

The Morphological and Morphometric Analysis of Accessory Mental Foramen Among the Pakistani Population and Its Clinical Significance

Mohtasham Hina¹, Ayesha Noor², Ayesha Nosheen³, Tayyaba Qureshi⁴, Saima Naz⁵, Sanah Sameen⁶

Abstract

Objective: To determine the different possible locations, shapes, and numbers of AMF (Accessory Mental Foramen), their incidence on the mandible bilaterally, and their distance from the mental foramen (MF), since the foramina are surgically significant due to the passage of mental nerve divisions through them, their position and location are crucial to be understood by dental surgeons for nerve block, surgical interventions, and prevention of nerve injury.

Methodology: A total of 96 mandibles out of 110 were measured bilaterally using Digital Vernier Caliper to determine distance of AMF from the MF. Other parameters were observed and analyzed using SPSS version 26, Paired T tests and Chi square test were performed on various parameters.

Result: 22 AMFs were present in mandibles, with 36.36% AMFs on the right side, 9.09% were found on the left side, and 54.54% bilaterally. Approximately 81.81% of the mental foramina were oval in shape, while the remaining 18.18% were round. The AMF was found posterior (27%) and inferior (27%) to the MF, whereas other findings included AMF location anterosuperior (9%), anteroinferior (9%), posterosuperior (18%), and posteroinferior (9%) to the alveolar crest. The distance of the AMF from the MF was (6.05 ± 4.23 mm) on the right side and (3.60 ± 2.88 mm) on the left side, with a statistically significant difference ($p = 0.013$).

Conclusion: A recent study precisely measured various possible parameters related to the AMF, including incidence, shape, and position with respect to various anatomical landmarks. The information in this study will assist dental surgeons and anaesthesiologists in surgical interventions, finding the correct position for local anaesthesia, preventing damage to the neurovascular bundles, and preventing incomplete anaesthesia.

Keywords: Mental Foramen, Accessory Mental Foramen, Mandible, Accessory Mental Nerve, Premolar

Introduction

The mental foramen is situated on the anterolateral side of the mandible, extending laterally and upward in a posterior direction. Any additional foramen besides the mental foramen is referred to as an accessory mental foramen. Typically found below the first molar tooth, both the mental and accessory mental foramina exhibit ethnic variations.¹ Situated vertically in line with the supraorbital notch, the mental foramen is located between the premolars and serves as an exit point for the mental nerve and vessels.² The occurrence of an accessory mental foramen is not uncommon, with bilateral occurrence, even multiple in number.³ The occurrence of AMF is an important anatomical bony variant. In most cases, these small openings are smaller than the MF and are situated superiorly, inferiorly, laterally, or medially.⁴ It is not uncommon to encounter Human mandibles with multiple mental foramina (MF) on one side are not uncommon. In such cases, typically only one is designated as the primary MF, while the others are categorised as accessory mental foramina (AMF). The size and position of the AMF relative to the MF and teeth of the mandible can vary, and its presence differs among various ethnic populations.⁵

Conflicts of Interest: None
Financial Support: None to report
Potential Competing Interests: None to report

Disclaimer: This study has not been published or submitted elsewhere for publication.

AI Disclosure: Artificial intelligence tools (ChatGPT, OpenAI, 2025) were used solely for language refinement and formatting. No AI tools were used for data analysis, interpretation, or result generation. All scientific content, analyses, and conclusions were developed and verified by the authors, who took full responsibility for the integrity and accuracy of the work.

Data Availability Statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Institutional Review Board Approval
 265/IREF/RMU/2025
 08-07-2025
 Rawalpindi Medical University

Review began 21/01/2026
 Review ended 17/09/2026
 Published 30/09/2026
 © Copyright 2026

Hina et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY-SA 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.



How to cite this article: Hina M, Noor A, Nosheen A, Qureshi T, Naz S, Sameen S. The Morphological and Morphometric Analysis of Accessory Mental Foramen Among the Pakistani Population and Its Clinical Significance. JRM. 2026 Sep. 30;30(3).

<https://doi.org/10.37939/jrmc.3278>

The AMF is located in proximity to the mental foramen and is typically positioned posteriorly, has been studied by Suman et al., who identified the nerves passing through the AMF originating as branches of the mental nerve, responsible for innervating the mucous membrane and skin from the mouth corner to the lip area.⁶ In the case of anaesthetic injection via the mucous membrane, pain can also occur due to injury to the nerves passing through the AMF.⁷ Familiarity with the characteristics of MF and AMF, including their location, size, shape, position, and occurrence, is critical for oral surgeons during nerve block procedures in lower jaw surgery. The AMF stems from the division of the mental nerve before entering the MF, underscoring the significance of identifying its dimensions, shape, and presence to prevent nerve injury during periapical interventions.⁸ The identification of the accessory mental foramen (AMF) can be done through various methods, including visual examination of dry skulls, radiographic techniques (such as periapical and panoramic views), and computed tomography scans (CT or CBCT). Cone-beam computed tomography (CBCT) offers a notable advantage over traditional radiography by providing detailed three-dimensional (3D) images for a thorough anatomical assessment of the targeted area.⁹ The Localization of AMF in mandibular radiographs is challenging because of its small size. Overlapping and deformation are common in panoramic images of the mandible, influencing the misconception of key anatomic features.¹⁰ The mental foramen (MF) serves as a crucial anatomical landmark for dental surgeons performing periodontal surgery in the mental region of the mandible.¹¹ The existence of an accessory mental foramen can lead to various challenges during surgical procedures, such as open reduction of mandibular fractures, segmental orthognathic surgeries, and implant placement. Prior verification of the presence of accessory mental foramina is crucial to avoid damage to the accessory nerve and related complications.¹² A Precise understanding of the variations in the mental foramen and additional mental openings is essential for dental professionals undertaking procedures on the mandible, such as implants, root canals, and orthognathic surgeries. This knowledge is vital for ensuring proper anaesthesia and achieving positive surgical outcomes.^{2,13} The accessory mental nerve is a significant anatomical feature in dentistry, particularly crucial for procedures such as local anaesthesia, genioplasty, mandibular trauma rehabilitation, chin bone harvesting, mandibular premolar root resection, and dental implant placement.¹⁴ Sensitivity, temperature, and tactile stimulation within the affected region can be temporarily or irreversibly lost due to injury to this nerve.^{15,16} This study aimed to provide important anatomical insights into the location, variations, and occurrence of accessory mental foramina. This information is vital for dental surgeons and anaesthesiologists to prevent damage to the neurovascular bundle during surgical interventions and nerve blocks.

Methodology

This cross-sectional, non-experimental study used a convenience sampling technique to study the accessory mental foramen (AMF). The current study involved the examination of 110 dried adult human mandibles of unspecified sex and age from the anatomical collection at the Bone Museum of King Edward Medical University, Lahore, Pakistan. The study was completed over 4 weeks from March to April 2025.

All mandibles with complete dentition, intact rami, and alveolar crest were included in this study. Fourteen mandibles were excluded because of excessive raggedness and deformation. Mandibles showing clear signs of disease, prior surgical interventions, or traumatic injury were excluded.

Of the 110 mandibles, only 96 (right and left sides dealt with separately in the results) were studied. The 96 mandibles provided 192 mandibular sides, which were considered separate observational units for side-specific analyses. AMF-related measurements and locations were recorded independently on the right and left sides. The occurrence of AMF and their shapes were observed. The position and distance of the AMF in relation to the MF were also examined [17].

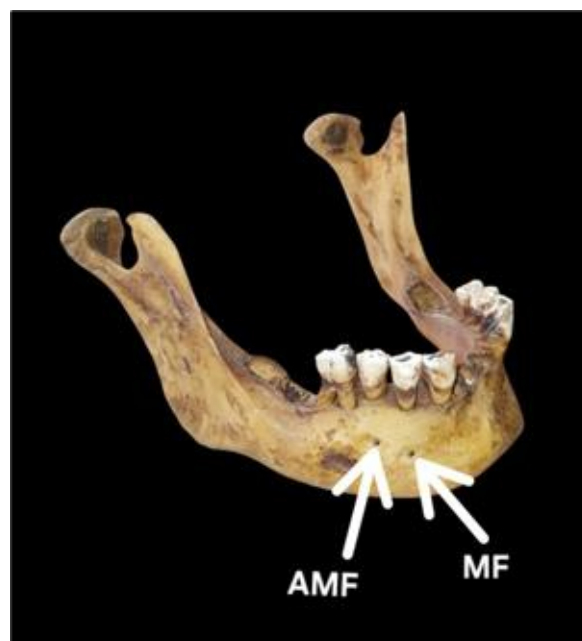


Figure 1: MF and AMF on the right side

Additionally, the position of the AMF with respect to the alveolar crest was documented. Measurements of the accessory mental foramen (AMF) were taken using a digital Vernier caliper to assess their distance from the MF. SPSS version 26 was used for statistical analysis in this research, where Paired T Tests were performed for paired morphometric parameters of the mental foramen, and different shapes and locations of MF and AMF were analysed using the chi-square test with a statistically significant P-value less than 0.05 was considered (P-value<0.05 =significant).

Results

We observed a total of 96 mandibles, which means 192 individual sides (right and left), in which 22 AMF were present. Among the 22 AMFs, 36.36% (8) AMFs were present on the right side, 9.09 % (2) were found on the left side, and 6 mandibles 54.54% (12) bilaterally [Table 1]. Shape observation showed that approximately 81.81% of AMF were oval in shape, while the remaining 18.18% were round [Table 2]. In approximately 54.54% of cases, AMF was located below the 2nd premolar tooth, observed on both sides. The second most common position was below the 1st Premolar tooth (18.18%) and below the 1st Molar tooth (18.18%), observed bilaterally. Finally, in approximately 9.09% of cases, AMF was located below the 2nd Molar tooth on both sides [Table 3]. The AMF was found posterior (27%) and inferior (27%) to the MF, whereas other findings included AMF location anterosuperiorly (9%), anteroinferiorly (9%), posterosuperiorly (18%), and posteroinferiorly (9%) to the alveolar crest [Table 4]. The distance of the AMF from the MF was (6.05 ± 4.23 mm) on the right side and (3.60±2.88) on the left side, with a statistically significant difference (p = 0.013) [Table 2]. The corresponding 95% confidence interval was reported to quantify the precision of the estimated mean difference.

Table 1: Accessory Mental Foramina in the Mandible

% of AMF on Right side of Mandible	% of AMF on left side of Mandible	% of AMF on Bilateral sides of Mandible	% of total no. of AMF out of 192 sides (96 mandibles)
8 (36.36%)	2 (9.09%)	12 (6 mandibles) (54.54%)	22 (11.45%)

Table 2: Shape and Distance of AMF from MF (in mm)

Side	Shape of AMF			Chi-square Test	P. Value	Distance from MF (in mm)			P Value
	Round	Oval	Total			Side	Right	Left	
Right	4 (18.18%)	10 (45.45%)	14 (63.63%)	25.94	<0.001	Min-Max	1.55-12.10	1.2-8.1	0.013
Left	0 (0.0%)	8 (36.36%)	8 (36.36%)			Mean±SD	6.05 ± 4.23 mm	3.60 ± 2.88 mm	

*P value <.01 is statistically significant

Table 3: Position of AMF with reference to Alveolar border

Side	Below 1 st Premolar Tooth	Below 2 nd Premolar Tooth	Below 1 st Molar Tooth	Below 2 nd molar Tooth	Total	Chi-square Test	P Value
Right	4 (18.18%)	6 (27.27%)	2 (9.09%)	2 (9.09%)	14 (63.63%)	141.56	<0.001
Left	0 (0.00%)	6 (27.27%)	2 (9.09%)	0 (0.00%)	8 (36.36%)		
Total	4 (18.18%)	12 (54.54%)	4 (18.18%)	2 (9.09%)	22 (100%)	-	-

*P value <.01 is statistically significant

Table 4: Position of AMF with respect to MF

Side	Anterio-Superiorly	Anterio-Inferiorly	Posterior	Posterior-Superiorly	Posterior-Inferiorly	Inferior	Total	Chi-square Test	P Value
Right	2 (9.09%)	2 (9.09%)	4 (18.18%)	4 (18.18%)	2 (9.09%)	0 (0.00%)	14 (63.63%)	94.65	<0.001
Left	0 (0.00%)	0 (0.00%)	2 (9.09%)	0 (0.00%)	0 (0.00%)	6 (27.27%)	8 (36.36%)		
Total	2 (9.09%)	2 (9.09%)	6 (27.27%)	4 (18.18%)	2 (9.09%)	6 (27.27%)	22 (100%)		

*P value <.01 is statistically significant

Discussion

Different studies have been conducted on the accessory mental foramen morphology and morphometry in several racial and ethnic groups, investigating different key features. We compared our findings with those of previous studies to assess similarities and differences.

Multiple studies conducted in different regions of India showed percentages of occurrence of AMF (5.55%) K Udhaya et al.¹² (13%) Estudio de la Posición et al.,⁸ (3.33%) S. Gupta et al.,¹⁷ and (22%) Singh et al.¹⁸ while Ismail et al. found gender-based differences prevailing in males among Erbil population.¹⁹ These variations may be due to population diversity and errors in data collection and analysis. Kalender et al.²⁰ and J Muinelo-Lorenzo et al.¹⁴ populations showed similar results.

The mean distance between MF and AMF is given in [Table 2], ranging from 1.55 to 12.10 mm on the right side and 1.2 to 8.1 mm on the left side. Thomaidi et al.¹³ examined the mean distance of AMF from MF (4.12 ± 2.15 mm), ranging from 3.2 to 17.72 mm. In the Saudi population,²¹ the mean distance between the MF and AMF was 3.3 ± 0.55 mm, ranging from 2.32 to 5.00 mm. The mean distance between the MF and AMF was 4.67 mm in Brazilian individuals.²²

According to this study, oval-shaped AMF (81.81%) were most common, whereas 18.18% were round [Table 2]. Most AMF were oval in shape in the Zambian population,²³ and 75% of the AMF in the Nepali population were oval-shaped, as reported by Tiwari et al.¹² In studies by Thomaidi et al.,¹³ 55.6% round and 44.4% oval AMF were present. The shape of the AMF may differ among various ethnic groups. The present study found that the most common position of the AMF with respect to the alveolar crest was below the 2nd premolar (54.54%) [Table 3], followed by below the 1st premolar on the right side (18.18 %) and below the 1st molar on both sides (18.18 %). Sing et al.⁸ examined the AMF below 1st molar. In the literature, the Position of AMF with respect to the alveolar crest has not been studied properly; only a few researchers have examined it. Our studies continue to show similarity to the Chinese population, where AMF was prevalent below the 2nd premolar teeth.²⁴ In the Turkish population, the AMF is usually inferior or posteroinferior to the MF.¹⁸ Most commonly, the AMF was found posteroinferiorly to the MF, as described by Aytugur et al.,²⁵ (35%) and Coban et al.²⁶ Our findings also showed a resemblance to this, with 27.27% of AMF examined posterior to the MF and 27.27 % examined inferior to the MF [Table 4],

To the best of our knowledge, this is the first study in Pakistan in which all the parameters of AMF and its clinical significance have been discussed. The limitations of this study include the inability to fully examine heterogeneity due to ethnic differences and the lack of gender-based data. The examination of rare anatomical variants may be subject to reporting bias²⁷. Age and sex/gender information were not available for the dried mandibles in the institutional collection; therefore, these variables were not analysed or imputed. This limits the assessment of demographic differences and is acknowledged as a limitation of this study.

Conclusions

A recent study precisely measured various possible morphometric parameters and morphological characteristics related to the accessory mental foramen, evaluated the variation in the incidence of the AMF with respect to the MF, alveolar crest, and distance between the MF and AMF. The findings of this study will contribute to dental surgeons and anaesthesiologists in surgical interventions, finding the correct position for local anaesthesia, and preventing damage to the neurovascular bundle, such as the mental nerve and accessory mental nerve, and incomplete anaesthesia.

Author Information

¹Associate Professor, Rawalpindi Medical University

^{2,3}2nd Year MBBS Student, Rawalpindi Medical University

⁴Assistant Professor, Rawalpindi Medical University

⁵Professor, Rawalpindi Medical University 6. Postgraduate Trainee, Rawalpindi Medical University.

Corresponding author: Dr. Mohtasham Hina  drhinahina@yahoo.com

Contributions:

MH AN₁ AN₂ TQ SN SS - Conception, Design

MH AN₁ AN₂ TQ SN SS - Acquisition, Analysis, Interpretation

MH AN₁ AN₂ TQ SN SS - Drafting

MH AN₁ AN₂ TQ SN SS - Critical Review

All authors approved the final version to be published & agreed to be accountable for all aspects of the work.

References

1. Seema, Verma P. Morphology and morphometry of mental foramen in adult human mandibles of North Indian population. *Natl J Clin Anat.* 2015 Apr-Jun;4(2):76-9. <https://doi.org/10.4103/2277-4025.297305>
2. Udhaya K, Saraladevi KV, Sridhar J. The morphometric analysis of the mental foramen in adult dry human mandibles: a study on the South Indian population. *Journal of clinical and diagnostic research: JCDR.* 2013 Aug 1;7(8):1547. <https://doi.org/10.7860/JCDR/2013/6060.3207>
3. Thomaidi ZM, Tsatsarelis C, Papadopoulos V. Accessory mental foramina in dry mandibles: An observational study along with systematic review and meta-analysis. *Dentistry Journal.* 2025 Feb 22;13(3):94. <https://doi.org/10.3390/dj13030094>
4. Bruna-Mejias A, Nova-Baeza P, Torres-Riquelme F, Delgado-Retamal MF, Orellana-Donoso M, et al. Morphological characteristics of the double mental foramen and its relevance in clinical practice: an observational study. *Diagnostics (Basel).* 2024 Jun 17;14(12):1277. <https://www.mdpi.com/2075-4418/14/12/1277#>
5. Paraskevas G, Mavrodi A, Natsis K. Accessory mental foramen: an anatomical study on dry mandibles and review of the literature. *Oral and maxillofacial surgery.* 2015 Jun;19:177-81. <https://doi.org/10.1007/s10006-014-0474-1>
6. Suman P, Singh S, Mahato RK. Mental foramen and accessory mental foramen: a dry human mandibles study in South Indian population. *National Journal of Clinical Anatomy.* 2018 Oct 1;7(4):182-9. <https://doi.org/10.4103/2277-4025.294770>
7. Kasat PA, Muthiyan GG, Bhuiyan PS. A morphological study of mental foramen of the dry adult human mandibles. *Int J Anat Res* 2016;4(3):2552-2560.
8. Çimen T, Saka YY, Ünel HK, Duruel O. Evaluation of the Mental Foramen and Accessory Mental Foramen with Cone Beam Computed Tomography. *Selcuk Dental Journal.* 2025 May 1;12(2):230-3. <https://doi.org/10.15311/selcukdentj.1706374>
9. Zmysłowska-Polakowska E, Radwański M, Łęski M, Ledzion S, Łukomska-Szymańska M, Polgaj M. The assessment of accessory mental foramen in a selected polish population: a CBCT study. *BMC medical imaging.* 2017 Dec;17:1-5. <https://doi.org/10.1186/s12880-017-0188-6>
10. Singh Y, Shakya P, Saba NU, Singh H, Kumar N. A Morphometric Study of the Mandibular Foramen, Lingula, and the Incidence of Accessory Mandibular Foramina in Dry Mandibles. *Cureus.* 2025 Mar 24;17(3):e81087. . <https://doi.org/10.7759/cureus.81087>
11. Agarwal DR, Gupta SB. Morphometric analysis of mental foramen in human mandibles of South Gujarat. *People's Journal of Scientific Research.* 2011 Jan;4(1):15-8.
12. Tiwari N. Left Accessory Mental Foramen in Dry Mandibles in Department of Anatomy in a Medical College: A Descriptive Cross-sectional Study. *J Nepal Med Assoc.* 2022 Sep;60(253):805-7. <https://doi.org/10.31729/jnma.7770>. PMID: 36705125
13. Thomaidi ZM, Tsatsarelis C, Papadopoulos V. Accessory Mental Foramina in Dry Mandibles: An Observational Study Along with Systematic Review and Meta-Analysis. *Dent J (Basel).* 2025;13(3):94. <https://doi.org/10.3390/dj13030094>

14. Muinelo-Lorenzo J, Suárez-Quintanilla JA, Fernández-Alonso A, Varela-Mallou J, Suárez-Cunqueiro MM. Anatomical characteristics and visibility of mental foramen and accessory mental foramen: Panoramic radiography vs. cone beam CT. *Medicina oral, patologia oral y cirugía bucal*. 2015 Oct 9;20(6):e707. <https://doi.org/10.4317/medoral.20585>
15. Singh P, Kumar A, Kumar A. Study of Position, Shape, Size, Incidence of Mental Foramen and Accessory Mental Foramen and Its Clinical Significance. *European Journal of Cardiovascular Medicine*. 2024 Jul 5;14:1286-90.
16. Ito K, Gomi Y, Sato S, Arai Y, Shinoda K. Clinical application of a new compact CT system to assess 3-D images for the preoperative treatment planning of implants in the posterior mandible: A case report. *Clinical oral implants research*. 2001 Oct;12(5):539-42. <https://doi.org/10.1034/j.1600-0501.2001.120516.x>
17. Gupta S, Soni JS. Study of anatomical variations and incidence of mental foramen and accessory mental foramen in dry human mandibles. *Natl J Med Res*. 2012 Mar;2(1):28-30.
18. Kumar VS, Kumar M, Rani S, Anant G, Madhukar PK, Bharti JP, Laxmi V. Mental Foramen Morphometry in Adult Human Mandibles: An Anatomical Analysis. *European Journal of Cardiovascular Medicine*. 2023 Oct 1;13(4).
19. Ismail R, Naghshbandi J, Bataineh A, Babakuliyev A, Mohsin M, Nakshbandi A. Morphometric Analysis of Mental Foramen Using Cone Beam Computed Tomography in a Sample of the Erbil Population. *Sulaimani Dental Journal*. 2025 Aug 1;12(2):1-0. <https://doi.org/10.17656/sdj.10205>
20. Kalender A, Orhan KA, Aksoy U. Evaluation of the mental foramen and accessory mental foramen in Turkish patients using cone-beam computed tomography images reconstructed from a volumetric rendering program. *Clinical anatomy*. 2012 Jul;25(5):584-92. <https://doi.org/10.1002/ca.21277>
21. Aljarbou F, Riyahi AM, Altamimi A, Alabdulsalam A, Jabhan N, Aldosimani M, Alamri HM. Anatomy of the accessory mental foramen in a Saudi subpopulation: A multicenter CBCT study. *The Saudi Dental Journal*. 2021 Dec 1;33(8):1012-7. <https://doi.org/10.1016/j.sdentj.2021.06.005>
22. Barbosa DA, Maferano EF, Teixeira RC, Kurita LM, de Menezes Pimenta AV, de Barros Silva PG, Chaves FN, Gurgel ML, Costa FW. Epidemiological and Radiomorphometric Aspects of the Accessory Mental Foramen in Brazilian Individuals: An Analysis by Cone Beam Computed Tomography. *Journal of Clinical and Experimental Dentistry*. 2024 Nov 1;16(11):e1379. <https://doi.org/10.4317/jced.61607>
23. Subramanian B, Anthony SN, Mubbunu L, et al. Anthropometrics Analysis of Mental Foramen and Accessory Mental Foramen in Zambian Adult Human Man-dibles. *Sci World J*. 2019;2019. <https://doi.org/10.1155/2019/9093474>
24. Xiao L, Pang W, Bi H, Han X. Cone beam CT-based measurement of the accessory mental foramina in the Chinese Han population. *Exp Ther Med*. 2020 Sep;20(3):1907-1916. . 10.3892/etm.2020.8954. Epub 2020 Jun 29. PMID: 32782499; PMCID: PMC7401220. <https://doi.org/10.3892/etm.2020.8954>
25. Aytugur E, Özeren C, Lacin N, Veli I, Çene E. Cone-beam computed tomographic evaluation of accessory mental foramen in a Turkish population. *Anatomical science international*. 2019 Jun 1;94:257-65. <https://doi.org/10.1007/s12565-019-00481-7>
26. Coban D, Unal Erzurumlu Z, Sadik E, Yasa Y. Evaluation of mental foramen and accessory mental foramen using cone beam computed tomography in a Turkish population. *BMC Medical Imaging*. 2025 Apr 30;25(1):140. <https://doi.org/10.1186/s12880-025-01589-1>
27. Papadopoulos V, Filippou D, Fiska A. Prevalence of rare anatomic variants-Publication bias due to selective reporting in meta-analyses studies. *Folia Med*. 2024;66:795-817. <https://doi.org/10.3897/folmed.66.e137881>