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Case Report

The Effect of Nutrition and Drug Interactions (Methylphenidate HCl) on ADHD in a Young Adult: A Case Report

Fitiara Indah Permatasari[1], Farapti Farapti[1], Babucarr Jassey[2], Moses Tende Stephens[3], Gabriel Zean[4]

[1]Department of Nutrition, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia
[2]Department of Public Health Services, Ministry of Health, The Quadrangle, Banjul, The Gambia
[3]Research Institute for Health Science, Chiang Mai University, Taiwan
[4]Faculty of Basic Medical Science, University of Liberia, Monrovia, Liberia

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Correspondence Author:
Email: [1]fitiara.indah.permatasari-2021@fkm.unair.ac.id, [2]farapti@fkm.unair.ac.id

Abstracts

Introduction: ADHD is a common neurodevelopmental condition often managed with stimulant medications such as methylphenidate. While pharmacotherapy remains effective for symptom controlgrowing attention has focused on the role of nutrition in modulating treatment outcomes and overall management of ADHD. However, concerns remain regarding long-term outcomes, adverse effects, and dependence on medication. In recent years, research has increasingly emphasized a more integrative perspective beyond pharmacotherapy, incorporating environmental and nutritional factors to a more comprehensive understanding, including the role of environmental factors, diet, and nutrition. **Methods:** This case report discusses a 20-year-old female college student with a history of ADHD who presented with behavioral disturbances and sleep deprivation. She had previously shown improvement in focus and academic performance with methylphenidate (CONCERTA), but experienced weight gain as a side effect, motivating her to study nutritional science. Nutritional factors and food–drug interactions appeared to influence both the expression of ADHD symptoms and the tolerability of pharmacotherapy. **Discussion**: This case highlights individual variability in response to methylphenidate, particularly concerning metabolic effects. The effectiveness and adverse reactions to ADHD medications may be influenced by dietary interactions, suggesting the importance of a personalized treatment approach. A well-balanced diet may enhance cognitive performance and improve pharmacologic tolerability, especially when it includes adequate intake of protein, unsaturated fats, and essential micronutrients. **Conclusion:** The management of ADHD should consider both pharmacological and nutritional factors. Integrating dietary support into treatment plans may enhance outcomes and reduce side effects, offering a more holistic and individualized model of care.

Keywords: Anxiety, Procrastination, Self-Efficacy, Self-Control, Mental disorder

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INTRODUCTIONS

Attention-Deficit/Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder marked by persistent patterns of inattention, hyperactivity, and impulsivity that significantly impair social, academic, and occupational functioning. According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), the onset of symptoms must occur before the age of 12 and be present in multiple settings, such as home and school, to warrant a clinical diagnosis. These impairments typically emerge during early development and often persist into adolescence and adulthood. These symptoms begin in early developmental periods, typically in childhood, and lead to significant impairments in educational, social, and occupational functioning. According to ICD-11, the core features include difficulties in sustaining attention, controlling impulses, and regulating activity levels in ways that are not consistent with the individual's age or developmental stage [1]. The symptoms must be pervasive across different contexts and persist over time, ruling out transient behavioral issues or symptoms arising solely from other mental or medical conditions.

Emerging evidence highlights that nutritional status, particularly levels of omega-3 fatty acids, iron, zinc, and magnesium, can influence ADHD symptom severity and may modulate the efficacy and tolerability of pharmacological treatments [2]. For example, individuals with low omega-3 status have shown improvements in ADHD symptoms when supplements are added to stimulant medications, sometimes enabling lower medication doses and reducing side effects. Additionally, dietary patterns typical of Western diets may exacerbate ADHD through impacts on gut–brain signaling, oxidative stress, and synaptic function, whereas interventions like intermittent fasting or improved nutrient intake hold promise to enhance stimulant response [3]. Pharmacotherapy with stimulants such as methylphenidate often suppresses appetite and may lead to micronutrient deficiencies; integrating nutritional strategies could therefore optimize clinical outcomes by both counteracting adverse metabolic effects and supporting neurotransmitter pathways affected by medication [4]. Together, these data support investigating how diet and supplements interact with ADHD medications to improve symptom control and minimize side effects.

Attention-Deficit/Hyperactivity Disorder (ADHD) is a common neurodevelopmental condition characterized by persistent patterns of inattention, hyperactivity, and impulsivity that interfere with functioning or development. Though often diagnosed in childhood, ADHD symptoms can persist into adolescence and adulthood, significantly impacting academic performance, occupational success, and interpersonal relationships [5]. Recent global data suggest that the prevalence of ADHD remains high, with growing recognition of adult and female presentations that have historically been underdiagnosed [6]. ADHD is one of the most common neurodevelopmental disorders globally. A comprehensive umbrella review of meta-analyses (n = 3.3 million participants) estimates the worldwide prevalence in children and adolescents at around 8 % (95 % CI 6–10 %), with rates nearly twice as high in boys (10 %) compared to girls (5 %) .

The most recent global meta-analysis (2023) aligns closely, reporting approximately 7.6 % prevalence in children aged 3–12 and 5.6 % in adolescents aged 12–18 . In adults, persistent ADHD (meeting full diagnostic criteria since childhood) affects about 2.6 % worldwide, while symptomatic adult ADHD affects as many as 6.8 % [7]. In Indonesia, studies indicate a wide variation in ADHD prevalence among children and adolescents, likely due to differing assessment tools and sampling contexts. A recent 2023 study using the Indonesian version of the Conners 3 Teacher Rating Scale reported

a 6-12 year-old school sample prevalence of approximately 5.1 % (16/314 students) confirmed by child psychologist evaluation. In contrast, a study utilizing the Indonesian ADHD Rating Scale (IARS) among primary school students in Jakarta reported a significantly higher ADHD prevalence of 26.2% (95% CI: 24.8–27.6), with a male-to-female ratio of approximately 2:1 [8]. Similarly, a community-based survey conducted in Surabaya identified 13.3% of children aged 9 to 13 as being at high risk for ADHD [9]. These discrepancies highlight the variability in prevalence estimates, which may be attributed to differences in diagnostic instruments, geographic settings, and sample populations. Despite such variations, even the most conservative figures underscore ADHD as a major public health concern in Indonesia. This epidemiological context emphasizes the urgent need for research into modifiable risk factors, particularly nutritional influences and pharmacological interventions, that could improve treatment outcomes on a national scale. Investigating the interaction between diet and medication is especially relevant given the large number of children affected and the potential for integrative strategies to enhance both symptom control and overall well-being.

Pharmacological treatment, particularly stimulant medications, remains the most evidence-based intervention, with robust support for short-term symptom control. However, concerns regarding long-term outcomes, side effects, and overreliance on medication have prompted increased interest in behavioral therapies, neurofeedback, and digital interventions [10]. Emerging evidence also suggests that integrated, individualized treatment approaches may yield the most sustainable results, especially when combined with school and family support systems. These issues are particularly relevant in marginalized populations, where ADHD is frequently misunderstood or untreated. Given these complexities, ongoing research is essential to deepen our understanding of ADHD's diverse presentations and inform equitable, evidence-based clinical practices. A recent case study highlighted that non-pharmacological approaches alone may not be sufficient for managing children diagnosed with ADHD accompanied by conduct disorder, emphasizing the importance of individualized, combined treatments and parental cooperation in the therapeutic process [11].

In recent years, scientific attention to ADHD has shifted from a purely pharmacological approach to a more comprehensive understanding, including the role of environmental factors, diet, and nutrition. Nutrition has been shown to have a significant influence on brain development and cognitive function, so deficiencies in micronutrients such as iron, zinc, magnesium, and omega-3s may contribute to ADHD symptoms [12]. In addition, consumption of foods high in sugar and certain additives has also been associated with increased symptoms of hyperactivity in children [13].

On the other hand, pharmacological therapy remains the first line of treatment for ADHD, especially the use of methylphenidate, a central nervous system stimulant that has been consistently shown to improve attention, decrease impulsivity, and reduce hyperactivity in individuals with ADHD [10]. Although methylphenidate is effective in the short term, its long-term use is still a matter of discussion due to potential side effects, tolerance, and dependence. Several recent studies have shown that nutritional status may influence response to treatment, with individuals with certain micronutrient deficiencies showing lower responses to stimulant therapy [14]. The interaction between nutrition and ADHD medication is an increasingly important topic, given its implications for treatment effectiveness and individualized long-term therapy planning. A multimodal approach that combines nutritional interventions, pharmacotherapy, and behavioral therapy may provide more optimal and sustainable clinical outcomes

[15].

Therefore, this study aims to explore the association between nutritional status and the effectiveness of methylphenidate in individuals with ADHD. A deeper understanding of nutritional factors as modulators of pharmacological therapy is expected to contribute to the development of a more personalized and evidence-based approach to ADHD management.

CASE

A 16-year-old female college student was brought to the Child and Adolescent Psychiatry Outpatient Clinic at a general hospital by her parents and aunt in 2019. Although her parents accompanied her for the initial visit, subsequent consultations were primarily attended by her aunt. The patient had a curious and inquisitive nature since primary school and exhibited a strong interest in music, particularly as a keyboardist. She had a history of academic achievements and held numerous certificates of merit. Since childhood, the patient aspired to become a doctor, a goal influenced by her mother's encouragement and the belief that the profession could help others and provide financial security. However, her trajectory changed following a psychological crisis in 2019.

In 2019, the patient experienced significant behavioral and cognitive changes following what she described as a distressing experience involving digital privacy violation ("hacking through her phone"). She demonstrated a loss of control and went without sleep for more than seven consecutive days. These symptoms prompted her family to seek psychiatric care. At that time, a diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) was made, and she was prescribed CONCERTA® (methylphenidate HCl) 18 mg/day. Despite treatment, she experienced increased appetite and weight gain—an uncommon but reported side effect of the medication. The patient's dissatisfaction with this side effect played a role in her decision to study nutritional science, where she aimed to better understand and manage health and nutrition-related issues.

- Childhood: High academic interest, musical involvement, goal of becoming a doctor.
- 2019: Acute psychiatric episode; diagnosed with ADHD; started on methylphenidate HCl.
- 2021: Began studying nutritional science at university; demonstrated strong communication skills and was positively recognized by faculty.
- 2023: Experienced a recurrence of psychological distress after another digital "hacking" incident, though milder than in 2019. Showed signs of cognitive decline and difficulty in social adaptation.

The patient was diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD), combined presentation, based on the DSM-5 diagnostic criteria during her initial psychiatric evaluation in 2019. This diagnosis was made by a child and adolescent psychiatrist following a semi-structured clinical interview, behavioral observation, and input from family members. The clinical presentation included a persistent pattern of inattention (e.g., difficulty sustaining attention, forgetfulness, distractibility) and hyperactivity-impulsivity (e.g., restlessness, excessive talking, impulsive decision-making) that significantly interfered with daily functioning and academic performance. As part of the neurodevelopmental evaluation, the patient underwent a developmental history assessment and behavioral screening. Though formal neuropsychological testing was not documented, the diagnosis was supported by clinical features consistent with ADHD and corroborated by family reports of longstanding symptoms since early adolescence. Pharmacological intervention was initiated with methylphenidate HCl extended-release (CONCERTA®) at a dose of 18 mg/day, starting in 2019. The treatment

continued over multiple years, with periodic psychiatric monitoring and dose adjustments as needed. While the standard expectation for methylphenidate includes appetite suppression, in this case, the patient reported paradoxical increased appetite and significant weight gain, contributing to her motivation to study nutrition science.

Pharmacological treatment included methylphenidate HCl (CONCERTA®) at 18 mg/day. The medication improved her focus and academic functioning, particularly evident during her first two years in university. However, she experienced paradoxical increased appetite and subsequent obesity—a rare but documented adverse effect. The patient and her family declined hospitalization. She was treated at home with regular outpatient psychiatric follow-ups. Non-pharmacological interventions included academic support and family education. Her continued interest in health led her to pursue and succeed in a nutritional science program until the relapse in 2023.

The initial treatment period resulted in a significant improvement in attention and academic performance. The patient re-engaged in academic and social activities and was appreciated by peers and faculty for her communication and presentation skills. The 2023 relapse was milder than the initial episode, but it caused cognitive difficulties and social adaptation issues. Nevertheless, she retained insight into her condition and continued to function with moderate independence.The patient provided informed written consent for this case report. Non-clinical details have been modified to maintain confidentiality.

DISCUSSIONS

This case contributes to the evolving understanding of ADHD management by documenting an atypical response to methylphenidate, wherein the patient experienced increased appetite and subsequent obesity, contrary to the more commonly reported effect of appetite suppression [16]. Such individual variability highlights the need for personalized monitoring of metabolic side effects in stimulant-treated patients. The case also reflects how pharmacological side effects can influence life decisions—such as the patient's motivation to pursue nutritional science—emphasizing the psychosocial impact of ADHD treatment. Moreover, this case reinforces recent findings on the bidirectional relationship between nutrition and ADHD symptoms. Nutritional imbalances, particularly involving iron, zinc, magnesium, and omega-3 fatty acids, have been shown to affect both the severity of ADHD and the efficacy of pharmacological interventions [17]. The patient's proactive approach to nutrition as a tool for understanding and managing her condition suggests the potential for integrating dietary counseling as part of a multidisciplinary ADHD care model, as recommended by recent literature [18].

For children with Attention-Deficit/Hyperactivity Disorder (ADHD) who are undergoing pharmacological treatment, particularly with stimulant medications such as methylphenidate, dietary regulation plays a vital supportive role. Careful attention should be given to macronutrient composition, especially ensuring adequate intake of protein and healthy (unsaturated) fats, which are digested more slowly and help sustain satiety and stable energy levels throughout the day. These nutrients may also mitigate common side effects of stimulant medications, such as appetite suppression or erratic eating patterns [19]. In addition, carbohydrates remain critical for optimal brain function, as approximately 60% of glucose derived from carbohydrates is utilized by the brain for energy metabolism and neurotransmitter synthesis [20]. Therefore, a balanced intake of complex carbohydrates such as whole grains, fruits, and vegetables is essential to support cognitive development, concentration, and emotional regulation in children with ADHD. Nutritional planning

should thus aim to maintain adequate carbohydrate consumption, while balancing other macronutrients to promote consistent energy levels and enhance the effectiveness of pharmacotherapy.

For children with ADHD, balanced meals are essential to support brain function and energy regulation. Each meal should include 100–150 grams of rice or other complex carbohydrates, as the brain relies heavily on glucose for cognitive processes [2]. High-protein foods such as red meat (iron-rich), fish (omega-3 and omega-6), chicken(high protein density), eggs (complete protein), and tofu (plant-based protein) are recommended to aid development and satiety. Due to high activity levels, two daily snacks—mid-morning and afternoon—can help maintain energy. Simple carbohydrates like chocolate or biscuits may be included in moderation to quickly supply glucose to the brain, but should be balanced with protein or fiber to avoid sugar spikes [21].

Protein and fat intake should be emphasized in the diet of children with ADHD due to their critical roles in growth and metabolic functions. Protein is essential for the formation and repair of body tissues, particularly important for active children who experience lactic acid buildup during physical activity; during sleep, protein supports muscle recovery and tissue repair. Fat serves as a vital energy reserve, and when protein levels are insufficient, fats can be metabolized to support tissue maintenance. Additionally, vegetables and fruits should be included in every meal, as they provide essential vitamins and minerals that act as coenzymes, facilitating the digestion, absorption, and metabolism of carbohydrates, proteins, and fats. Ensuring balanced nutrition in this manner can help address the specific metabolic and developmental needs of children with ADHD [22].

Protein good for ADHD Brain Function because neurotransmitters require protein-rich foods, Protein can prevent rushes in blood sugar, which increase hyperactivity and impulsivity [23]. Carbohydrates is good for snacking time cause Several studies suggest that some kids who have ADHD are “turned on” by excessive amounts of sugar [24]. But there is study concluded that the more sugar hyperactive children consumed, the more destructive and restless they became. A study conducted at Yale University indicates that high-sugar diets increase inattention in some kids. As individual metabolic responses vary, dietary effects can differ significantly among patients [25].

Balanced diet meals is important for ADHD, A registered dietitian based in Bethesda, Maryland, Faye Berger Mitchell is the mother of a nine-year-old who was diagnosed with ADHD at the age of seven [26]. Although her daughter uses stimulant medication to manage ADHD symptoms, Mitchell believes that medication alone isn’t sufficient. She has observed that her daughter’s behavior is more stable and manageable when she consumes a nutritious diet rich in vegetables, complex carbohydrates, fruits, and ample protein [2]. Dr. Ned Hallowell, founder of the Hallowell Center for Cognitive and Emotional Health located in Sudbury, Massachusetts, and New York City, encourages his ADHD patients to be mindful of their meal composition. He suggests filling half the plate with fruits or vegetables, one-quarter with protein, and the remaining quarter with carbohydrates. Additionally, he recommends consuming multiple servings of fiber-rich whole grains daily to help maintain stable blood sugar levels and avoid sharp fluctuations [27].

Vitamins are also important for children with ADHD, as supplements and diet can help correct nutritional deficiencies that exacerbate ADHD symptoms. Vitamin and minerals that ADHD needs is multivitamins (can be from fruits and vegetables or supplement if their need it), Omega-3 Fatty Acids (from fish, salmon, nuts,etc), Vitamin D3 (for dopamine regulations so can improve cognitive function), Ginkgo and Ginseng, Pycnogenol, Rodiola Rosea, and fullcream fresh milk cause it contains fats that reserves

energy if the children still in deficit calories and their body need recovery after their activity [18].

Minerals is the last important things for ADHD, A 2021 meta-analysis published in Scientific Reports revealed that individuals with ADHD tend to have reduced levels of zinc in their bloodstream and may face a higher risk of zinc deficiency (zinc is key roles in enzymatic activity, cell signalling, and the modulation of neurotransmitter activity) [28]. Caffeine and L-theanine (can from coffe candy kopiko its good not too high caffeine, but know the limit max 3/day for not over blood sugar). And last but not least is Iron is another essential micronutrient that may be lacking in individuals with ADHD, as studies have shown that children with the condition often have considerably lower iron levels compared to those without ADHD [29]. fact, A study published in the Annals of Medical and Health Sciences Research indicates that reduced iron levels could account for as much as 30% of the severity of ADHD symptoms [30]. Meal is 3 times per day: breakfast (06.00-08.00), lunch (11.00-12.00), dinner (17.00-19.00 pm). And for time snack: morning snack (09.00-11.00), and evening snack (15.0017.00) [31]. Breakfast is so important, cause it can make our body strong and fit to start your day before school, besides breakfast can helps combat obesity (Kick-starting your child's day with a healthy meal may even help combat obesity. Research supports that Individuals who regularly eat breakfast tend to have a lower risk of being overweight compared to those who skip it. This is likely because breakfast helps manage appetite, balances hormone levels, and influences daily calorie expenditure. Regarding snacking, the body relies on glucose (a simple sugar) for energy. Glucose is stored in the liver and released when needed, but these reserves often run low by mid-morning and late in the day [32]. Lunch is critical for sustaining energy levels and supporting both cognitive and physical performance throughout the afternoon. A nutritionally balanced midday meal should include a diverse range of food groups to ensure adequate intake of macronutrients and essential micronutrients. Daily energy and nutrient requirements are typically distributed across main meals and snacks, with general dietary guidelines recommending that approximately 20% of total caloric intake be consumed at breakfast, 30% at lunch, another 30% at dinner, and the remaining 20% through snacks [33]. It is important to recognize that calories obtained from beverages also contribute to overall intake. Inadequate nutritional intake during the day—particularly in the morning—can result in reduced attention span, fatigue, and impaired cognitive function, all of which may negatively affect academic performance. These observations underscore the importance of ensuring that children consume a complete and nourishing breakfast, followed by a well-planned lunch, to maintain optimal learning capacity and overall well-being.

Actually ADHD don't have problems with allergies, so if you want to know what their allergies is doing some screened for allergies. Research indicates that certain children may experience increased hyperactivity and difficulty concentrating after consuming gluten, wheat, corn, and soy [34]. In Smart Foods for ADHD and Brain Health, Rachel Gow emphasizes the critical role that nutrition plays in managing ADHD symptoms, particularly in children and adolescents. She highlights how nutritional deficiencies especially in essential fatty acids, magnesium, zinc, and iron, can exacerbate cognitive and behavioral issues associated with ADHD. Gow also discusses the importance of whole foods, omega-3-rich diets, and minimizing processed sugars and additives to support brain function and emotional regulation. Importantly, she explores how dietary choices may interact with ADHD medications, such as methylphenidate HCl (commonly known by brand names like Ritalin or Concerta). For

example, certain foods and supplements can influence the absorption and effectiveness of methylphenidate, while others may increase side effects like appetite suppression or sleep disturbances. Gow stresses the need for individualized nutritional plans that take into account both dietary habits and pharmaceutical treatments, aiming to create a more holistic and sustainable approach to managing ADHD [17].

CONCLUSION

Effective management of Attention-Deficit/ Hyperactivity Disorder (ADHD) requires a comprehensive approach that integrates both pharmacological and nutritional strategies. While stimulant medications such as methylphenidate remain central to symptom control, growing evidence suggests that nutritional status can significantly modulate treatment efficacy, side effect profiles, and cognitive functioning. This case underscores the importance of individualized care, highlighting how diet and drug interactions can influence therapeutic outcomes. Incorporating targeted nutritional assessment and intervention into ADHD treatment plans may not only enhance the effectiveness of pharmacotherapy but also promote more sustainable, holistic, and patient-centered care.

Future research should prioritize well-designed clinical studies to elucidate the mechanisms by which nutritional factors influence the pharmacodynamics of ADHD medications. Investigating specific dietary patterns, micronutrient deficiencies, and food–drug interactions across diverse populations may enable the development of evidence-based nutritional guidelines. Such findings could inform integrated care models that optimize both medical and nutritional interventions, particularly in resource-limited or underserved settings .

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest regarding this research. However, we recognize that the publication and exposure of scientific data related to ADHD and mental health may potentially influence future research, policy-making, and institutional interests. We remain committed to transparency and objectivity in presenting our findings, and we acknowledge that future developments or collaborations with related institutions could pose ethical considerations. All efforts have been made to ensure that this study's conclusions are unbiased and solely based on the data obtained.

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