



ORIGINAL ARTICLE

Impact of malnutrition on cardiac autonomic modulation in children^{☆,☆☆}

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KEYWORDS

Autonomic nervous system;
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Abstract

Objective: To compare the autonomic behavior between malnourished children and a control group using analysis of heart rate variability (HRV).

Method: Data were analyzed from 70 children who were divided into two groups: malnourished and eutrophic, according to the Z-score nutritional status for height and age. For analysis of HRV indices, heart rate was recorded beat to beat with the child in the supine position for 20 min. The analysis of these indices was performed using linear methods, analyzed in the time and frequency domains. Student's *t*-test for unpaired data and the Mann-Whitney test were used to compare variables between groups, with a significance level of 5%.

Results: A reduction in systolic and diastolic blood pressure and an increase in heart rate were found in malnourished children compared to eutrophic children. The HRV indices suggested that malnourished children present reductions in both sympathetic and parasympathetic autonomic nervous system activity. The SDNN, rMSSD, NN50, pNN50, SD1, SD2, TINN, LF (ms²), and HF (ms²) indices were lower in malnourished children.

Conclusion: Malnourished children present changes in cardiac autonomic modulation, characterized by reductions in both sympathetic and parasympathetic activity, as well as increased heart rate and decreased blood pressure.

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PALAVRAS-CHAVE

Sistema nervoso
autônomo;
Frequência cardíaca;
Desnutrição;
Variabilidade da
frequência cardíaca;
Saúde da criança

Impacto da desnutrição na modulação autonômica cardíaca em crianças**Resumo**

Objetivo: avaliar a modulação autonômica cardíaca de crianças desnutridas por meio da variabilidade da frequência cardíaca (VFC).

Método: foram analisadas 70 crianças com média de idade de 3.71 anos, que foram distribuídas em dois grupos, de acordo com o estado nutricional: desnutridas (n = 35) e eutróficas (n = 35), seguindo o escore Z, para estatura e idade. Para análise dos índices da VFC, a frequência cardíaca foi captada batimento a batimento com as crianças em decúbito dorsal por 20 minutos. A análise desses índices foi realizada por meio de métodos lineares, analisados nos domínios do tempo e da frequência. Teste t de Student para dados não pareados e teste de Mann-Whitney foram aplicados para comparar as variáveis entre os grupos, com nível de significância de 5%.

Resultados: Redução da pressão arterial sistólica e diastólica e aumento na frequência cardíaca foram encontrados nas crianças desnutridas quando comparada às eutróficas. Os índices da VFC sugerem que crianças desnutridas apresentam uma redução da modulação simpática e parassimpática do sistema nervoso autônomo. Os índices SDNN, rMSSD, NN50, pNN50, SD1, SD2, TINN, BF e AF em ms² foram menores nas crianças desnutridas.

Conclusão: crianças desnutridas apresentam modificações na modulação autonômica cardíaca caracterizada por depressão no componente simpático e no parassimpático, bem como aumento na frequência cardíaca e diminuição da pressão arterial.

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Introduction

Malnutrition is considered a serious public health problem.¹ Epidemiological data indicate that it affects about 15.5% of the population worldwide and a third of this is children.² The consequences of malnutrition in children include, among others: problems in physical development, such as short height, reduced muscle mass, and a decline in bone calcification; effects on physiological conditions, providing an inefficient immune system; iron deficiency anemia and frequent bacterial proliferation; and delayed mental development, with learning disabilities.³ Therefore, child malnutrition promotes permanent damage to health and thus promotes high mortality.³

Furthermore, studies have shown that malnutrition produces changes in the function of the autonomic nervous system in children.⁴ This condition of imbalance may represent an important negative factor, since the autonomic function controls some of the internal functions of the body and, accordingly, deserves attention.

One way to evaluate the behavior of the autonomic nervous system is heart rate variability (HRV), a simple and non-invasive tool aimed at the detection and study of cardiac autonomic dysfunction, either in physiological or pathological conditions.⁵

Studies that investigate autonomic modulation in child malnutrition are scarce. Only one study including children, which evaluated the modulation of the autonomic nervous system in malnutrition using HRV, was found in the literature.⁴ Sirivastava et al.⁴ compared the HRV of malnourished children with healthy children matched for sex and age. The authors found that the low frequency (LF) index

in normalized units and the LF/high frequency (HF) ratio presented an increase, whereas the HF index in normalized units presented a reduction in the group of malnourished children. In conclusion, the authors suggested that cardiac autonomic function characterized by increased sympathetic modulation occurs in malnourished children.

Other studies^{6,7} show increased sympathetic modulation of the autonomic nervous system in malnutrition. Belchior et al.⁷ analyzed the effect of protein malnutrition in rats and found an increase in blood pressure, however, alterations in vascular reactivity were not found, whereas Sawaya et al.⁶ found a strong association between malnutrition and hypertension. These studies suggest possible changes in HRV. This correlation could be considered an important tool for determining prognosis and the need for special attention and care toward the autonomic nervous system and cardiovascular function in malnourished children.

In this context, understanding malnutrition, the causal factors, and the consequences and repercussions becomes important, reiterating its status as a public health problem. Malnutrition appears to promote changes in cardiac autonomic behavior; however, data on the analysis of this behavior are scarce. Considering that growth affects the cardiovascular system⁸ and has a significant effect on the maturation of the autonomic nervous system and its representations in cardiac modulation,⁹ this scenario is problematic.

Thus, with the intention of adding elements to the literature related to the above issue, this study aimed to compare the autonomic behavior between eutrophic and malnourished children aged 3–5 years, based on the analysis of HRV indices.

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