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WEANING AGE FINDER (WEAN): A SIMPLE TOOL FOR ESTIMATING WEANING AGE FROM ISOTOPIC DATA

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Nitrogen stable isotope ratios ($\delta^{15}\text{N}$) of incremental dentine collagen have been extensively applied in bioarchaeology for the reconstruction of breastfeeding and weaning practices in ancient populations. The shifts in $\delta^{15}\text{N}$ values reveal the duration of exclusive breastfeeding, the onset and offset of weaning (weaning age), and potential signals of physiological stress. Contrary to the significant progress in measurement precision, estimating the duration of weaning is performed visually, a task that is time and labor intensive.

We generated a tool for automatically estimating weaning ages based on $\delta^{15}\text{N}$ measurements of first permanent molars. The tool implements the elbow method, which consists of plots the $\delta^{15}\text{N}$ values to assigned ages and picks the elbow of the curvature as the individual's weaning age. We applied our approach to published datasets with visually estimated weaning ages and compared the results to evaluate the error between visual assessment and elbow method estimation.

The results show a strong correlation between the two methods underlining that a mathematical framework can be accurately applied in weaning age estimation. The tool estimates the weaning age of a single or many individuals and combines current advances of bioarchaeological research and visually appealing graphics (scatter and line plots, Z-scores). Moreover, it identifies individuals whose $\delta^{15}\text{N}$ values may indicate physiological stress and assists in the presentation and comparison of isotopic profiles. WEAN is a novel and robust method for weaning age estimation that streamlines the assessment of $\delta^{15}\text{N}$ values for the exploration of breastfeeding and weaning patterns in antiquity.

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Keywords

breastfeeding and weaning, incremental dentine analysis, stable isotope analysis

Note/comment