentrations, unlike certain countries, such as the United States, where iodized salts have 100 mg per kg of table salt [22]. In addition, the difficulty of the microregional health system to offer specific laboratory and imaging tests such as scintigraphies for the diagnostic conclusion of the cases could affect the prevalence rate.

As to type 1 diabetes mellitus, the prevalence of microregion is lower than that of worldwide (192 per 100,000) [16], which may be due to the existence of some pertinent problems such as incorrect diagnosis, fragile health promotion actions, underutilization of health information systems, and nonsystematic records [23,24]. Technologically more developed regions are more likely to optimize their health systems and improve their indicators to facilitate the planning of preventive and diagnostic actions [25].

Toward systemic lupus erythematosus, the prevalence in the microregion was higher than in Spanish studies (17.5–34.1 per 100,000) [26,27] but lower than in the only Brazilian study (98 per 100,000) [10]. Other studies in Latin America [28,29] showed estimates ranging from 50 to 60 per 100,000, suggesting an increase in the number of cases in tropical and temperate climates in the warmer seasons of the year, probably due to the higher exposure of individuals to ultraviolet light.

Regarding the prevalence of endemic pemphigus foliaceus in the microregion, it is found to exceed that of the state of Minas Gerais (1.22 per 100,000) [30], which may be due to the rural, riverside, and indigenous population of the microregion that usually has rustic dwellings that favor the circulation of simulids, triatomines, and scimecid bugs, unlike the better housing conditions of the populations of other more developed regions of the state of Minas Gerais [31,32].

Referring to the estimate of lichen planus, it is noted that the prevalence in the microregion is lower than that worldwide. As no national study was found for comparative analysis of its more common clinical form. The exact prevalence of lichen planus is unknown. However, its estimated prevalence ranges from 0.22% (220 per 100,000) to 0.5% (500 per 100,000) worldwide [33,34]. It is suggested that the prevalence of lichen planus in the microregion may be affected by failures due to misdiagnosis, the diversity of clinical presentation, and the asymptomatic nature of the most common subtype that makes the disease an increasingly underdiagnosed health problem [35,36].

With respect to immune ulcerative colitis, its prevalence in the microregion is lower than that of a study conducted in the state of São Paulo, which had a prevalence of 14.81 per 100,000 [37]. Apparently, the prevalence of inflammatory bowel disease in less developed regions such as the microregion is lower than that observed in developed regions, and may also be the result of reduced diagnostic awareness, confusion with infectious causes of diarrhea, or reduced availability of technical resources [38].

Comparing the prevalence of ankylosing spondylitis, the microregion's prevalence is higher than Japan's prevalence (0.48 per 100,000) [39], but it is close to other world estimates such as the United States (6.4 per 100,000 in a study in Rochester, Minnesota) [40] and also in studies in northern Europe, such as Finland and Norway (both with 7.3 cases per 100,000) [41,42]; however, in the northeastern region of Greece the prevalence is higher (29.5 per 100,000) [43]. This lower prevalence in the microregion can be explained by geographical and ethnic issues, as the disease is more prone to Caucasians due to the influence of white genetic ancestry, whereas the microregion population is predominantly miscegenated, it is therefore a protective factor that may influence its prevalence [44,45].

Sjögren's syndrome in the microregion was prevalent with a lower level than that found in the only Brazilian study to date conducted in the metropolitan region of Vitória in the state of Espírito Santo (170 per 100,000) [46]. Other studies showed different results that ranged from 0.04% (40 per 100,000) in a study conducted in the United States [47], 0.7% (700 per 100,000) in China [48], to 3–4% (3,000–4,000 per 100,000) in the United Kingdom [49].

It is possible to verify that the prevalence of multiple sclerosis in the microregion was higher than that in a national study (1.88 per 100,000) [50] but lower than those in other studies conducted in the state of Minas Gerais (12.5/18.1 per 100,000) [51,52] and in the state of São Paulo (12.5/15.54 per 100,000) [53,54]. The microregion may have been influenced by geographical and climatic protection factors, as regions with greater latitude in relation to the equator line tend to have the largest number of cases.

When comparing the prevalence of rheumatic polymyalgia in the microregion with that in the United States (700 per 100,000) [55], a considerable difference was observed. Highest prevalence was reported in rural areas of a Canadian province and greater geographical variation in the Nordic countries, especially Norway, which is contrary to the data in southern European countries such as Spain and Italy where lower values were reported [56,57]. The microregion probably presents a lower prevalence owing to the geographical factor protection along with the difficulty faced in the diagnosis due to the lack of specific tests, as it is relevant for a timely and careful exclusion of other conditions that may mimic it such as late-onset rheumatoid arthritis and malignant neoplasms, which can cause similar symptoms. In this sense, the disease is characterized by wide variations in clinical practice and the available classification criteria are rarely used [56,58].

The scleroderma prevalence rate in the microregion was lower than that found in a Brazilian study (10.5 per 100,000) [59] but is higher than that found in a European study (3.1 per 100,000) [60], where the rates tend to be lower in northern Europe as is the case in Denmark. Epidemiological studies reveal a higher frequency of this condition in the United States of America (24.2 cases per 100,000) [61] and in southern regions of Europe; the fact that it is a rare disease and the difficulty in diagnosing it make confirmatory cases extremely challenging for the local health system.

In relation to the prevalence of psoriatic arthritis in the microregion, it is concluded that the level found is discrete compared with the worldwide prevalence (20–250 per 100,000) [62]. It is believed that the microregional health system has difficulty with its diagnostic component, given that the use of biomarkers is not available worldwide and there are currently no well-defined criteria and instruments for assessing cases using criteria created for other diseases, increasing the possibility of diagnostic errors [63,64].

As for the prevalence of alopecia areata, Addison's disease, antiphospholipid syndrome, celiac disease, Crohn's disease, myasthenia gravis, polymyositis, and immune thrombocytopenic purpura, all had the same prevalence level in the present study (1.6 per 100,000) but were lower than the prevalence studies respectively consulted (100/200, 0.45/11.7, 40/50, 1,000/2,000, 5.65, 14.2, 7.2, and 11.2 per 100,000) [65–72], suggesting that the small number of cases may be due to the fact that these pathologies are considered rare and the underdiagnosis related to problems with referral flow and counter-referral of users when accessing consultations [73,74].

Among the wide variety of existing ADs, the rarity of occurrence and the difficulty in detecting some of its types in the studied microregion led us to analyze only the most common ones. Although rare individually, as a group they affect a significant percentage of the population, resulting in an important public health problem. Some characteristics inherent to ADs can make the analysis of epidemiological data difficult due to the multiplicity of their clinical forms, long spontaneous remissions, insidious onset that may delay the diagnosis of the disease, and generation of fatal complications preventing its correlation with determining factors [75].

Some studies on the prevalence of ADs were conducted in the country, but individually, being addressed throughout this study. In addition, international statistics indicate that Brazil is still among the countries with the highest incidence of rheumatic fever [76].

Regarding Guillain-Barré syndrome, there are no prevalence data in Brazil [77], only studies that indicate an annual incidence of 0.46–0.6 cases per 100,000 nationwide, and 0.40 for the southeast region of Brazil [78,79]. Few epidemiological studies estimating the prevalence of ADs have been conducted in Latin America [80]. Most of the available studies are from North America, Europe, and Asia [81–85].

Some worldwide prevalence estimates have been verified such as Rasmussen's encephalitis with a rate of 0.18 per 100,000 [86]; and incidence rates from several studies were also consulted such as autoimmune hypophysitis with a coefficient of 1 case per 9 million people [87]. For dozens of orphan ADs, such as Cogan's syndrome, there is still no incidence or prevalence data for the limited number of documented patients [88].

Our data show that the higher frequency of ADs affects mainly people of productive age and that the prevalence is proportional to the increase in age, of which most individuals were over 30 years of age according to the literature [89].

A relevant factor that may explain differences in estimates of AD prevalence is their slow progression of signs and symptoms, making age of onset often unpredictable. In childhood, the most common diseases are type 1 diabetes mellitus, celiac disease, and vitiligo. In young adults, multiple sclerosis, myasthenia gravis, vitiligo, and lupus are the most common. Middle-aged people are more likely to have Sjögren's syndrome, systemic sclerosis, and rheumatoid arthritis. Older people are more likely to have Sjögren's syndrome, Hashimoto's thyroiditis, and myasthenia gravis. Another possibility is that some diseases such as Crohn's disease, myasthenia gravis, psoriasis, and autoimmune thrombocytopenic purpura, have bimodal course with diversified incidence peaks regarding age of onset, generating detection bias and making understanding of the demographic profile of AD a great challenge for the epidemiology [90].

Regarding ethnicity, browns were a higher percentage of the sample followed by whites, proving that this miscegenation in the microregion can be influenced by Caucasian genetic ancestry that is susceptible to ADs [91]; reinforcing the findings of the study that claims that ADs have a higher incidence in whites and browns than in yellows and blacks [92].

Seminal international study [16] states that geographical and ethnic factors may lead to differences in the risk of developing ADs between specific countries or ethnic groups living in the same area; and that type 1 diabetes is more common in northern European countries compared with southern countries; a similar pattern is suggested for multiple sclerosis, but with less area variation in rates. It was found that in the USA, blacks are at higher risk compared with whites with regard to systemic lupus erythematosus and scleroderma; and age at diagnosis is approximately 7 years younger among blacks with these diseases compared with whites. An increased risk of systemic lupus erythematosus has also been reported among Asian and Afro-Caribbean immigrants in the UK; rheumatoid arthritis rates are similar among whites, blacks, and Hispanics.

Table 5 indicates that the higher prevalence of ADs mainly affects female individuals, with a ratio of 2:1 between the sexes, presenting a considerable similarity with a previous study [93] that states that women have a risk 2.7 times higher than men to acquire an AD, manifesting in 78% of the cases in the female sex. Data analysis shows that the proportion of women and men suffering from ADs varies according to the disease, and the number of female individuals with Hashimoto's thyroiditis, rheumatoid arthritis, Graves' disease, and systemic lupus erythematosus presented statistical significance compared with males. The reasons for this inequality lie in the way that sex hormones influence the immune system, as women have higher corticosterone–cortisol concentrations than men and glucocorticoids suppress the production of sex hormones and the action of these hormones on the tissues, which are important mechanisms for the regulation of Th1 and Th2 cytokines in the inflammatory response to the development of ADs [94].

Most of the authors consulted [16,91,95–97] state that gender differences in the prevalence for ADs are most prominent in Sjögren's syndrome, systemic lupus erythematosus, Hashimoto's thyroiditis, Graves' disease, and scleroderma, in which 80% of patients are women. Regarding rheumatoid arthritis, multiple sclerosis, and myasthenia gravis, the proportion is lower, but 60% of the patients are still female. There is gender equivalence for ulcerative colitis and a preponderance of men over women for type 1 diabetes mellitus and ankylosing spondylitis.

Despite the acknowledgment that these studies conducted so far constitute a significant source of scientific information for public health, the state of the art of studies on the prevalence of ADs in the country can still be considered limited to meet the various demands for improving methods for their production and even compromising the composition of representative applied researches, especially in the area of clinical and environmental epidemiology.

Studies such as this can be useful for improving the quality of care and for better definition of causes, frequencies, types, severity, and communities, as well as for predicting and providing resources used and their appropriateness [98]. The results of this study allow improving the approach of patients as they are updated and monitored, stimulating public health measures.

5. CONCLUSION

In a region with broad social and regional inequality as this, changes in the approach to ADs are one of the greatest challenges of the current public health system. It is not only enough to detect the carriers, but also necessary to create conditions of early diagnosis to subsidize the effectiveness of the epidemiological surveys and the prevalence estimates to be made.

CONFLICTS OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

AUTHOR CONTRIBUTIONS

D.S.T.J. designed the study, developed methodology and data collection tools, conducted data analysis, and drafted the manuscript. C.M.O. contributed to the design of the study and data collection tools. E.M.A. supervised the research implementation, critically reviewed all aspects of the study, and assisted in drafting the manuscript. All the authors have approved the final manuscript.

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ABBREVIATIONS

ADs, autoimmune diseases; CI, confidence interval; kg, kilogram; km, kilometer; m, meter; mg, milligram; Th, T helper cell, TX, Texas; UK, United Kingdom; USA, United States of America.

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