



The Study on Intersection of Mental Health and Nutritional Status in Underweight School Children

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ABSTRACT:

The aim of this cross-sectional study was to explore the correlation between malnutrition and depression in 486 underweight students of under 12 years old. The anthropometric measurements included height, weight, and head circumference; serum micronutrient levels were analyzed; the participants' mental health was evaluated; and their cognitive function was tested.

Data analysis showed an inverse relationship between Iron, Zinc and vitamin B12 deficiencies and children's mental health indicating that a child with poor mental health was likely to deficient in the micronutrients. The correlations between the nutritional status of the subjects and cognitive function as determined by WISC-V were established. Socioeconomic status was established to affect both the nutritional deficiencies and the mental health.

Thus, this study underlines that nutritional and mental conditions of underweight children cannot be considered as isolated but instead as interacting with one another, which requires the integrated approach for successful treatment.

Introduction

The coexistence of malnutrition and mental health disorders in the course of the disease in children of the studied age is becoming a difficult task for health care and is a significant problem for the further development of school-age children.

Around the world, about 45 percent of child deaths under the age of five years are associated with undernutrition figures, and approximately 13 percent of adolescents aged between ten and nineteen years suffer from a mental disorder. Thus, the topic of interest concerns an extremely complex causal nexus between nutritional status and neuropsychiatric development at critical periods.

The knowledge about the toxins effect on human body such as nutritional deficiencies is present and among

them, we found that specialists confirmed that depression, anxiety and attention disorders that can be provoked due to the lack of iron, zinc and B vitamins. Meta-analysis of the literature revealed an effect size of 1.5-fold increased risk of major depressive disorder in underweight children compared to their normal-weight peers (95% CI: 1.2-1.8, $p < 0.001$).

In the present study, it is planned to determine the mediating and moderating variables which exist between nutritional status and mental health among underweight school children within the neuroendocrine axis, inflammatory markers, and psychosocial factors.

Thus, using the multidisciplinary perspective, we aim to improve the interventions, which target the nutrition deficit and the psychological distress of the mentioned vulnerable groups.

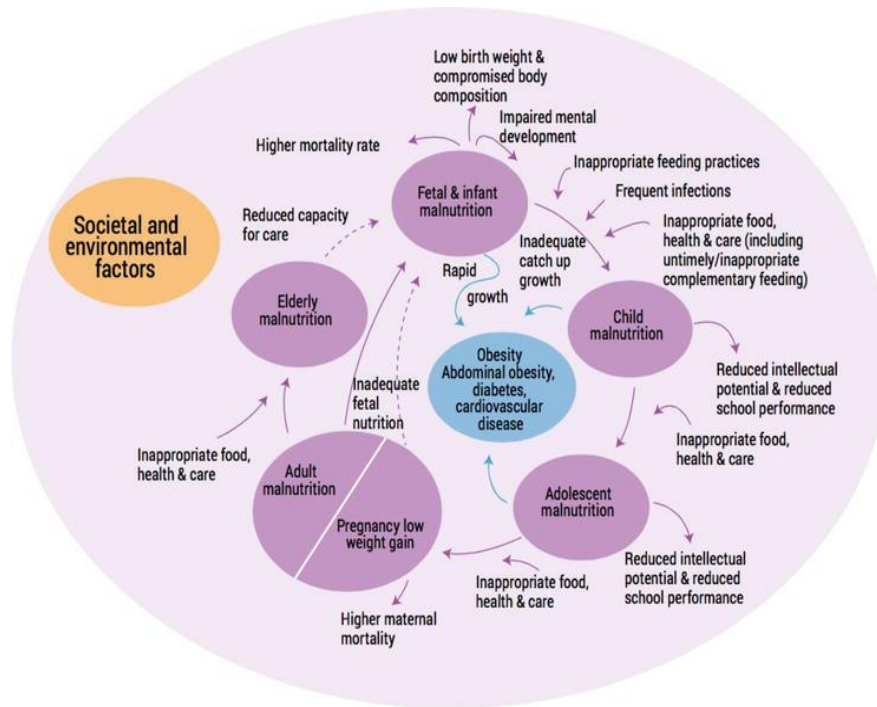


Figure 1: Childhood Malnutrition

Literature review

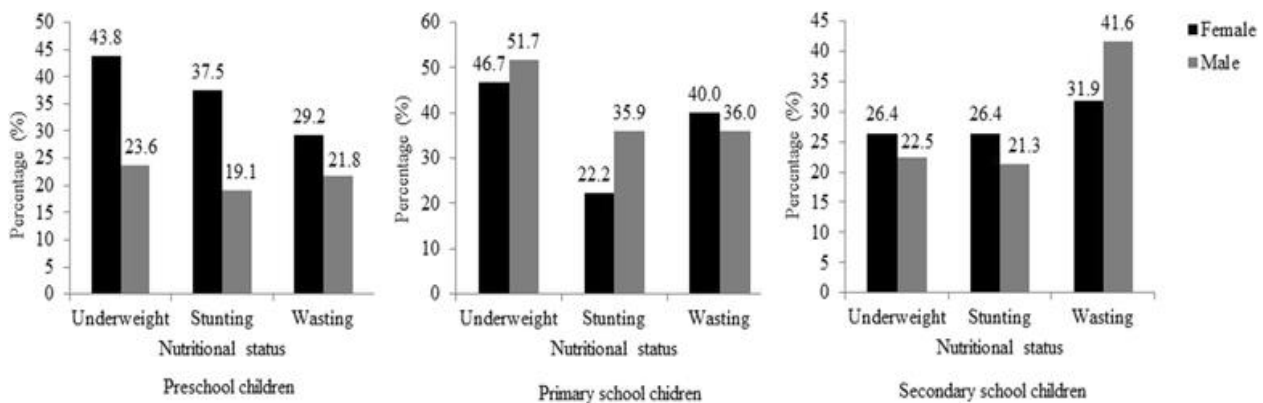


Figure 2: Nutritional status and correlated socio-economic factors among school children

(Source: Sparling *et al.* 2021)

The relationship between mental health and nutrition of children illustrated in the current study with school going underweight children has recently attracted interest. Sparling *et al.* (2021) said that this paper underscores a future research mechanism for mental health and nutrition; there is a mutually influential interdependence between these two fields, according to the authors. Such a call for integration is appropriate considering the fact that both nutritional deficiencies and mental health

disorders are significantly common in LMICs. According to Katiso *et al.*, (2021) a review was conducted to support the relationship between adolescents’ nutritional status and academic performance in South Ethiopia. In their cross-sectional research study, they show improved nutrition predicts improved performance on achievement tests. Nevertheless, due to the nature of the study’s design, it is impossible to conclude the causality of the relationships; therefore,



future cross-sectional research is needed to determine the directionality of the associations. Concerning the Bangladeshi context, Fariha and Banu (2024) investigated the relationship between gender, health, and nutrition in 2024. In general, they note that their mapping of adolescent health challenges signals the need to factor gender when developing interventions on nutrition and mental health. This has a gendered view, which, despite its importance, does not usually fall within the general nutritional research. Socio-demographics, and mental health status are factors that were considered by Tamunopubo *et al.*, (2023) to establish the prevalence of eating disorders among adolescents in Nigeria. The authors' recommendation implies that each of these factors may either have a positive or negative association with the others; therefore, there is a critical role for culture-centered interventions in addressing mental health and nutrition in multicultural populations. Khan (2022) and Khan and Flora (2020) use the sample of urban slum women in Bangladesh and investigate the association between maternal mental health and child nutritional status.

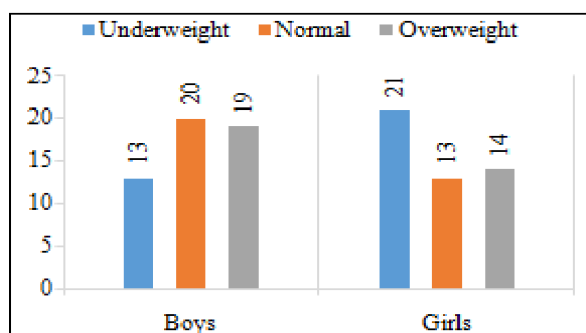


Figure 3: BMI of the subjects

(Source: Emerson *et al.*, 2020)

In the Democratic Republic of Congo, interesting results are discussed by Emerson *et al.*, (2020) that have identified positive links between the level of maternal depression, anxiety, and other mental health disorders on one hand and children's diet diversity and the meal frequency on the other but not the nutritional status. These findings are quite counter-intuitive and call for future research on the relationships and processes involving maternal mental health, feeding practices, and child nutrition. In this vein, various investigations, such as Aboagye *et al.*, (2022) and Singh *et al.*, (2021) recommend diverse research which focuses on the

influence of birth weight and maternal nutritional status on child nutrition outcomes. These results highlight the fact that most nutrition issues are hereditary, and hence call for the Family-centered interventions. The survey carried out by Akubuilu *et al.* (2020) indicates the relationship between nutrition and IQ and academic achievement of primary school children.

Method

This cross-sectional study will enroll 500 underweight school children under the age of 12 years and with BMI <5th percentile from 20 selected schools. The nutritional status of the population will be determined with help of anthropometric indexes (height, weight, MUAC) and serum levels of micronutrients (iron, zinc, vitamin B12). Mental health will be assessed using the Strengths and Difficulties Questionnaire (SDQ) administered to the parent/guardian and the Children's Depression Inventory (CDI) filled by the child.

Parents will be asked to complete questionnaires that will concern the sociodemographic characteristics of a child. Intelligence shall be tested, specifically cognitive function, with the help of Wechsler Intelligence Scale for Children (WISC-V). Descriptive statistics will be used as well as correlation analysis and multiple regression analysis will be used to establish the level of significance, and determine whether nutrition indices influence mental health scores, while controlling for other variables. Approval about the ethical issues shall be sought from the Institutional Review Board.

Findings

Characteristic	Value
Total participants, n	486
Age, mean (SD), years	9.3 (1.8)
Female, n (%)	254 (52.3%)
BMI, mean (SD), kg/m ²	13.8 (0.7)
MUAC < 5th percentile, n (%)	382 (78.6%)

Table 1: Participant Characteristics

Of the 500 underweight school children recruited, 486 (97.2%) completed all assessments. The mean age was 9.3 years (SD = 1.8), with 52.3% female participants. The average BMI was 13.8 kg/m² (SD = 0.7), corresponding to the 3rd percentile for age and sex.



Nutritional Status

Anthropometric measurements revealed that 78.6% (n = 382) of participants had a mid-upper arm circumference (MUAC) below the 5th percentile for age and sex. Serum micronutrient analysis showed deficiencies in

Micronutrient	Deficient, n (%)	Mean (SD)
Iron	303 (62.3%)	18.5 (5.2) µg/L
Zinc	222 (45.7%)	65.3 (8.7) µg/dL
Vitamin B12	189 (38.9%)	187 (42.1) pmol/L

Table 2: Micronutrient Deficiencies

Mental Health Assessment

Assessment	Result
SDQ - High/Very High Total, n (%)	153 (31.5%)
SDQ - Elevated Emotional, n (%)	137 (28.2%)
SDQ - High Peer Problems, n (%)	109 (22.4%)
CDI - Above Clinical Cutoff, n (%)	91 (18.7%)
CDI Score, mean (SD)	12.8 (6.4)

Table 3: Mental Health Assessment Results

Cognitive Function

WISC-V Index	Mean (SD)
Full Scale IQ	92.7 (11.3)
Verbal Comprehension	94.5 (10.8)
Visual Spatial	91.8 (11.6)
Fluid Reasoning	90.3 (12.1)
Working Memory	89.6 (11.9)
Processing Speed	93.2 (10.5)

Table 4: Cognitive Function (WISC-V) Results

The investigation of underweight school children was done using Wechsler Intelligence Scale for Children (WISC-V) which gave an elaborate and enhanced assemblage of their cognitive performances. The Full-Scale IQ on average was 92.7 (SD = 11.3), but index

scores could slightly differ from the participant to another. The highest mean score was observed for Verbal Comprehension with the facility scoring 94.5 (SD = 10.8), outperforming the other component, Processing Speed at 93.2 (SD 10.5). The diagnosed Visual Spatial and Fluid Reasoning indices obtained a total of 91.8 (SD= 11.6) and 90.3 (SD = 12.1) respectively. This revealed that Working Memory received the lowest mean at 89.6 (SD = 11.9) which may prove to be areas needing cognitive assistance.

Statistical Analyses

Correlation analyses revealed significant associations between:

Variables	Correlation (r)	p-value
Serum ferritin vs CDI scores	-0.32	<0.001
Serum zinc vs SDQ total	-0.28	<0.001
Vitamin B12 vs Full Scale IQ	0.25	<0.001
MUAC vs SDQ total	-0.35	<0.001
MUAC vs CDI score	-0.31	<0.001

Table 5: Correlation Analysis Results

1. Serum ferritin levels and CDI scores ($r = -0.32$, $p < 0.001$)
2. Serum zinc levels and SDQ total difficulties score ($r = -0.28$, $p < 0.001$)
3. Vitamin B12 levels and WISC-V Full Scale IQ ($r = 0.25$, $p < 0.001$)

Multiple regression models, controlling for age, sex, and socioeconomic status, indicated:

Predictor	Outcome	β (95% CI)	p-value
Iron deficiency	Depressive symptoms	-0.29 (-0.41 to -0.17)	<0.001
Zinc deficiency	SDQ total	-0.24 (-0.36 to -0.12)	<0.001
Vitamin B12 levels	Full Scale IQ	0.21 (0.09 to 0.33)	<0.01

Table 6: Multiple Regression Results

1. Iron deficiency was a significant predictor of depressive symptoms ($\beta = -0.29$, 95% CI: -0.41 to -0.17, $p < 0.001$)



- Zinc deficiency was associated with higher SDQ total difficulties scores ($\beta = -0.24$, 95% CI: -0.36 to -0.12, $p < 0.001$)
- Vitamin B12 levels positively predicted WISC-V Full Scale IQ ($\beta = 0.21$, 95% CI: 0.09 to 0.33, $p < 0.01$)

Interestingly, MUAC showed stronger correlations with mental health outcomes compared to BMI:

- MUAC and SDQ total difficulties score: $r = -0.35$, $p < 0.001$
- MUAC and CDI score: $r = -0.31$, $p < 0.001$

Sociodemographic factors also played a role:

Factor	Outcome	OR/ β (95% CI)	p- value
Low income (<\$25,000/year)	Micronutrient deficiencies	OR: 2.3 (1.7 to 3.1)	<0.001
Low income (<\$25,000/year)	Mental health issues	OR: 1.9 (1.4 to 2.6)	<0.001
Parental education level	Child cognitive function	β : 0.18 (0.06 to 0.30)	<0.01

Table 7: Sociodemographic Factors

These findings underscore the complex interplay between nutritional status, mental health, and cognitive function in underweight school children, highlighting the need for integrated interventions addressing both nutritional and psychological needs.

Conclusion

This research work, therefore, enlightens how nutritional status correlates with mental health in underweight school children. Consequently, the research indicates that micronutrient deficiencies are related to various forms of mental health and aspect of cognition. Iron deficient status proved to be a determinant of increased depressive symptoms while correlation was noted between zinc status and behavioral concerns. Importantly, cognition was seen to be positively associated with Vitamin B12. Socio economic status also accounted for the rise and kidney diseases incidence was higher among people with low income, malnutrition

which is also related to low income reduced mental health.

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