

UNIVERSITI TEKNOLOGI MARA

**IMPACT OF MICRONUTRIENT
DEFICIENCIES ON PHYSICAL
GROWTH, ADHD, AGGRESSION,
WORKING MEMORY AND
ACADEMIC PERFORMANCE OF
FIRST-YEAR PRIMARY PUBLIC-
SCHOOL STUDENTS IN THREE
SELECTED DISTRICTS OF KABUL
CITY, AFGHANISTAN**

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ABSTRACT

Micronutrient deficiency in childhood is the primary cause of many health problems, particularly in developing nations like Afghanistan. The purpose of this study was to determine the micronutrient deficiencies and their relationships to physical growth, attention deficit hyperactivity disorder (ADHD), aggressiveness, working memory, and academic performance among first year primary public-school students. Multistage random sampling method was done and a random sample of 358 primary school students was chosen. Micronutrient levels in the blood were examined in plasma samples. Anthropometric characteristics were assessed, together with demographic information, and compared to WHO criteria. The original English versions of the ADHD-T, Children Aggression Scale Teacher (CAS-T), and Academic Performance Questionnaire (APQ) questionnaire's factorial structure, validity, and reliability of the scales were performed to assess children's levels of ADHD, aggression, and academic performance (AP). Students' working memory (WM) was assessed using the Wechsler Intelligence Scale for Children 5th Edition (WISC-V). More than half of these students had deficiencies in vitamin D (95%), vitamin B12 (73.96%), and calcium (100%), as well as in vitamin A (33.6%), zinc (24.23%), and folic acid (5.1%). 11.5% of students were stunted, 3.9% were underweight, 10.3% were thin. A significant positive correlation was noted between zinc level and weight for age z-score (WAZ). The ADHD-T-Dari, CAS-T-Dari, and APQ-Dari had strong content and face validity as well as good internal consistency. The two-factor model of ADHD-T-Dari (inattention and hyperactivity/impulsivity) performed best in the confirmatory factor analysis. Inattention (16.8%), hyperactivity/impulsivity (29.9%), and ADHD (21.5%) were present in these students and male students scored higher than the females. ADHD were associated to vitamin D and vitamin B12 deficiency. Students with poor family income and illiterate parents showed a significantly greater frequency of ADHD. Male students scored much higher on the aggression, and showed a negative relationship with parent education, especially for female students. Folic acid, calcium and zinc levels had a negative association with aggression. Aggression had positive correlation with ADHD which was more apparent in male students. The average working memory score was 25.25 which was higher for female student, but the difference was not statistically significant. WM and micronutrient levels did not significantly correlate with ADHD, but negatively correlate with female students' aggressive. The AP scores for female was higher but was not statistically significant. The AP of male students showed a positive correlation with parental education. There was no correlation between AP and micronutrient level, while ADHD and aggression associated negatively with AP. In conclusion, higher prevalence of micronutrient deficiencies was found among primary school students. Zinc had positive correlation with WAZ. Vitamin D and vitamin B12 deficiency were associated with ADHD and folic acid, while calcium and zinc deficiency were associated with aggression. Micronutrient level had no significant correlation with WM and AP of children, while ADHD and aggression showed a strong negative correlation with the AP of students.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Micronutrients are nutrients needed by the body in small amounts, they include vitamins and minerals. Micronutrients are involved in several biochemical and physiological processes of the body. Micronutrient deficiencies (MNDs) have a direct impact on growth, DNA methylation and cognitive impairment. World Health Organization (WHO) and UNICEF reported Afghanistan as a country in a disaster state of malnutrition, especially for children and women (UNICEF, 2019; WHO, 2010). Amongst micronutrient deficiencies, vitamin A, vitamin D, folic acid, B12, calcium and zinc deficiencies are highly prevalent than others (Dewey, 2016). Children at the age of elementary school are at the highest risk of MNDs (Mushtaq et al., 2011). However, low family income and reliance on wheat as a staple food crop which is consumed increasingly and displacing traditional food may cause MNDs in Afghan school children. Wheat products have a low content of bioavailability of zinc and the presence of phytic acid, which bind with minerals and make a complex of minerals with phytate and tend to be low bioavailability because of its impaired absorption in the digestive system (Hunt, 2002). Meanwhile, vitamin A, vitamin D, folic acid, vitamin B12 and zinc are essential for the proper growth, development, haematogenesis and appropriate function of the brain of children.

Cognition refers to the mental processes involved in memory, attention, learning, and executive functions. Such as people with attention deficit hyperactivity disorder (ADHD) have trouble concentrating their attention in ways that allow them to adapt to their surroundings effectively (Sternberg & Sternberg, 2017). ADHD is a neurodevelopmental condition that often begins in early childhood and progresses into adulthood with a variety of negative outcomes, including low self-esteem, interpersonal interaction issues, and school learning challenges. Inattention, hyperactivity, and impulsivity are subtypes. ADHD is one of the most frequent mental diseases affecting children, with the incidence in the childhood–adolescent group ranging between 2% and 8% worldwide (Granero et al., 2021).