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**Original Research**

# Application of Multiple Correspondence Analysis in Clinical and Demographic Variables of Ameloblastoma

*Aplicação da Análise de Correspondência Múltipla em Variáveis Clínicas e Demográficas do Ameloblastoma*

*Aplicación del Análisis de Correspondencias Múltiples Variables Clínicas y Demográficas del Ameloblastoma*

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**Abstract**
The objective was to perform statistical analysis of clinical and demographic variables, investigating their relationships through Multiple Correspondence Analysis (MCA). This was a retrospective study based on medical records of patients diagnosed with ameloblastoma between January 2013 and October 2024 in a public hospital in Pernambuco, Brazil. Clinical and demographic data were collected, and the MCA was conducted using RStudio software. The results indicate that conventional ameloblastoma (CA) was more prevalent in adult women, in the mandible, and treated with resection. The plexiform pattern was associated with resection, while the desmoplastic pattern was associated with decompression. Unicystic ameloblastoma (UA) was predominantly observed in men and treated with enucleation. These findings suggest that the subtype and age of patients directly influence therapeutic choices. Treatment strategies should balance clinical efficacy with the impact on patients' quality of life.
**Descriptors:** Ameloblastoma; Multiple Correspondence Analysis; Treatment Patterns; Quality of Life; Hospital.
**Resumo**
O objetivo foi realizar uma análise estatística de variáveis clínicas e demográficas, investigando suas relações por meio da Análise de Correspondência Múltipla (ACM). Tratou-se de um estudo retrospectivo baseado em prontuários de pacientes diagnosticados com ameloblastoma entre janeiro de 2013 e outubro de 2024 em um hospital público de Pernambuco, Brasil. Dados clínicos e demográficos foram coletados, e a ACM foi realizada utilizando o software RStudio. Os resultados indicam que o ameloblastoma convencional (AC) foi mais prevalente em mulheres adultas, na mandíbula, e tratado por meio de ressecção. O padrão plexiforme associou-se à ressecção, enquanto o padrão desmoplásico associou-se à descompressão. O ameloblastoma unicístico (AU) foi observado predominantemente em homens e tratado por enucleação. Esses achados sugerem que o subtipo e a idade dos pacientes influenciam diretamente as escolhas terapêuticas. As estratégias de tratamento devem equilibrar a eficácia clínica com o impacto na qualidade de vida dos pacientes.
**Descritores:** Ameloblastoma; Análise de Correspondência Multipla; Qualidade de Vida; Hospital.
**Resumen**
El objetivo fue realizar un análisis estadístico de variables clínicas y demográficas, investigando sus relaciones mediante el Análisis de Correspondencias Múltiples (ACM). Se trató de un estudio retrospectivo basado en las historias clínicas de pacientes diagnosticados con ameloblastoma entre enero de 2013 y octubre de 2024 en un hospital público de Pernambuco, Brasil. Se recopilaron datos clínicos y demográficos, y el ACM se llevó a cabo utilizando el software RStudio. Los resultados indican que el ameloblastoma convencional (AC) fue más prevalente en mujeres adultas, se localizó con mayor frecuencia en la mandíbula y se trató mediante resección. El patrón plexiforme se asoció con la resección, mientras que el patrón desmoplásico se asoció con la descompresión. El ameloblastoma unicístico (AU) se observó predominantemente en hombres y se trató mediante enucleación. Estos hallazgos sugieren que el subtipo y la edad de los pacientes influyen directamente en la elección del tratamiento. Las estrategias terapéuticas deben equilibrar la eficacia clínica con el impacto en la calidad de vida de los pacientes.
**Descriptores**: Ameloblastoma; Análisis de Correspondencia Múltiple; Calidad de Vida;Hospital.

## INTRODUCTION

Multiple correspondence analysis (MCA) is applied to explore and visualize associations between qualitative variables in several areas of science. In dentistry, its application is still little studied, but it has great potential to broaden the understanding of clinical and demographic relationships, especially in rare and heterogeneous conditions. Ameloblastoma is a benign, heterogeneous, although rare, odontogenic tumor that has a potential local aggressiveness and high recurrence rates, requiring a careful and individualized therapeutic approach. The nature of ameloblastoma and associated treatments affect patients' quality of life, impacting social, psychological, and emotional aspects, with

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consequences that go beyond physical health, altering patients' general well-being and social integration[1-4].

Several studies have addressed ameloblastoma using descriptive and inferential statistics, investigating aspects such as age distribution, anatomical predilection, histopathological types, and treatment modalities. However, few have explored the simultaneous interaction between these qualitative variables, limiting the understanding of how they relate in an integrated manner. In this context, MCA can be applied to these qualitative variables for the identification of associations and underlying patterns, representing them graphically in an accessible and intuitive way[5,6].

Thus, this paper aims to perform a statistical analysis of clinical and demographic variables of ameloblastoma, investigating their relationships using Multiple Correspondence Analysis. To achieve this research objective, a retrospective study was applied based on medical records of patients diagnosed with ameloblastoma between January 2013 and October 2024 in a public hospital in Pernambuco, Brazil.

This research contributes to the literature by providing a statistical understanding of the factors associated with the different subtypes and their variables related to the cases analyzed. In addition, it explores how the type of treatment and the tumor are associated. Understanding the relationships between the variables can provide essential data to improve clinical management and quality of life. This paper highlights the relevance of MCA as a complementary analytical method in dental research and encourages its application in other clinical and epidemiological scenarios.

## MATERIAL AND METHOD

This study was based on analyzing 42 cases of ameloblastoma diagnosed at Hospital Getúlio Vargas (HGV) in Recife, Pernambuco, Brazil, between January 2013 and October 2024. The research included demographic (age, sex, and race) and clinical (anatomical location, subtype, and treatment) variables. Only patients with a confirmed diagnosis through histopathological examination were included, and medical records with incomplete information or inconclusive diagnoses were excluded.

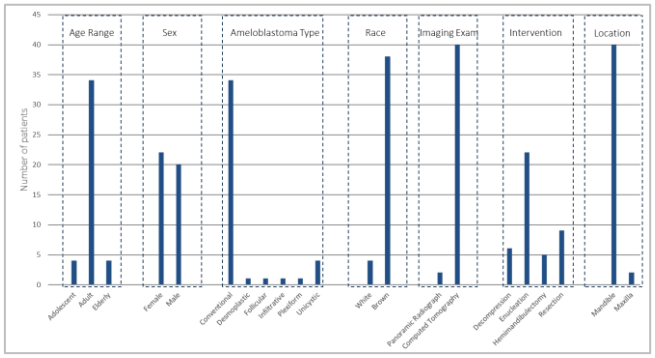
Data collection was performed after approval by the Ethics Committee of the Hospital Getúlio Vargas, under protocol number 79357324.8.0000.0362, using the HGV Electronic Patient Record (PEP) digital system. During the study period, the oral and Maxillofacial Surgery and Traumatology Sector treated 17,545 patients, of whom only 42 were diagnosed. These records were reviewed and anonymized to ensure patient privacy.

Histological subtypes were categorized as described in the PEP, with adjustments for standardization. Multicystic ameloblastoma was included in the CA group because the literature often considers them equivalent due to their morphology and behavior (2). Similarly, cystic ameloblastoma was included as UA since this term is widely used to describe single cystic lesions (7).

Data analysis was performed using RStudio software, which allows data manipulation and the creation of graphical visualizations. For MCA, the FactoMineR, factoextra, and ggplot2 packages were used to explore the associations between qualitative variables and visualize the results. The dataset was initially organized in a spreadsheet, and the categorical variables were coded. After this organization and coding, the database was imported into RStudio software for statistical analysis.

## RESULTS

Graph 01 presents the demographic and clinical variables of the 42 patients. Most were in the adult age group. CA was the most frequent. Most patients were brown, reflecting Brazilian demographic aspects. Tomography was the primary diagnostic exam. The most performed procedure for treatment was surgical enucleation. The most common location was the mandible. The gender distribution was balanced.




**Graph 1 –** - Distribution of Clinical and Demographic Variables of Ameloblastoma Cases Analyzed between 2013 and 2024 at Hospital Getúlio Vargas, Recife-PE (Source: Authors)

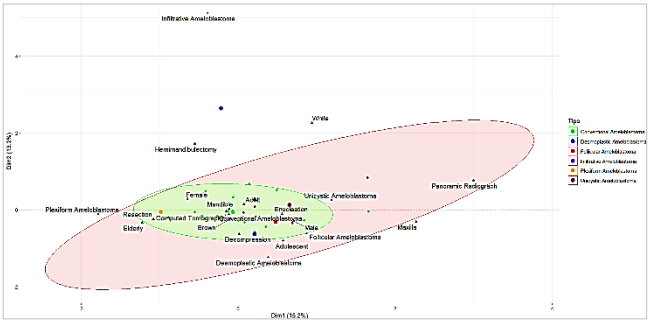
Graph 2 explains the correspondence map generated by MCA. Each point on the graph represents a variable analyzed, such as ameloblastoma subtype, sex, age, anatomical location, and treatment. The proximity between points reflects associations between variables.

CA is more frequently associated with adult female patients and less conservative treatments, such as resection. In addition, there is a strong correlation with imaging tests, mainly CT, and the condition is more prevalent in self-declared brown patients. Its predominant location is in the mandible. UA is more common in male patients and is related to more conservative treatments, such as enucleation.

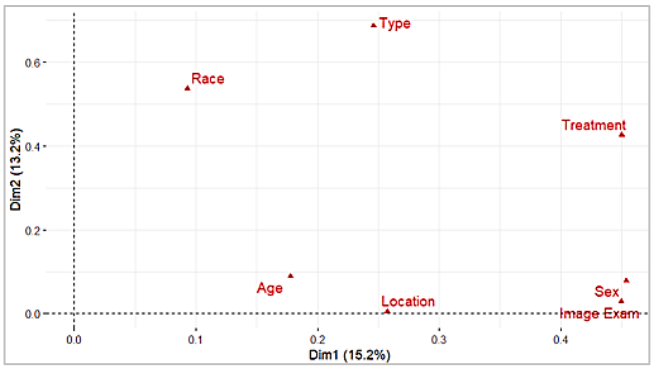
Graph 3 illustrates the relationship between

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the variables analyzed. Each red dot represents a characteristic such as Type, Treatment, Breed, Sex, Age, Location, and Imaging Exam. The position of each dot on the graph reflects its contribution to the main dimensions and the relationship with the data.




**Graph 2 –** Correspondence Map of Ameloblastoma Cases Analyzed between 2013 and 2024 at Hospital Getúlio Vargas, Recife-PE (Source: Authors; Note: Rstudio)




Graph 3 - Distribution of Variables in the MCA Dimensions of Ameloblastoma Cases Analyzed between 2013 and 2024 at Hospital Getúlio Vargas, Recife-PE (Source: Authors; Note: Rstudio).

The age variable contributes to Dm1 and Dm2 by indicating that the age range of patients plays an essential role in the data analysis. Its position in the graph suggests a possible association with different clinical or therapeutic patterns, and its proximity to location indicates that the anatomical distribution of the tumor may vary according to the age of the patients. Treatment appears far from Dm2 and slightly isolated, suggesting its choice may depend on factors not visually represented in the graph. Type is positioned far from Dm1, showing that the histological classification of ameloblastoma impacts the data structure, and its location in the graph indicates that the tumor subtype is a determining factor in the analysis.

## DISCUSSION

According to the World Health Organization (WHO) Classification 2022, CA can present different histological patterns. Follicular, characterized by epithelial islets with peripheral cells such as ameloblasts. Plexiform, formed by anastomosed cords of epithelial cells instead of well-defined islets[8,9], and desmoplastic, which presents a densely collagenized stroma, giving it a more fibrous appearance and a mixed radiographic pattern, radiolucent and radiopaque[10].

In addition to these histological patterns, CA may manifest infiltrative growth, a characteristic associated with its potential for recurrence. However, bone infiltration does not define a separate subtype; it is merely a manifestation of tumor behavior[2,11]. For this analysis, we followed the nomenclature described in the medical records, ensuring greater fidelity in the relationship of data with the MCA.

It was possible to observe proximity between the plexiform pattern and treatment by resection, while the desmoplastic pattern showed an association with treatment by decompression. These findings suggest that the treatment choice may be related to the histological pattern of the tumor. Because it is associated with resection, the plexiform pattern may indicate more extensive or aggressive growth, requiring more radical surgical approaches. The desmoplastic pattern, more frequently treated with decompression, may present characteristics that favor this conservative approach, possibly due to the presence of a denser and less invasive strom4,8,10,12.

CA had a higher prevalence among adult and female patients, in addition to being associated with more invasive treatments, such as resection. This finding agrees with the literature, which indicates resection as the most performed treatment for CA[13]. In addition, a relationship was observed with imaging tests, especially tomography. According to Moraes et al., tomography is one of the main tests to detect ameloblastoma. The analysis also indicated that CA was more frequent in patients who self-declared as brown, and the literature suggests that the tumor is more prevalent in individuals with dark skin[14]. Regarding location, its predominance was in the mandible, confirming previous findings that the mandible, especially the posterior region, is most affected by the tumor[15]. UA correlated with male patients and less aggressive treatments, such as enucleation. Leite-Lima[16] states that conservative treatments are often performed for UA, aiming to preserve the structures involved with the lesion[16,17].

Age is essential to the dimensions, suggesting that age group can directly impact treatment choice. Younger patients undergo less invasive procedures to preserve anatomical structures and reduce potential sequelae[16,18]. The invasive nature of some treatments can affect physical, emotional, and psychological aspects, generating impacts such as loss of bone structure, facial changes, anxiety, and social isolation. This situation presents a significant clinical problem: opting for a more conservative surgery, aiming to

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preserve the patient's quality of life and minimize the negative impacts of invasive treatments, but with the risk of tumor recurrence, or choosing more aggressive approaches, which can reduce the risk of recurrence, but with more significant impacts on quality of life[19,23].

For this reason, in many cases, less invasive treatments are performed to minimize physical and emotional side effects, preserving quality of life and limiting damage to the bone structure. This therapeutic approach is an attempt to balance the benefits of treatment with the overall impacts on the patient's life[11,20,21,24].

## CONCLUSION

This research contributes to the literature by providing statistical knowledge through MCA in identifying and interpreting associations between variables, such as demographic and clinical characteristics. The findings of this study have direct implications for professional practice, especially in the diagnosis and treatment of ameloblastoma.

The main limitation of this study is the sample is limited to a single hospital, given that ameloblastoma is a rare tumor, which may affect the generalizability of the results. Although the findings confirmed the existing literature, they reflect the specific characteristics of the sample investigated. Therefore, future studies can expand the sample to include multiple referral centers, increasing the diversity of the data and providing a more robust and representative analysis.

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## CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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