



Development of the Z-score for nutritional assessment

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Abstract: The Z-score is normally used to describe the number of Standard deviations, and it denotes a data point that deviates from the mean value. The Z-scores can be used to determine the percentage of data points. The value is also called a percentile. It was developed in the 19th century. The concept of using z-scores to assess stunting, wasting, and

underweight status in children was developed by the World Health Organization (WHO), which was standardized with the development of the WHO Child Growth Standards. The Z-score for stunting, wasting, and underweight is calculated using the formula: $Z = (X - M) / SD$. The Z-score has positive, negative, and Neutral interpretations in the interpretation of data in the normal distribution curve. 0 indicates a data point that is equal to the mean.

Keywords: Interpretation, standard deviation, normal distribution, Z-score.

Declaration: There is no conflict of interest.



Introduction

The Z-score, a fundamental concept in statistics, has evolved from its origins in understanding biological variability to becoming a widely used tool for data standardization and analysis across various fields. Initially developed in the late 19th century by statisticians like Karl Pearson and Francis Galton. The concept of using z scores to assess stunting, wasting, and being underweight in children was developed by the World Health Organization (WHO), which became standardized with the development of the WHO Child Growth Standards. The WHO Multicenter Growth Reference Study (MGRS) was undertaken between 1997 and 2003 to generate new growth curves for assessing the growth and development of infants and young children around the world. The MGRS collected primary growth data and related information from approximately 8500 children from widely different ethnic backgrounds and cultural settings (Brazil, Ghana, India, Norway, Oman, and the USA). The new growth curves are expected to provide a single international standard that represents the best description of physiological growth for all children from birth to five years of age and to establish the breastfed infant as the normative model for growth and development(1).

The MGRS study is officially introduced and popularizes the use of the Z score

- Height-for-age Z-score (HAZ) - Stunting
- Weight-for-height Z-score (WFZ) - Wasting
- Weight-for-Age Z-score (WAZ) - Underweight

WHO proposes the calculation of z-scores for the analysis and interpretation of anthropometric values, either for population-based and individual assessment, and suggests z-scores as a sex-independent variable that can be grouped by combining sex and age groups. Moderate malnutrition is defined as a weight-for-age (WFA) between -3 and -2 SD below the mean of the WHO child growth standards. Similarly, moderate wasting (low weight-for-height (WFH)), stunting (low height-for-age (HFA)) are defined as a z-score between -3 and -2 SD. Z-score values below -3 indicate severe wasting and stunting(2).



The Z-score for stunting, wasting, and underweight is calculated using the formula: $Z = (X - M) / SD$. Where 'X' is the individual child's measurement (height for stunting, weight for underweight, and weight-for-height for wasting), 'M' is the median value for that measurement from the WHO Child Growth Standards (for the child's age and sex), and 'SD' is the standard deviation for that measurement from the WHO standards. Since 2006, when the World Health Organization launched the new Child Growth Standards, over 140 countries have adopted them(3).

Methodology: A review of secondary data from different journals and articles related to the topic was conducted.

Conclusion

Z-scores are a valuable tool in nutritional assessment, offering a standardized way to evaluate growth and nutritional status, particularly in children. A Z-score can identify and pinpoint improvement or deterioration in the weight and height of children in reference to the children of the same age and sex. It is a statistically valid comparison to the reference population. It can be applied to both individuals and populations. Z-score is a more accurate and reliable way of presenting prevalence data in population-level surveys. It is sex-independent, thus allowing the evaluation of the growth status of children by combining sex and age groups(4).

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