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The Effect Healthy Balanced Diet On The Academic Achievement Of Secondary School Students

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Abstract

This study investigates the effect of a healthy balanced diet on the academic achievement of secondary school students. Given the well-established involvement of nutrition in cognitive development and mental performance, the research examines the relationship between students' dietary habits and their academic achievement. The study was conducted on April 6th and 7th, 2025, at Martyr Major General Tariq Al-Marjawi School, using an online questionnaire distributed to 77 students. The questionnaire consisted of 10 items assessing students' eating behaviours, vitamin and nutrient intake, hydration habits, and awareness of diet's academic benefits. Academic achievement was categorized based on previous semester grades into Excellent, Moderate, or Weak. Statistical analysis using logistic regression test showed that 9 out of 10 dietary behaviors had a statistically significant association with higher academic performance ($p < 0.05$), including the consumption of protein-rich foods, fruits and vegetables, vitamin-rich foods, and proper hydration. Notably, students who practiced healthier dietary habits were significantly more likely to attain higher academic grades, with odds ratios ranging from 1.17 to 1.5. The findings confirm a strongly positive correlation between nutrition and academic outcomes, stressing the necessity for improved nutritional awareness and dietary practices among adolescents.

Therefore, it is recommended that educational institutions and policymakers to spread awareness about balanced diets in order to enhance students' academic performance.

Key words: **Balanced diet**, **student achievement**, **dietary habits**, **secondary-stage student**

1. Introduction

Nutrition plays a vital role in cognitive development and academic achievement, particularly among adolescents in secondary schools. A healthy, balanced diet provides essential nutrients that support brain functions such as concentration and memory, which are crucial for academic success. Researches have shown that students who maintain a nutritious diet, including enough intake of proteins, vitamins, and minerals, tend to perform better in classroom than those with poor dietary habits (Adolphus *et al.* 2013).

Malnutrition, which can be either in the form of undernutrition or overconsumption of unhealthy foods, has been also linked to impaired cognitive abilities, reduced attention span, and lower academic performance (Taras, 2005). One of the most critical dietary factors influencing learning is breakfast consumption. Studies indicate that students who regularly eat a balanced breakfast show better memory, problem-solving skills, and concentration compared to those who skip breakfast (Hoyland *et al.* 2009).

Furthermore, specific nutrient deficiencies, such as insufficient amounts of iron, omega-3 fatty acids, and vitamin B12, have been associated with poor cognitive performance and increased fatigue, leading to lower academic achievement (Benton, 2008). On the other hand, a diet high in processed foods, sugars, and unhealthy fats has been found to impair learning abilities (Florence *et al.* 2008).

Unfortunately there is an increased prevalence of unhealthy dietary habits among adolescents, so it is essential to investigate the relationship between nutrition and academic performance. This research aims to explore how a healthy, balanced diet affects secondary school students' academic achievements, emphasizing the importance of proper dietary habits in order to enhance the cognitive abilities, learning effectiveness, and overall school performance.

2. Theoretical framework

A balanced diet consists of the 7 nutrients in their correct proportions. In this section each nutrient is discussed along with its benefits to the body and food sources in which this nutrient can be found.

a. Carbohydrates

The Importance of Carbohydrates in Nutrition

Wasyluk *et al.* (2019) explain that carbohydrates are the primary energy source for the human body, accounting for approximately 50–60% of daily caloric intake. They are especially crucial for the central nervous system (CNS), which determines carbohydrate requirements based how much energy is needed.

StatPearls (2023) suggests that carbohydrates offer multiple health benefits, particularly when it is consumed in complex forms such as whole grains, vegetables, fruits, legumes and cereals etc. These complex carbohydrates are digested slowly, leading to a gradual release of energy and stable blood sugar levels. Furthermore, dietary fibres which is a crucial

carbohydrate found in these foods, supports digestive health, promotes a feeling of fullness, and helps manage cholesterol levels. Numerous studies indicate that diets fibre-rich food may reduce the incidence of type 2 diabetes, obesity, and cardiovascular diseases.

Sources of Carbohydrate

Ludwig *et al.* (2018) demonstrated that whole grain sources such as oats, brown rice, and whole wheat contain slowly digestible carbohydrates and dietary fibres that beneficially regulate glucose metabolism of the body.

Reynolds *et al.* (2019) further established through their Lancet meta-analysis that the fruits and vegetables contains natural beneficial sugars such as fructose and maltose which are better than the processed sugars that can lead to cardiovascular and metabolic disorders.

By Messina and Victor (2022) explained that legume, including chickpeas and lentils, are particularly important due to their resistant starch content, which serves as a substrate for a healthy gut microbiota.

Deehan *et al.* (2020) provided mechanistic evidence in Cell Host & Microbe that lactose and galacto-oligosaccharides and other dairy-derived carbohydrates promote a diversified gut microbiome.

b. Protein

Impact of Protein on Students' Academic Achievement:

According to Wu (2016), protein plays a vital role in the development and upkeep of body tissues. It supplies amino acids, which are essential for producing enzymes, hormones, and components of the immune system. Getting enough protein is especially important during periods of growth and change, such as pregnancy, childhood, and aging. Both insufficient and excessive protein intake can lead to health issues.

Leidy and Casperson (2021) suggest that protein intake may improve executive function and working memory, especially during cognitively demanding tasks.

Protein-rich foods:

According to Langyan *et al.* (2022), plant-based proteins are a sustainable and health-promoting alternative to animal-based proteins, offering essential amino acids, aiding in the management of chronic diseases, and being abundant in cereals, legumes, pseudocereals, nuts, and seeds, which together contribute to 57% of global protein intake.

c. Lipids

Functional Role in the Brain

Chianese *et al.* (2018) highlighted that Lipids constitute approximately half of the brain's dry weight and are vital for supporting synaptic plasticity, facilitating neurotransmission, and ensuring overall brain functionality.

Benefits of Healthy Fats

Osman & Nawara (2021) omega-3 fatty acids ,such as Docosahexaenoic Acid (DHA) and Eicosapentaenoic Acid (EPA) from fish, and Alpha-Linolenic Acid (ALA) from walnuts and flaxseeds, are essential for maintaining brain health. Its benefits includes:

1.Reduce brain inflammation
2.Promote neurogenesis and synaptic plasticity, enhancing memory and learning

3.Offer protection against brain injuries and lower the risk of depression and Alzheimer's disease
4.DHA is particularly important during pregnancy and early childhood for healthy brain development
Negative Impact of Unhealthy Fats

Osman & Nawara (2021) mentioned that diets high in saturated and trans fats contribute to oxidative stress and inflammation in the brain, particularly affecting the hippocampus (responsible for memory) and hypothalamus (regulates body weight).

In addition to that they mentioned that the trans fats—found in products like margarine, frostings, and processed snacks—are linked to a higher risk of cognitive decline, anxiety, and Alzheimer's disease; so consequently, the excessive consumption of unhealthy fats can suppress neurogenesis and reduce levels of brain-derived neurotrophic factor (BDNF), hindering learning and memory.

The following section will include the health benefits of fat-soluble vitamins, water-soluble vitamins and minerals and their sources are vegetables and fruits

d. Fat-soluble Vitamins

Vitamin A and Cognitive Development

Ross and Zolfaghari (2000) state that vitamin A is essential for the maintenance of vision, immune competence, and cellular communication. In the context of cognitive development, retinoic acid—the active metabolite of vitamin A—regulates gene expression in the brain and supports synaptic plasticity, a key factor in learning and memory processes and its deficiency has been linked to impaired visual processing and weakened immune responses, which can negatively affect school attendance and performance.

Vitamin D and Brain Function

Holick (2007) explains that vitamin D plays a role beyond bone health, including its involvement in neurotransmission and neuroprotection. The presence of vitamin D receptors in the brain suggests a direct influence on mood regulation, memory, and executive functioning.

Vitamin E as a Neuroprotective Antioxidant

Traber and Atkinson (2007) highlight that vitamin E functions as a major antioxidant, protecting cell membranes from oxidative damage—a process that can contribute to neurodegeneration if uncontrolled. Its role in preserving neuronal structure and function makes it crucial for maintaining mental clarity and learning capacity, particularly under stress.

Vitamin K and Neural Health

Ferland (2012) notes that vitamin K contributes to cognitive health by supporting neuronal signalling and protection against oxidative stress. It also aids in the synthesis of sphingolipids, essential components of brain cell membranes. Lower levels of vitamin K have been linked with decreased cognitive performance in older adults.

Vitamin A and Immune Function

Ross and Zolfaghari (2000) explain that vitamin A plays a crucial role in immune function by maintaining the integrity of epithelial tissues and supporting the differentiation and proliferation of immune cells. A deficiency in vitamin A is associated with increased susceptibility to infections and a weakened immune response.

Vitamin D and Immune System Regulation

Jorde and Grimnes (2011) indicate that vitamin D directly influences the immune system by modulating the activity of both innate and adaptive immune responses. Adequate levels of vitamin D are essential for reducing the risk of autoimmune diseases and enhancing the body's defences against infections.

Vitamin E and Aging

Jiang *et al.* (2006) state that vitamin E, as a powerful antioxidant, plays a protective role against oxidative stress, a significant factor in aging and age-related diseases, including cognitive decline. Sufficient intake of vitamin E has been linked to slower cognitive decline in aging individuals and improved overall mental function.

e. Water-soluble vitamins

Vitamin B1 (Thiamine)

As discussed by Maqbool *et al.* (2018), vitamin B1 (Thiamine) functions primarily as a coenzyme in carbohydrate metabolism, playing a critical role in the conversion of glucose into energy. It also supports normal nerve function and overall energy production in the body.

Vitamin B2 (Riboflavin)

Maqbool *et al.* (2018) also stated that vitamin B2 (Riboflavin) is essential for oxidation-reduction reactions, acting as a component of the coenzymes FAD and FMN. According to Aslam et al. (2017), it supports cellular energy production and contributes to the maintenance of healthy skin, eyes, and nerve functions.

Vitamin B3 (Niacin)

Maqbool *et al.*, (2018) also mentioned that vitamin B3 (Niacin) is involved in energy metabolism as a component of the coenzymes NAD and NADP. It plays a role in maintaining healthy skin and a properly functioning nervous and digestive system

Vitamin B5 (Pantothenic Acid)

As noted by Said (2015), Pantothenic acid is a part of coenzyme A, which is necessary for fatty acid metabolism and energy production. Additionally, it plays a vital role in the synthesis and breakdown of fatty acids, amino acids, and other biomolecules.

Vitamin B6 (Pyridoxine)

Said (2015) also discussed that pyridoxine is key in amino acid metabolism, the synthesis of neurotransmitters such as serotonin and dopamine, and the production of haemoglobin. It supports brain development, immune function, and overall health

Vitamin B7 (Biotin)

Said (2015) mentioned that biotin serves as a coenzyme in various carboxylation reactions. It is important for the metabolism of fatty acids, amino acids, and glucose, and contributes to maintaining healthy skin, hair, and nails.

Vitamin B9 (Folic Acid/Folate)

As Paparella *et al.*, (2025) stated, folic acid is crucial for DNA synthesis and cell division. Deficiency can lead to megaloblastic anaemia and, during pregnancy, neural tube defects. Excessive intake may mask vitamin B12 deficiency.

Vitamin B12 (Cobalamin)

Paparella *et al.* (2025) also mentioned cobalamin is vital for red blood cell formation and

neurological function. Deficiency can cause anaemia and neurological issues. Toxicity is rare, but high intakes offer no benefit in individuals without malabsorption.

Vitamin C (Ascorbic Acid)

Paparella *et al.* (2025) highlighted that ascorbic acid acts as a strong antioxidant and is essential for collagen synthesis. Deficiency leads to scurvy, characterized by fatigue and bleeding gums. High doses may cause gastrointestinal discomfort.

f. Minerals

Burrows *et al.* (2017) emphasize that a balanced diet is essential for improving students' academic outcomes.

Nyaradi *et al.* (2013) highlight that a lack of important nutrients such as iron, iodine, and omega-3 fatty acids has been linked to weaker brain function and lower school performance. For instance, when adolescents suffer from iron deficiency anaemia, they often experience problems with attention, memory, and their overall ability to think clearly.

Adolphus *et al.* (2013) note that skipping breakfast—a habit that many secondary school students adopt—can also harm academic performance. Furthermore, research has shown that regularly eating a healthy breakfast helps enhance memory, attention, and overall academic success, highlighting the importance of starting the day with a nutritious meal.

According to the Institute of Medicine (2005), minerals are commonly classified into two groups: major minerals (macro minerals) and trace minerals (microminerals). The major minerals are calcium (Ca), magnesium (Mg), potassium (K), sodium (Na), chloride (Cl), phosphorus (P), and sulphur (S). On the other hand, trace minerals include iodine (I), zinc (Zn), selenium (Se), iron (Fe), manganese (Mn), copper (Cu), cobalt (Co), molybdenum (Mo), fluoride (F), chromium (Cr), and boron (B).

Burrows *et al.* (2017) further explain that minerals, both macro and micro, are vital nutrients that support various physiological functions, including brain activity. Ensuring sufficient mineral intake is essential for optimal brain performance, which can significantly impact students' academic achievement.

Beard and Connor (2003) demonstrate that a deficiency in specific minerals can hinder cognitive abilities, potentially leading to lower academic performance. For example, iron deficiency has been associated with reduced cognitive function and academic performance in children.

Burrows *et al.* (2017) also report that a systematic review published in Healthcare explored the connection between dietary intake and academic performance in college students. The review concluded that a well-balanced diet, which includes sufficient mineral intake, enhances cognitive function and contributes to overall academic success.

The Institute of Medicine (2011) states that calcium is one of the most essential minerals for human health, playing a crucial role in bone development, muscle function, and nerve signalling. A lack of adequate calcium intake can result in osteoporosis and impaired muscle contractions, potentially affecting physical performance and overall well-being.

Barbagallo and Dominguez (2010) indicate that magnesium is another important mineral that supports enzyme function, energy production, and

muscle relaxation. Furthermore, research indicates that magnesium deficiency is associated with increased stress, anxiety, and poor sleep quality, all of which can negatively impact cognitive performance and academic outcomes.

Geleijnse *et al.* (2007) assert that potassium plays a role in brain function, and its deficiency can contribute to mood disturbances and cognitive impairments. Ensuring an adequate intake of potassium is important for adolescents, especially those under academic stress.

He and MacGregor (2008) add that too much sodium in the diet has been associated with high blood pressure, which, if uncontrolled, can negatively affect cognitive abilities and academic functioning in the long term.

Sandstead *et al.* (2000) found that children who suffer from zinc deficiency may experience decreased attention spans, memory problems, and learning difficulties. Zinc is essential for brain signalling and its deficiency has been shown to impact neuropsychological function.

Rayman (2012) emphasizes that selenium, though needed only in small quantities, plays a significant role in protecting the brain from oxidative stress and maintaining healthy brain function. Selenium deficiency has been linked to mood disorders, cognitive decline, and neurological diseases, all of which can hinder learning and academic success.

Lozoff *et al.* (2006) emphasize that iron is a fundamental component of haemoglobin, which is responsible for oxygen transport in the blood and insufficient iron levels can lead to anaemia, fatigue, and impaired cognitive function, particularly in children and adolescents.

Aschner and Aschner (2005) describe that manganese plays a role in bone formation, metabolism, and antioxidant defence. Although it is required in small amounts, a deficiency in manganese can negatively affect brain function and physical development.

Klevay (2000) points out that copper is essential for red blood cell production, immune function, and neurological health and that copper imbalances can contribute to neurodegenerative disorders and cognitive impairments.

Watanabe *et al.* (2004) explain that cobalt is a key component of vitamin B12, which is necessary for red blood cell formation and neurological function and the deficiency in cobalt can lead to anaemia and neurological disorders, affecting overall health and cognitive performance.

Rajagopalan (1988) states that molybdenum is involved in enzyme function and detoxification processes. Although rare, molybdenum deficiency can lead to metabolic disturbances and neurological issues.

Choi *et al.* (2012) report that fluoride is primarily known for its role in dental health, helping to prevent tooth decay and strengthen enamel. However, excessive fluoride exposure has been associated with neurological effects and cognitive decline.

Anderson (1998) suggests that chromium is important for insulin regulation and glucose metabolism and that chromium supplementation may improve cognitive function in individuals with glucose metabolism disorders.

Nielsen (2014) concludes that boron is a trace element that influences bone health, brain function, and hormone regulation and that boron

supplementation can enhance cognitive performance and motor skills.

g. Water

According to Munteanu *et al.* (2021), water is an essential element of life, it contributes in about 60% of the human body and plays vital roles in physiological, cellular, and systemic functions. Furthermore, it enhances enzymatic activity, maintains organ elasticity, and supports not only physical performance but also cognitive abilities. Despite its limitless importance, water is one of the most crucial nutrients that is overlooked in dietary guidelines.

Jéquier and Constant (2010) emphasized that even mild dehydration—defined as a 1–2% loss of body mass—can affect brain functions and increase fatigue of the body.

Additionally, Manz *et al.* (2005), highlighted that adequate fluid intake can help prevent medical conditions such as urinary tract infections, constipation, obesity, and cardiovascular disorders.

Water's significance, as noted by Munteanu *et al.* (2021), also extends beyond the scope of biological necessity into theoretical and cultural frameworks. For example, Emoto (2005) suggested that water can affect emotional and energetic influences, while traditional Chinese medicine recognizes it as one of the five elemental forces crucial for maintaining harmony and health of the body.

3. Methods:

This study was conducted in 6th and 7th of April 2025 on secondary stage students of Martyr Major General Tariq Al-Marjawi School (formerly Al-Kamal Experimental School). The primary goal of this study was to determine the dietary habits of students and also measure their academic achievement in order to detect the relation between those two variables.

The questionnaire included 10 questions; 9 of them were about the dietary habits of the individual and the last question was to assess the awareness of the students of the importance of the balanced nutritional diet and its positive impact on their academic performance. Along with that their academic achievement of students was detected my mentioning their grades in the previous semester as the following: Excellent if your grade is above 70%, Moderate if your grade is between 70% and 50%, Weak if your grade is below 50%.

The study was conducted using an online questionnaire prepared using Google Forms and sent to all enrolled students via WhatsApp where they can access the link of the questionnaire. The questionnaire was written in Arabic language which is the native language of all of the surveyed students. The questionnaire's introductory statement outlined the study's purpose and scope, informing the students that their participation was entirely voluntary and posed no risks. Additionally, they were assured that their responses and grades would be kept anonymous and completely confidential.

Statistical analysis

Minitab Statistical software program was used to perform data analysis. Logistic Regression test was used to examine the relationship between the dietary habits (independent variables) and the student's academic achievement (categorical dependent variable). 77 response, n= (77), was received for the questionnaire and responses was varying between Yes, No, Maybe. Results were

tabulated used Microsoft Excel Sheets and was also used to calculate the percentage of each response n (%) rounded to 3 significant figures.

4. **Results**:

The study investigated the relationship between dietary habits and academic performance among students. The results revealed statistically significant associations between specific dietary behaviours and higher odds of achieving a 'Good' academic level. Below is an interpretation of the findings, supported by comparisons to existing literature and citations from the provided research links.

Table (1): showing results of the questionnaire about the dietary habits

Dietary Habit	*Total "Yes"* n=77 n (%)	Total "*NO*" n=77 n (%)	Total "*Maybe*" n=77 n (%)
Q1) Are you keen to include all the major food groups in your daily meals?	26 (33.8%)	30 (39.0%)	22 (28.6%)
Q2) Do you eat a variety of fruits and vegetables every day?	28 (36.4%)	25 (32.5%)	25 (32.5%)
Q3) Do you limit your consumption of sugary foods such as pastries, sweets, and soft drinks?	33 (42.9%)	23 (29.9%)	22 (28.6%)
Q4) Do you consume protein–rich foods daily? (e.g., meat, eggs, legumes, dairy, nuts)	62 (80.5%)	3 (3.9%)	13 (16.9%)
Q5) Do you eat foods rich in vitamins (e.g., liver, whole milk products, fish, fruits, vegetables)?	51 (66.2%)	7 (9.1%)	20 (26.0%)
Q6) Are you getting enough vitamin D from sun exposure or supplements?	31 (40.3%)	19 (24.7%)	26 (33.8%)
Q7) Do you think drinking water helps you improve your concentration while studying?	51 (66.2%)	18 (23.4%)	9 (11.7%)
Q8) Do you drink enough water throughout the day?	41 (53.2%)	14 (18.2%)	23 (29.9%)
Q9) Are you adding healthy fats to your diet from sources like avocados, nuts, and olive oil?	18 (23.4%)	42 (54.5%)	17 (22.1%)
Q10) Do you think eating healthy helps you focus and understand at school?	48 (62.3%)	6 (7.8%)	24 (31.2%)

Table (2): showing the level of achievement of the participants

Level of achievement	n=77 n (%)
Excellent (grade is above 70%)	55 (71.4%)
Moderate (grade is between 70% to 50%)	5 (6.5%)
Weak (grade is below 50%)	17 (22.1%)

Table (3): showing statistical analysis between the results and the level of achievement of participants

Dietary Questions	*p*–value	Odd ratio	Interpretation Odds Increase (%)
Q1) Are you keen to include all the major food groups in your daily meals?	**0.002**	**1.33**	**Strong evidence of a relationship**. Students who have this diet habit had **33%** higher odds of being in the 'Good' academic level
Q2) Do you eat a variety of fruits and vegetables every day?	**0.001**	**1.31**	**Strong evidence of a relationship**. Students who have this diet habit had **31%** higher odds of being in the 'Good' academic level
Q3) Do you limit your consumption of sugary foods such as pastries, sweets, and soft drinks?	**0.026**	**1.5**	**Statistically significant**. Students who have this diet habit had **50%** higher odds of being in the 'Good' academic level
Q4) Do you consume protein–rich foods daily? (e.g., meat, eggs, legumes, dairy, nuts)	**0.043**	**1.41**	**Statistically significant**. Students who have this diet habit had **41%** higher odds of being in the 'Good' academic level
Q5) Do you eat foods rich in vitamins (e.g.,	**0.044**	**1.48**	**Statistically significant** Students who have this diet habit had **48%**

liver, whole milk products, fish, fruits, vegetables)?			higher odds of being in the 'Good' academic level.
Q6) Are you getting enough vitamin D from sun exposure or supplements?	**0.002**	**1.34**	**Strong evidence of a relationship**. Students who have this habit had **34%** higher odds of being in the 'Good' academic level
Q7) Do you think drinking water helps you improve your concentration while studying?	**0.002**	**1.39**	**Strong evidence of a relationship** Students who thinks so had **39%** higher odds of being in the 'Good' academic level
Q8) Do you drink enough water throughout the day?	**0.026**	**1.49**	**Statistically significant**. Students who has this diet habit had **49%** higher odds of being in the 'Good' academic level
Q9) Are you adding healthy fats to your diet from sources like avocados, nuts, and olive oil?	**0.002**	**1.17**	**Strong evidence of a relationship**. Students who have this diet habit had **17%** higher odds of being in the 'Good' academic level

NOTE*

1) **Odds ratio** (OR): tells you how much more (or less) likely an outcome is for one group compared to another: OR > 1: Higher odds of being in a better academic level.

2) ***p*–value**: tells you whether a result is statistically significant (is there exist a relationship or not).

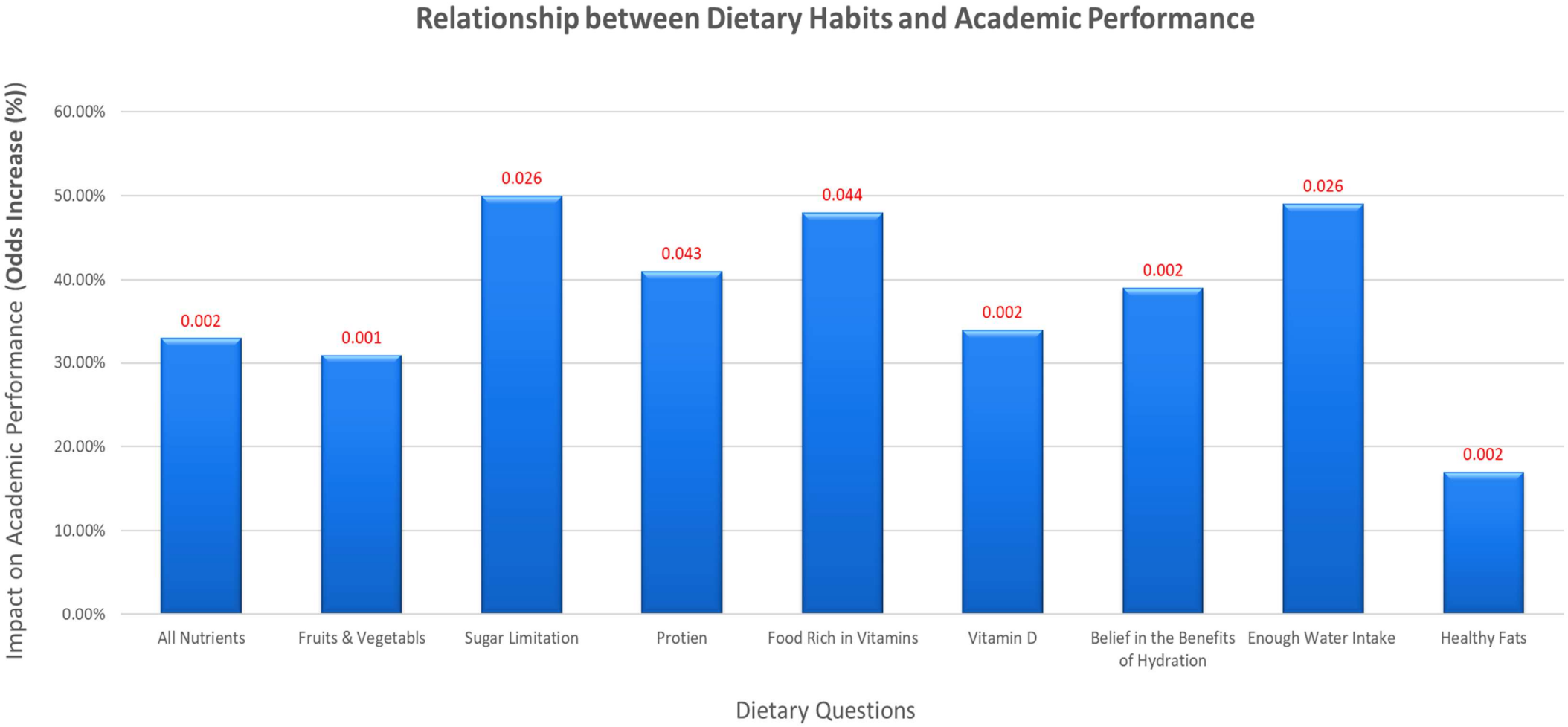
When (p-value < 0.05) them exist a relationship,

But when (p-value > 0.05) there is no relationship.

Statistically Significant Link is Found of Dietary Factors

- 9 out of 10 diet-related questions showed a significant (p-value < 0.05) association with academic level, this means specific eating behaviors do influence student academic level.
- There is evidence of a relationship between diet and academic performance,

Figure(1): Showing A Bar Graph Relationship Between Dietary Habits And Academic Performance



Note:

- Numbers above bars represent *p*-value
- Y-axis represents Odds Increase (%)
- X-axis represents Dietary questions

5. Interpretations of results

1.Balanced Diet with All Nutrients Included

A statistically significant association (p = 0.002, OR = 1.33) was found between consuming all major food groups and academic success. Students who followed a balanced diet were 33% more likely to achieve good academic performance.

Supporting study: This supports the idea that a well-rounded intake of essential nutrients enhances brain function and concentration. Burrows *et al.* (2017) similarly reported a positive link between overall diet quality and academic outcomes.

2.Daily Intake of Fruits and Vegetables

Students who regularly consumed a variety of fruits and vegetables had 31% higher odds of attaining better academic results (p = 0.001, OR = 1.31). These foods are rich in antioxidants, vitamins, and minerals that promote cognitive health.

Supporting study: Naghizadeh *et al.* (2017) also emphasized the cognitive benefits of a high fruit and vegetable intake.

3.Limitation of Sugar Intake

Limiting sugary food intake was associated with a 50% increase in the likelihood of higher academic performance (p = 0.026, OR = 1.5). High sugar consumption has been linked to impaired memory and reduced attention span.

Supporting Study: This finding aligns with Khan *et al.* (2019), who noted a negative impact of sugar on academic achievement.

4.Regular Protein Consumption

Students who consumed protein-rich foods on a daily basis had a 41% greater chance of achieving stronger academic results (p = 0.043, OR = 1.41). Protein is essential for neurotransmitter synthesis and maintaining mental alertness.

Supporting study: Bitar *et al.* (2024) reported that increased protein intake positively influenced students' focus during exams.

5. Food rich in Vitamins

Eating foods high in essential vitamins was linked to a 48% improvement in academic success odds (p = 0.044, OR = 1.48). Vitamins, particularly B-complex, C, and E, contribute to efficient neural functioning.

Supporting study: According to Khosravi et al. (2015), adequate vitamin intake is crucial for cognitive performance.

6.Sufficient Vitamin D Levels

Maintaining healthy levels of Vitamin D—whether through sunlight or supplements—was correlated with a 34% higher chance of academic success (p = 0.002, OR = 1.34). Vitamin D has a role in mood regulation and cognitive ability.

Supporting Study: Khosravi et al. (2015) also found that vitamin D deficiency can lead to fatigue and concentration issues.

7. Belief in the Benefits of Hydration

Students who believed that water enhances concentration were 39% more likely to perform well academically (p = 0.002, OR = 1.39). This belief may encourage better hydration habits, which in turn support mental clarity.

Supporting Study: Booth *et al.* (2012) emphasized the importance of hydration for maintaining alertness.

8.Enough Water Intake

Proper hydration was significantly associated with academic success, with hydrated students showing a 49% higher likelihood of high performance (p = 0.026, OR = 1.49). Water intake plays a key role in sustaining cognitive energy and attention.

Supporting study: These results are supported also by Booth *et al.* (2012).

9. Consumption of Healthy Fats

A diet including healthy fats—such as those from nuts, avocados, and olive oil—was associated with a 17% increased chance of better academic performance (p = 0.002, OR = 1.17). Omega-3 and other beneficial fats are known to support memory and overall brain health.

Supporting study: Bitar *et al.* (2024) similarly found a positive link between healthy fat intake and academic outcomes.

10.Do students think that their diet can affect their academic achievement?

62.3% of the students did know that their diet can affect their academic performance while the remaining participants (37.7%) were either not sure or did not know that diet can affect their academic performance

6. Conclusion

This study provides compelling evidence that dietary habits play a significant role in shaping students' academic performance. The statistical analysis revealed that students who maintain balanced diets—characterized by the regular consumption of all major food groups, fruits, vegetables, protein-rich foods, and vitamin-rich items—tend to perform better academically. Furthermore, healthy behaviours such as limiting sugary foods, staying well-hydrated, and ensuring adequate vitamin D intake were also strongly associated with higher academic achievement.

These findings support existing literature that underscores the link between nutrition and cognitive function, memory, concentration, and overall mental performance. The consistency of the results with previous research highlights the potential of dietary interventions as a non-pharmacological strategy to enhance students' academic success.

Given the observed associations, it is recommended that schools, parents, and policymakers promote nutritional education and ensure access to healthy food options for students; especially that 7.8% of the students don't think that balanced diet affect their academic performance additionally with 31.2% of students who are not sure that their diet may affect their academic performance or not Future research should explore these relationships further, potentially integrating longitudinal data to establish causality and evaluate the long-term academic impact of improved dietary practices.

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8. References and Sources

Adolphus, K., Lawton, C. L., & Dye, L. (2013). The effects of breakfast on behavior and academic performance in children and adolescents. Frontiers in Human Neuroscience, 7, 425.

Ahmad, F., Hasan, H., Abdelhady, S., Fakih, W., Osman, N., Shaito, A., & Kobeissy, F. (2021). Healthy meal, happy brain: How diet affects brain functioning. Frontiers for Young Minds, 9, 578214.

Anderson, R. A. (1998). Chromium, glucose intolerance and diabetes. Journal of the American College of Nutrition, 17(6), 548–555.

Aschner, J. L., and Aschner, M. (2005). Nutritional aspects of manganese homeostasis. Molecular Aspects of Medicine, 26(4-5), 353–362.

Barbagallo, M., & Dominguez, L. J. (2010). Magnesium and aging. Current Pharmaceutical Design, 16(7), 832–839.

Beard, J. L., & Connor, J. R. (2003). Iron status and neural functioning. Annual Review of Nutrition, 23, 41–58.

Benton, D. (2008). The influence of children's diet on their cognition and behavior. European Journal of Nutrition, 47(3), 25-37.

Bitar A, Barakat F, Hawat A, Alsaid B. Dietary and smoking habits during the exam period and their effect on the academic achievement among Syrian medical students. BMC Med Educ. 2024 Jan 12;24(1):60.

Booth, P., Taylor, M., & Edmonds, C. J. (2012). Water supplementation improves visual attention and fine motor skills in school children. Appetite, 59(3), 730–737.

Burrows, T. L., Whatnall, M. C., Patterson, A. J., & Hutchesson, M. J. (2017). Associations between dietary intake and academic achievement in college students: A systematic review. Healthcare, 5(4), 60.

Burrows, T., Goldman, S., Pursey, K., & Lim, R. (2017). Is there an association between diet and academic achievement? A systematic review. Journal of Human Nutrition and Dietetics, 30(2), 117–140.

Chianese, R., Coccurello, R., Viggiano, D., Scafuro, M., Fiore, M., Coppola, G., Operto, F. F., Fasano, S., Layé, S., Pierantoni, R., & Meccariello, R. (2018). Impact of dietary fats on brain functions. Current Neuropharmacology, 16(6), 1059–1085.

Choi, A. L., Sun, G., Zhang, Y., and Grandjean, P. (2012). Developmental fluoride neurotoxicity: a systematic review and meta-analysis. Environmental Health Perspectives, 120(10), 1362–1368.

Deehan, Eric C., Yang, Chong, Perez-Muñoz, Maria E., Nguyen, N.K., Cheng, C., González, Á.,

& Walter, J. (2020). Precision microbiome modulation with discrete dietary fiber structures directs short-chain fatty acid production. Cell Host & Microbe, 27(3), 389-404.

Emoto M. (2005). The Hidden Messages in Water. Beyond Words Publishing.

Ferland, G. (2012). Vitamin K and the brain: An overview. Advances in Nutrition, 3(2), 204–212.

Florence, M. D., Asbridge, M., & Veugelers, P. J. (2008). Diet quality and academic performance. Journal of School Health, 78(4), 209-215.

Geleijnse, J. M., Grobbee, D. E., & Kok, F. J. (2007). Impact of dietary and lifestyle factors on the prevalence of hypertension in Western populations. European Journal of Public Health, 17(3), 237–244.

He, F. J., and MacGregor, G. A. (2008). Beneficial effects of potassium on human health. Physiologia Plantarum, 133(4), 725–735.

Holick, M. F. (2007). Vitamin D deficiency. New England Journal of Medicine, 357(3), 266–281.

Hoyland, A., Dye, L., & Lawton, C. L. (2009). A systematic review of the effect of breakfast on the cognitive performance of children and adolescents. Nutrition Research Reviews, 22(2), 220-243.

Institute of Medicine. (2005). Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate. Washington, DC: National Academies Press.

Institute of Medicine. (2011). Dietary Reference Intakes for Calcium and Vitamin D. Washington, DC: National Academies Press.

Jéquier E., & Constant F. (2010). Water as an essential nutrient: The physiological basis of hydration. European Journal of Clinical Nutrition, 64(2), 115–123.

Jiang, Q., Christen, S., Shigenaga, M.K., & Ames, B.N. (2006). The role of vitamin E in the prevention and treatment of chronic diseases. American Journal of Clinical Nutrition, 74(6), 714–722.

Jorde, R., & Grimnes, G. (2011). Vitamin D and health: A systematic review and meta-analysis. Scandinavian Journal of Clinical and Laboratory Investigation, 243, 123–128.

Khan, N. A., Raine, L. B., Drollette, E. S., Scudder, M. R., Kramer, A. F., & Hillman, C. H. (2019). The impact of added sugar consumption on academic performance and cognitive function in school-aged children. Nutrients, 11(10), 2320.

Khosravi, M., Saedisomeolia, A., Djalali, M., Eshraghian, M. R., & Eshraghian, A. (2015). Association of vitamin D status with mental health and academic performance in Iranian students. Journal of Health, Population and Nutrition, 33(1), 111–117.

Klevay, L. M. (2000). Cardiovascular disease from copper deficiency—a history. The Journal of Nutrition, 130(2S Suppl), 489S–492S.

Langyan, S., Yadava, P., Khan, F. N., Dar, Z. A., Singh, R., & Kumar, A. (2022). Sustaining protein nutrition through plant-based foods. Frontiers in Nutrition, 8, Article 772573.

Leidy, H. J., & Casperson, S. L. (2021). Protein consumption enhances executive and working memory function under high task demands. Appetite, 167, 105235.

Lozoff, B., Beard, J., Connor, J., Barbara, F., Georgieff, M., and Schallert, T. (2006). Long-

lasting neural and behavioral effects of iron deficiency in infancy. Nutrition Reviews, 64(suppl_2), S34–S43.

Ludwig, David S., Hu, Frank B., Tappy, Lionel, & Brand-Miller, Jennie. (2018). Dietary carbohydrates: Role of quality and quantity in chronic disease. JAMA, 320(9), 898-917.

Manz F., & Wentz A. (2005). The importance of good hydration for the prevention of chronic diseases. Nutrition Reviews, 63(6 Pt 2), S2–S5.

Maqbool M.A., Aslam M., Akbar W., & Iqbal Z. (2018). Biological importance of vitamins for human health: A review. 2.

Messina, Victor. (2022). Nutritional and health benefits of dried beans. Nutrients, 14(15), 3591.

Munteanu C., Teoibas-Serban D., Iordache L., Balaurea M., & Blendea C.-D. (2021). Water from inside the human body – physiological, cultural, and health perspectives: Synthetic and Systematic literature review. Balneo and PRM Research Journal, 12(3), 196–209.

Naghizadeh, M. M., Rafraf, M., & Somi, M. H. (2017). Relationship between dietary intake and academic achievement among Iranian students. Journal of Health, Population and Nutrition, 36, Article 16.

Nielsen, F. H. (2014). Update on the possible nutritional importance of boron. Journal of Trace Elements in Medicine and Biology, 28(4), 383–387.

Nyaradi, A., Li, J., Hickling, S., Foster, J. K., & Oddy, W. H. (2013). The role of nutrition in children's neurocognitive development, from pregnancy through childhood. Frontiers in Human Neuroscience, 7, 97.

Paparella, R., Panvino, F., Leonardi, L., Pucarelli, I., Menghi, M., Micangeli, G., Tarani, F., Niceta, M., Rasio, D., Pancheva, R., Fiore, M., & Tarani, L. (2025). Water-Soluble Vitamins: Hypo- and Hypervitaminosis in Pediatric Population. Pharmaceutics, 17(1), 118.

Rajagopalan, K. V. (1988). Molybdenum: an essential trace element in human nutrition. Annual Review of Nutrition, 8(1), 401–427.

Rayman, M. P. (2012). Selenium and human health. The Lancet, 379(9822), 1256–1268.

Reynolds, Andrew, Mann, Jim, Cummings, John, Winter, Nicola, Mete, Engin, & Te Morenga, Lisa. (2019). Carbohydrate quality and human health: A series of systematic reviews and meta-analyses. The Lancet, 393(10170), 434-445.

Ross, A. C., & Zolfaghari, R. (2000). Retinoid and carotenoid metabolism in the intestine: Current concepts and new perspectives. Journal of Nutrition, 130(2S Suppl), 290S–295S.

Said, H. M. (2015). Water-Soluble Vitamins. In D. M. Bier (Ed.), Nutrition for the Primary Care Provider (Vol. 111, pp. 30–37). Basel: Karger.

Sandstead, H. H., Penland, J. G., Alcock, N. W., Dayal, H. H., Chen, X., Li, J. S., and Zhao, F. (2000). Effects of repletion with zinc and other micronutrients on neuropsychologic performance and growth of Chinese children. The American Journal of Clinical Nutrition, 71(2), 466–481.

StatPearls. (2023). Physiology, carbohydrates. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK538326/

Taras, H. (2005). Nutrition and student performance at school. Journal of School Health, 75(6), 199–213.

Traber, M. G., & Atkinson, J. (2007). Vitamin E and the risk of cardiovascular disease. Free Radical Biology and Medicine, 43(1), 4–15.

Wasyluk, W., Zdunek, G., & Pedrycz, A. (2019). The impact of carbohydrate intake on the behavior and cognitive functions of children and adolescents. Polish Journal of Public Health, 129(2), 64–67.

Watanabe, F., Yabuta, Y., Tanioka, Y., and Bito, T. (2004). Biologically active vitamin B12 compounds in foods for preventing deficiency among vegetarians and elderly subjects. Journal of Agricultural and Food Chemistry, 52(11), 3314–3320.

Wu, G. (2016). Dietary protein intake and human health. Food & Function, 7(3), 1251–1265.

Wu, L., Sun, D., & He, Y. (2020). Dietary protein intake and cognitive function in older adults: A systematic review and meta-analysis. Frontiers in Nutrition, 7, 23.

المستخلص العربي

تتناول هذه الدراسة تأثير النظام الغذائي المتوازن والصحي على التحصيل الأكاديمي لطلاب المدارس الثانوية. نظرًا للدور المعروف للتغذية في التطور المعرفي والأداء العقلي، تستكشف الدراسة العلاقة بين عادات الطلاب الغذائية وأدائهم الأكاديمي. تم إجراء البحث في 6 و7 أبريل 2025، في مدرسة الشهيد اللواء طارق المرجاوي، باستخدام استبيان عبر الإنترنت تم توزيعه على 77 طالبًا. شمل الاستبيان 10 أسئلة تقيم سلوكيات الطلاب الغذائية، تناولهم للفيتامينات والعناصر الغذائية، عادات الترطيب، ووعيهم بفوائد النظام الغذائي على التحصيل الأكاديمي. تم تصنيف التحصيل الأكاديمي بناءً على درجات الفصل الدراسي السابق إلى ممتاز، متوسط، أو ضعيف. أظهرت التحليلات الإحصائية باستخدام اختبار الانحدار اللوجستي أن 9 من أصل 10 سلوكيات غذائية كانت مرتبطة بشكل معنوي بتحقيق أداء أكاديمي أفضل($p < 0.05$) ، بما في ذلك تناول الأطعمة الغنية بالبروتين، الفواكه والخضروات، الأطعمة الغنية بالفيتامينات، والترطيب السليم. من الجدير بالذكر أن الطلاب الذين تبنوا عادات غذائية أكثر صحة كانوا أكثر احتمالًا للحصول على درجات أكاديمية أعلى، حيث تراوحت نسب الأرجحية من 1.17 إلى 1.50. تؤكد النتائج وجود علاقة إيجابية قوية بين التغذية والنتائج الأكاديمية، مما يبرز الحاجة إلى زيادة الوعي الغذائي وتحسين الممارسات الغذائية بين المراهقين. بناءً على ذلك، يُوصى بأن تعمل المؤسسات التعليمية على نشر الوعي حول أهمية النظام الغذائي المتوازن من أجل تحسين أداء الطلاب الأكاديمي.