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Research Article

Anemias in the South of Brazil: Higher Predisposition of Women in Fertile Age Categories, with Considerations for DOHaD Paradigm

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Abstract

Epidemiologic data on relative morbidity caused by various types of anemias were described in Brazilian states of Southern region during the chronologic period of 2008-2023. It was shown that age-related dynamics of anemias were not the same, as compared to cardiometabolic disorders. Moreover, feminine fraction of morbidity clearly demonstrated higher predisposition of women to anemias in the age categories (10-49 y) that roughly coincide with fertile period. Since gestational anemias can provoke lower birthweight in offspring, a well-known pathogenic mechanism of programming / imprinting phenomena in DOHaD concept, it is concluded that much higher attention should be payed to women's health in life-course mode, especially as referred to diagnosis, treatment and prevention of anemias.

Keywords: Anemias; Ontogeny; Gender Differences

Abbreviations

ISOAD: International Society on Aging and Disease; LA-DOHaD: Latin-American Chapter of International Society for Developmental Origins of Health and Disease; PhD: Philosophy Doctor; RS: Rio Grande do Sul.

Introduction

More than 35 years ago, British epidemiologist David J.P. Barker was the first to show that low birthweight (< 2.5 kg) can provoke higher risk of cardiometabolic disorders in the same individuals already during senescence (see discussion in [1]). These observations gave the start to formulation of DOHaD concept, according to which early life adversities are able to cause the programming/imprinting and embedding-like phenomena in subsequent ontogeny.

We have begun to study age-related morbidity and mortality with gender differences in the South of Brazil since 2005 [2]. Here we demonstrate the importance of various types of anemias in women's health for their offspring.

Methodology

As earlier [3-6], we extracted raw data from Brazilian national database called DataSus. The morbidity (as a number of hospitalizations) in each decade of age was recalculated as a percent of total morbidity in the whole ontogeny for both genders together, in every chronologic year, in each of three Brazilian states of Southern region: Rio Grande do Sul (RS), Santa Catarina and Parana.

Thereafter we calculated feminine fraction of morbidity in percent, also in each decade of age for the same chronologic years and

Brazilian states of Southern region. Finally, descriptive statistics were performed, estimating arithmetic mean and standard error of the mean in each of 4-year chronologic periods (a - 2008-2011; b – 2012-2015; c – 2016-2019; d – 2020-2023) during the total 16-year chronologic period (2008-2023), presenting the data in the form of plots with the use of Excel software.

We did not consider mortality data, because of quite low its values for anemias. As earlier, we have chosen Southern region of Brazil, because of predominance there of people with European origins, in order to perform subsequently international comparisons with some other countries in Latin America and Europe.

Results

Figure 1 and 2 show age-related dynamics of relative (or proportional) morbidity for Fe-deficient and other anemias in the state of RS. It can be seen that morbidity increases in advanced age categories, but its dynamics are quite different, as compared to those of cardiometabolic disorders, according to our previous investigations [3-6].

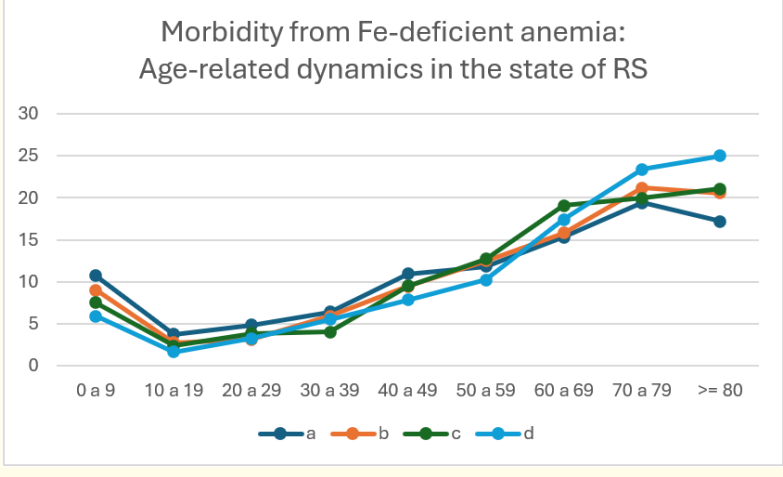

Figure 1

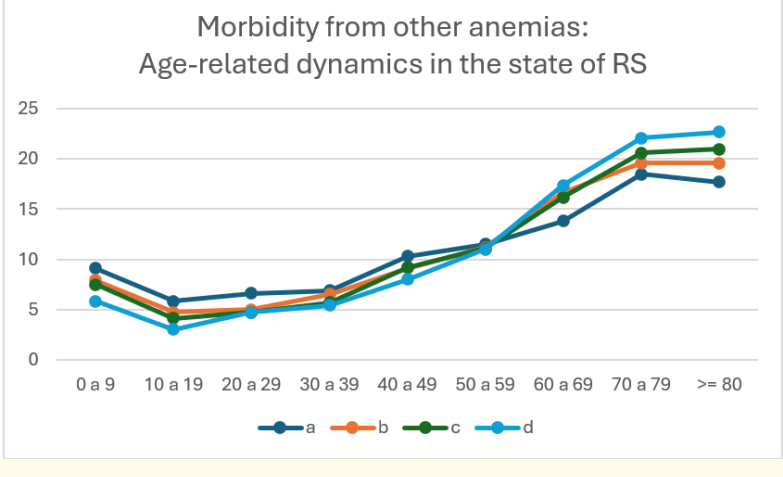

Figure 2

Figure 3 and 4 show feminine fraction of morbidity for Fe-deficient and other anemias, also in the state of RS, demonstrating clearly higher female predisposition to anemias during age decades of 10-49 y that roughly coincide with fertile period.

In all the figures presented standard errors of the mean are not shown for the sake of clarity, but they are usually lower than 1/10 of the mean. The data for other two Brazilian states of Southern

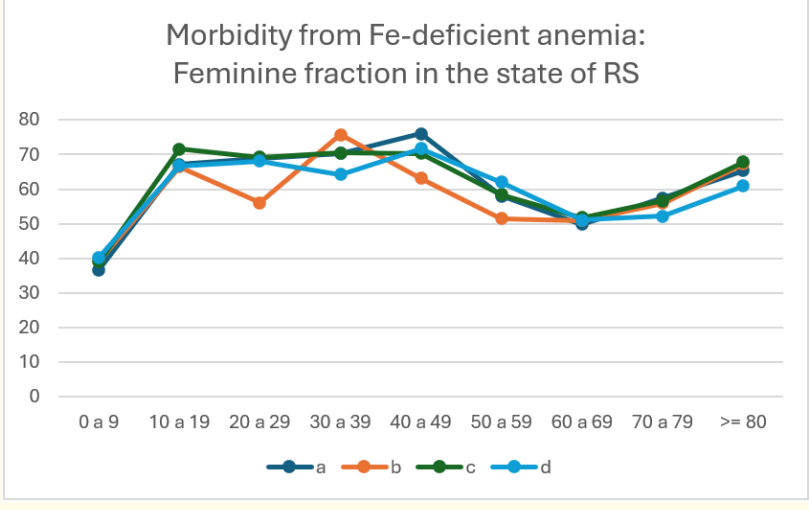

Figure 3

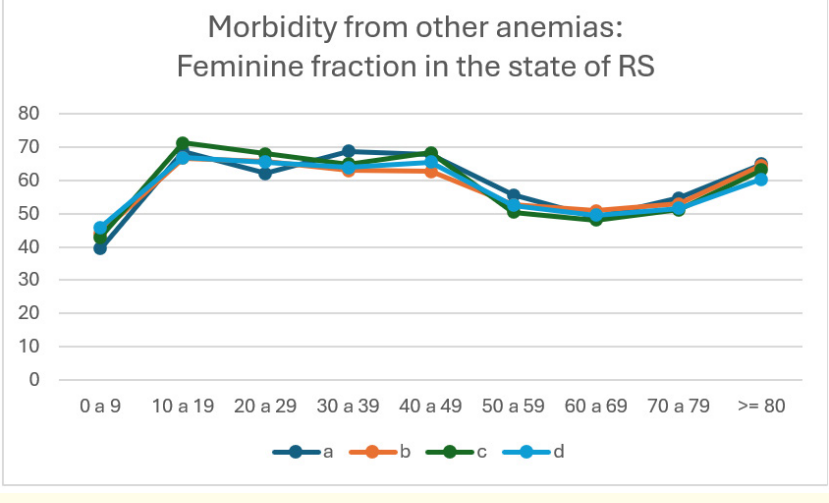

Figure 4

region are not demonstrated, since they are quite similar to those of RS.

One can observe also that during the whole chronologic period of 16 years there occur alterations neigher of age-related dynamics, nor of feminine fraction for Fe-deficient and other anemias, thus demonstrating (together with data for three Southern Brazilian states) nice stability of epidemiologic índices studied, both in time and space.

Discussion

It is already well known that pregnancy in humans increases naturally the predisposition to anemias, simply because of dilution of erythrocytes by higher volume of body fluid [7]. However, in less favoured populations this predisposition may be enhanced even further by several adversities, such as malnutrition or infections like malaria [8]. Pregnant women who live constantly in high altitude don't have sufficient time to adapt to chronic hypoxia summated with higher gestational demands [9]. As a result, intrauterine growth restriction gradually develops, resulting in lower birthweight of their offspring [10,11], a well-known pathogenic mechanism of higher risk of cardiometabolic disorders for the same individuals in subsequent ontogeny (see Introduction).

Conclusion

The data presented and bibliographic evidence discussed clearly show that higher attention should be focused on women's health during the whole fertile period, from adolescence to premenopausal age category, especially as referred to diagnosis, treatment and prevention of various types of anemias.

It is extremely important that alterations caused by hypoxia (and probably, by anemias also) tend to accumulate in a series of subsequent generations [9], thus demonstrating, for the first time in human populations, the essential value of phylopathogenic model [12], as referred to DOHaD concept.

After David J.P. Barker and other researchers, we claim that the principal goal of DOHaD paradigm should be the health and well-being of present and future human generations, in major part through the focused attention to women's health in life-course mode.

Acknowledgement

This work was just recently presented as a Poster during the 1st Symposium on DOHaD and Early Adversities, held in Porto Alegre – RS, Brazil on September 12, 2025.

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