Prevalence of gastroesophageal reflux disease: a population-based cross-sectional study in southern Chile

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Abstract

Background This study assessed the prevalence of gastroesophageal reflux disease (GERD) in a general adult population from Temuco in southern Chile. The association of GERD with demographic variables was also examined.

Methods A cross-sectional study among the general population of Temuco in southern Chile was conducted in 2017, using a validated and reliable questionnaire for detecting GERD. The urban area of Temuco, with a population of 245,317 inhabitants (2002 census), was divided into four zones, which were representative of the socioeconomic sectors of the city. The sample size was estimated assuming a prevalence of 52.8%, an accuracy of 3.0%, a confidence level of 95.0%, and a design effect of 1.15. Area sampling was used to build clusters. The prevalence of GERD was determined and associated factors were studied by means of bivariate and multivariate analyses.

Results A total of 1,069 subjects (47.9% women, median age 40 years) from the selected subareas were interviewed. The prevalence of GERD was 44.8%. The most frequently reported symptom was regurgitation (54.8%). One-third of subjects took medication to control symptoms and was considered ‘sick’ by the instrument, although >68% of them had never sought medical consultation. There was a significant association between GERD and age (P < 0.001) and female gender (P = 0.001).

Conclusions In this population-based study, the prevalence of GERD was high (44.8%). GERD was associated with age and female gender.

Key words: gastroesophageal reflux disease; prevalence; cross-sectional studies; evidence-based medicine; clinical epidemiology

Introduction

Gastroesophageal reflux disease (GERD) is a frequent cause of consultation. Typical symptoms, such as heartburn and regurgitation are common in the community, occurring in up to 33% of the adult population. It has been estimated that 30% of symptomatic subjects have esophagitis and that 70% require regular treatment for the control of symptoms, which can strongly affect their quality of life [1]. There are a few reports on the prevalence of GERD in the general population and most studies have been conducted in specific [2–6] or mixed
populations [7–9], such as elderly subjects [2], pregnant women [3], and subjects with type 2 diabetes [4], asthma [5], or depressive disorder [6]. Many questionnaires used to assess the prevalence of GERD are not reproducible or have not been previously validated [2–4, 9–17]. Also, the survey approach, including telephone interviews, postal questionnaires, and self-completed instruments, has methodological limitations [3, 11, 12, 14, 16–25].

Therefore, to overcome these limitations, we conducted a population-based study to assess the prevalence of GERD in the general adult population of Temuco, a city in southern Chile, using a validated and reliable questionnaire specific for reflux disease [26]. Data of previous prevalence studies of GERD using face-to-face interviews were compared with findings of our study. The objective of our study was to determine GERD prevalence in a general adult population from Temuco in southern Chile and its association with demographic variables.

Materials and methods

Data source

The source population consisted of all individuals 18 years or older living in the urban area of Temuco, Chile, between 1 March 2017 and 31 December 2017. According to Chile’s Institute of Statistics (INE), the total urban population of the city was 232,528 inhabitants, of whom 172,116 subjects were adults (≥18 years of age) [27].

Study design and participants

A cross-sectional survey was designed, the primary objective of which was to determine the prevalence of GERD in the adult urban population of Temuco. Secondary objectives were: (i) to describe clinical features and associated factors of patients with GERD and (ii) to assess demographic, anthropometric, and sociocultural factors of respondents to the survey. Subjects of both sexes, aged 18 years or older who gave written informed consent, were included in the study. Exclusion criteria were as follows: morbid obesity, scleroderma, pulmonary disease, presence of neoplasms, esophageal motor disorders, diseases capable of causing GERD or alterations in esophageal motility as part of its natural history, benign and malignant gastroduodenal diseases, history of surgery of the upper gastrointestinal tract, and caustic injury. Pregnant women and subjects with cognitive impairment or mental illness were also excluded.

Study procedures

A validated and reliable specific questionnaire for the diagnosis of GERD was used [26, 28]. The questionnaire consists of seven items: heartburn, regurgitation, chest pain, dry cough, dysphagia, dysphonia, and asthma. Heartburn, regurgitation, chest pain, and dry cough are scored from 0 to 3 (0: none; 1: at least once a month; 2: at least once a week; 3: every day) and dysphagia, dysphonia, and asthma from 0 (absent) to 1 (present), with a total score from 0 to 15. The questionnaire has been previously validated against the results of 24-hour esophageal pH monitoring and showed an internal consistency of 0.75 and inter-observer reliability of 0.87 [28]. Using a cut-off score of 3, the sensitivity, specific, positive, and negative predictive values were 92%, 95%, 98%, and 79%, respectively, with a correct classification of subjects of 92.4% [26, 28]. Other data of interest were added to the questionnaire, including age and gender, anthropometric data (height, weight, and body mass index [BMI]), tobacco and alcohol consumption, medications used for the control of GERD symptoms, and use of healthcare resources for GERD-related consultations.

Sampling and administration of the questionnaire

The urban area of Temuco was divided into four sectors, which were representative of different economic and cultural areas of the city, e.g. sectors 1 and 2 are of medium social and economic status, sector 3 of high status, and sector 4 of low status (Figure 1). The downtown district was excluded because most of the buildings were commercial properties or office spaces. Sectors were then divided into 12 subsectors of approximately clusters of 10 blocks each. A two-stage cluster random-sampling method was used, in which a subset of households within each selected conglomerate of blocks was randomly selected for inclusion in the study (Figure 2). A team of six previously trained medical students performed face-to-face interviews in the selected households. They also confirmed the eligibility criteria, obtained the written informed consent, and administered the questionnaire. Interviewers were totally familiar with the instrument and knew how to explain better any eventual question that has not been fully understood by the subjects interviewed. When no one fulfilled the inclusion criteria, the household on the right of the index home was selected. When no one lived in the household, the interviewer returned 24 hours later and, if it was still uninhabited, it was replaced by the contiguous household on the right. Respondents who, according to the scale, were found to suffer from GERD were referred to the healthcare center for further consultation.

Ethical consideration

The study was approved by the Ethics Committee of the Universidad de La Frontera. Written informed consent was obtained from all participants. Personal data were anonymized. This manuscript was written following the STROBE statement.

Sample size and statistical analysis

Considering that the urban adult population of Temuco is 172,116 inhabitants [27] and based on a prevalence of GERD of 52.8% found in a previous pilot study of our group [29], with an accuracy of 3.0%, a confidence interval of 95%, and a design
effect of 1.15, a sample size of 1,057 subjects was calculated. Categorical variables are expressed as frequencies and percentages, and continuous variables as mean and standard deviation or as median and range. The prevalence of GERD and the prevalence of individual symptoms of reflux disease were calculated. The chi-square test and the Fisher’s exact test were used for the comparison of categorical variables, and the Mann–Whitney U test or the Wilcoxon test for the comparison of continuous variables. Multiple logistic-regression analysis was used to assess variable independently associated with GERD. Statistical significance was set at \( P < 0.05 \).

**Results**

A total of 1,069 subjects were interviewed (47.9% women) with a median age of 40 years (range 18–92 years). The average BMI was 25.7 ± 4.4 kg/m² (range 15.8–54.1 kg/m²). Education level included primary education in 18.1% of subjects, secondary education in 47.0%, and university studies in 34.3%. Six people (0.6%) were illiterate. Current smoking was recorded in 5.5% of subjects and alcohol consumption in 3.0%. Working status included active workers in 45.5% of subjects, housewives in 17.2%, pensioners/retired in 6.0%, unemployed in 3.0%, and students in 28.2%.

The median overall score of the in-study population was 2 (range 0–13) and the average score was 2.7 ± 2.6. On the other hand, 590 subjects (55.2%) had a score of < 3 (average 0.9 ± 0.8) and 479 subjects (44.8%) had a score of ≥ 3 (average 5.1 ± 2.1). So, the prevalence of GERD was 44.8%. The prevalence of GERD varied according to areas surveyed (Table 1), but differences were not statistically significant. On the other hand, regurgitation was the most frequently reported symptom (54.8%) followed by heartburn (31.3%), cough (30.4%), and chest pain (29.8%) (Table 2).

About one-third of respondents (n = 353) with GERD scoring ≥ 3 in the questionnaire reported that they were using medications to control GERD symptoms, including antacids in 41.9% of cases, H₂ antagonists in 30.9%, and PPIs in 26.9% (no relationship between positivity questionnaire and PPIs use was verified). Drugs had been prescribed by a healthcare professional in only 53.0% of subjects (n = 187). Also, 68.0% of these subjects (n = 240) never visited the public healthcare system (55.0% were visited in private practices, 27.5% self-medicated, 14.2% chose alternative medicines, and the remaining 3.3% did not respond to this item).

In the bivariate analysis, the prevalence of GERD was higher in women than in men (64.3% vs 26.9%, \( P < 0.001 \)). Also, subjects with GERD were older and shorter (Table 3). In the multivariate analysis, age (\( P < 0.001 \)) and female gender (\( P = 0.001 \)) were the variables independently associated with GERD.

**Discussion**

The present population-based study carried out in the city of Temuco, Chile has shown a prevalence of GERD of 44.8%. We used a reliable and validated questionnaire for assessing esophageal reflux disease according to the presence and frequency of seven common symptoms of GERD. The prevalence found in the present study is lower than that observed in a previous
cross-sectional survey (52.8%) in 2002–2003 in the same city, although, in this case, only 364 persons were interviewed [29]. A review of prevalence studies of GERD in adult populations using face-to-face interviews and published from 2000 is summarized in Table 4 [15, 29, 30, 32–36, 38–40]. Prevalence rates are highly variable from 3.5% to 52.8% as well as the number of subjects included in the surveys (from 364 to 13,959) and the geographical origin of the study samples. In these studies, the GerdQ questionnaire developed by Jones et al. [41] and the GERD questionnaire developed by Locke et al. [31] were the tools most frequently used for diagnosing GERD. In some surveys, however, the prevalence of GERD was defined as the presence of acid regurgitation and/or heartburn at least once a week [33, 37]. Marked differences in the prevalence rates of GERD have been reported in populations from Asia (between 1.7% and 27.5%) [25, 29, 30] and Latin America (between 4.7% and 52.8%) [22, 29, 30]. Prevalence rates are highly variable, and to contribute to reducing the economic burden of the disease. In our study, particularly heartburn and regurgitation, although there are some, e.g. the fruit of the araucarias (La Araucanı´a Region typical tree), called ‘pinones’; however, there is not enough evidence to asseverate it.

We did not find differences in other factors that have been related to the disease, such as smoking or alcohol consumption [48, 49]. The small percentage of smokers and alcohol users in our study may account for this finding. On the other hand, the proportion of subjects with university studies was 34.3%—a high rate that can be explained by the presence of numerous education centers in two areas of the city. The percentage of unemployed patients was also high because students accounted for 28.0% of the study sample. An influence of the education level or working status on the development of GERD was not established.

The potential effect of indigenous elements in the population samples is difficult to determine precisely because, although the self-declared indigenous population in urban Temuco in the 2017 census was 24.7% (including different races of original peoples) [50], there is no form to determine the proportion of indigenous elements in the different in-study sectors (possibly this value can be even higher, because there are people with indigenous ancestry who are not considered as such). On the other hand, regarding the potential influence of migrants from rural communities around introducing higher Helicobacter pylori rates and hence less GERD, there is evidence supporting no relationship between GERD and H. pylori presence; also, successful eradication therapy does not have an impact on the emergence or exacerbation of GERD [51–54].

Another interesting point to comment on is the potential association between the high rates of GERD and esophageal cancer (Barrett’s-related) rates in the community. First of all, we do not know the reasons to explain the high prevalence of GERD found, but it is similar to a previous study published in 2005 [29]. On the other hand, the crude mortality rate of esophageal cancer per 100,000 inhabitants in Chile in 2015 was 3.7. However, in La Araucanı´a Region (Capital Temuco), it was 9.5 for men and 6.2 for women (the highest in the country) [55], so is a fascinating issue for further investigation. However, Barrett esophagus in our city has unknown incidence.

The present findings should be interpreted taking into account the limitations of the study, particularly the generalizability of the results to different target populations. The strengths of the study include the use of a validated and reliable questionnaire for assessment of GERD symptoms, trained interviewers, the face-to-face approach for administering the questionnaire, and the cluster random sampling for the selection of participants.

In conclusion, using a population-based cross-sectional study and a validated questionnaire, the prevalence of GERD in an urban area of southern Chile was 44.8%. An independent association of GERD with female gender and age was observed. Further studies using endoscopic examination would be necessary to ascertain the association between a positive questionnaire score for GERD and endoscopic esophagitis. In addition, it would be advisable to carry out education campaigns to detect and treat patients with GERD in order to prevent complications and to contribute to reducing the economic burden of the disease.

Table 3. Association between demographic variables and gastroesophageal reflux disease (GERD)

| Variable          | No GERD (n = 590) | GERD (n = 479) | P-value |
|-------------------|-------------------|----------------|---------|
| Age, years        | 40.7 ± 18.0       | 45.7 ± 18.0    | <0.001  |
| Sex, n (%)        |                   |                | <0.001  |
| Female            | 183 (35.7)        | 329 (64.3)     |         |
| Male              | 407 (63.1)        | 150 (26.9)     |         |
| Height, cm        | 164.1 ± 13.6      | 161.6 ± 12.5   | 0.047   |
| Weight, kg        | 68.7 ± 12.5       | 68.6 ± 12.7    | 0.942   |
| Body mass index, kg/m² | 25.6 ± 3.9 | 26.8 ± 4.9 | 0.162   |

subgroups were 25.6 ± 3.9 and 26.8 ± 4.9 kg/m², respectively (P = 0.1619). Related to any dietary elements in this geographical area of Chile that could lead to obesity, we can argue that effectively there are some, e.g. the fruit of the araucarias (La Araucanı´a Region typical tree), called ‘pinones’; however, there is not enough evidence to asseverate it.
| Reference  | Year | No. of subjects | Country | Population | Sampling method | Instrument | Validity | Reliability | Heartburn prevalence* (%) | Regurgitation prevalence* (%) | GERD prevalence (%) |
|------------|------|-----------------|---------|------------|-----------------|------------|----------|-------------|--------------------------|-----------------------------|---------------------|
| Dacoll [30] | 2000 | 1,141           | Uruguay | Urban population | Systematic sampling | GerdQ [31] | Yes      | NR          | 10.7                     | 8.1                         | 4.7                 |
| Wang [32]  | 2004 | 2,789           | China   | Adults of Xi’an | Stratified sampling | Unknown questionnaire | No        | No          | 4.1                      | 7.8                         | 17.4                |
| Cho [33]   | 2005 | 1,902           | Korea   | Asan-si residents | Simple random | Unknown questionnaire | Yes       | Yes         | 2.0                      | 2.0                         | 3.5                 |
| Manterola [29] | 2005 | 364             | Chile   | Urban adult population of Temuco | Cluster sampling | Manterola [26] | Yes       | Yes         | 46.4                     | 59.6                        | 52.8                |
| Moraes-Filho [15] | 2005 | 13,959          | Brazil  | Urban adult population of 22 cities | NR | Unknown questionnaire | No        | No          | 11.9                     | NR                         | 7.3                 |
| Mungan [34] | 2012 | 8,143           | Turkey  | Turkish general population | Simple random | GerdQ [31] | Yes       | Yes         | NR                       | NR                         | 27.6                |
| Shaha [35]  | 2012 | 2,000           | Bangladesh | Urban and rural areas of northeastern Bangladesh | Simple random | Manterola [26] | Yes       | Yes         | 5.25                     | 5.25                        | 5.5                 |
| Yöinem [36] | 2013 | 1,345           | Turkey  | Adults living in Sivas | Simple random | Locke [37] | Yes       | NR          | 8.0                      | 8.9                         | 19.3                |
| Bor [38]   | 2016 | 1,065           | Russia  | Adults in Moscow | Simple random | Locke [37] | Yes       | NR          | 17.5                     | 17.6                        | 23.6                |
| Wang [30]  | 2016 | 1,072           | India   | People in southern India | Multi-stage cluster | GerdQ [31] | Yes       | NR          | 26.4                     | 18.1                        | 22.2                |
| Bor [39]   | 2017 | 3,214           | Turkey  | Subjects aged 20 years or older from 17 cities | Three-stage stratified cluster | Locke [37] | Yes       | Yes         | 12.7                     | 18.7                        | 22.8                |
| Manterola  | 2020 | 1,069           | Chile   | Urban adult population of Temuco | Two-stage cluster random sampling | Manterola [26] | Yes       | Yes         | 31.3                     | 54.8                        | 44.8                |

aSymptom present at least once a week; GERD: gastroesophageal reflux disease; NR: not reported.
Authors’ contributions

C.M. and L.G. made substantial contributions to the conception, design, analysis, and interpretation of the data, and drafted the manuscript. T.O. and G.D. made substantial contributions to the design, analysis, and interpretation of the data. All authors read and approved the submitted version.

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Conflicts of interest

All authors declare that they have no conflicts of interest.

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