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Breakfast Composition and Its Impact on Cognitive Performance in Students' Memory

Kayla Xu

Ridge High School, Basking Ridge, New Jersey, USA, kaylalxu@gmail.com

Abstract: Breakfast is frequently regarded as the most crucial meal of the day, particularly for students whose scholastic success is significantly dependent on cognitive abilities like memory. This subject is significant as numerous students either forgo breakfast or ingest nutritionally deficient meals. This study investigates the effects of various breakfast varieties on students' memory performance. This review examines scientific research on the impact of various breakfast types on memory function. The results indicate that nutritionally balanced breakfasts, particularly those rich in protein, enhance students' short-term memory and attention, but breakfasts heavy in sugar, deficient in nutrients, or the omission of breakfast entirely, can detrimentally affect cognitive abilities. The article indicates that both the act of consuming breakfast and the specific foods chosen are crucial for enhancing kids' memory retention and academic success. Promoting healthful breakfasts may serve as a straightforward yet potent method to enhance academic performance by fostering increased memory.

Keywords: Medical and Health Sciences, Nutrition Science, Breakfast Consumption, Student Nutrition, Cognitive Performance

Introduction

Approximately 18% of U.S. high school students omit breakfast daily (Adolphus et al., 2016). The ability to retain information is especially vital for students facing substantial assignments and examinations. Numerous students underestimate the influence of breakfast on cognitive performance. Recent research examines the relationship between breakfast and memory, indicating that students' morning dietary selections may substantially affect their capacity to store and retrieve information.

Recent decades have revealed a substantial association between breakfast eating and cognitive function, particularly in children and adolescents. The systematic investigation conducted by Adolphus et al. (2013) assessed student performance on memory tests before and after breakfast. The results demonstrated that students who consistently ate breakfast displayed enhanced performance in memory tasks, such as recalling words or stories. The research demonstrated that improvements in memory were particularly significant in malnourished children .

Further research has focused on the dietary composition of breakfast that students should consume. Aubrey (2006) reported that breakfasts consisting of low-glycemic foods, such as oatmeal and whole grains, paired with low-sugar goods, improved students' performance on short-term memory assessments, including animal naming and numerical sequence repetition. Aubrey (2006) describes meals that are gradually metabolized, ensuring steady blood glucose levels and providing a consistent supply of energy to the brain. In contrast, teenagers who consumed high-glycemic or sugary foods saw notable decreases in energy levels. These crashes not only cause fatigue but also disrupt the brain's

glucose supply, impairing concentration, reducing working memory, and impairing short-term recall (Wesnes et al., 2003; Adolphus et al., 2016). Studies demonstrate that children who consume a high-energy, low-glycemic breakfast show significantly enhanced memory performance relative to those who have sugary meals, while analyses of multiple experiments confirm that unstable blood sugar levels detrimentally affect memory performance in the morning (Wesnes et al., 2003; Adolphus et al., 2016).

Numerous studies have analyzed the impact of breakfast on behavior and academic performance; however, few have directly examined the brain. A 1995 study entitled "Hippocampal Acetylcholine Release During Memory Testing in Rats: Augmentation by Glucose" revealed that post-overnight fasting intake improved memory performance compared to fasting (Ragozzino et al., 1996). The study demonstrates that this improvement arises from increased glucose levels, which promote the brain's synthesis of acetylcholine. Acetylcholine is a neurotransmitter that aids memory storage and retrieval, playing a vital function in the hippocampus, a brain region critical for learning (Ragozzino et al., 1996). The cognitive benefits of breakfast definitely surpass a simple boost in energy; they likely encompass how nutrients promote vital biochemical processes that improve memory formation and recall.

Despite research indicating improved memory function associated with breakfast consumption, there is a paucity of understanding regarding the external factors that affect this relationship. Most research has considered children as a homogeneous group, neglecting the impact of age, gender, socioeconomic situation, sleep quality, and school environment on the cognitive consequences of breakfast. All these variables could influence not only the degree to which breakfast improves memory but also the individuals and contexts in which the benefits may be more or less pronounced. Overlooking these discrepancies, research on the relationship between nutrition and memory has produced a narrow perspective. Future research that examines these environmental elements will be crucial for developing more precise and equitable nutrition guidelines for children.

This study examines the influence of breakfast intake on memory in students, highlighting glycemic index, cholinergic activity, and ideal meal compositions. This paper posits that breakfast markedly improves memory by directly supplying glucose to the brain and through extensive hormonal and neural mechanisms, supported by an analysis of different breakfast types (high carbohydrate versus high protein, or low versus high glycemic index) and the synthesis of evidence from nutritional neuroscience and physiology. Understanding these effects may aid students in making more informed dietary choices to improve learning and academic performance.

Background

Why it's important

Many students start their school day without eating breakfast or choose meals low in nutritional value. Comprehending the correlation between breakfast and memory is crucial for educators, researchers, and families aiming to enhance student achievement (Adolphus et al., 2016). Students' capacity to encode and recall information will be impaired without breakfast. As a result, this may lead to students falling behind their peers (Aubrey, 2006). The nutritional composition of breakfast directly influences cognitive function; hence, foods rich in whole grains, proteins, and other nutrients offer greater cognitive stimulation than high-carbohydrate, sugar-laden breakfasts (Arshad et al., 2025). For instance, when students consume breakfast without a balance of important nutrients, they are prone to diminished concentration and impaired memory. Over time, these minor everyday discrepancies may accrue, thereby negatively affecting future academic achievement. The cumulative impact of breakfast selections illustrates the extent to which daily dietary decisions can influence

the availability and potential for academic achievement and development. Moreover, studies indicate that cultivating lifelong healthy breakfast habits substantially enhances the capacity to fulfill academic responsibilities; thus, promoting breakfast at both individual and institutional levels should be prioritized (Galioto & Spitznagel, 2016). Omitting breakfast or choosing imbalanced meals is not merely a question of inconvenience.

Nutrition and the human brain

Glucose is regarded as the brain's energy source, as it fuels cognitive functions including attention, memory, and learning. Moreover, although the brain is a minor fraction of total body mass, it accounts for around twenty percent of the body's energy consumption, exclusively derived from glucose (Mergenthaler et al., 2014). This knowledge is significant to this research since it suggests how energy constraints may influence the cognitive behaviors under investigation. Research demonstrates that glucose consumption is associated with enhanced memory, especially in tasks requiring information retention or focus (Smith et al., 2011). This association elucidates the connection between breakfast, regarded as a method for enhancing blood sugar levels following nocturnal fasting, and cognitive performance. Research indicates that adolescents who drink breakfast generally perform better on memory and mathematics problems than those who do not (Defeyter & Russo, 2013). The results indicate that adequate glucose levels directly enhance memory and overall cognitive performance.

As blood glucose levels diminish, total cognitive performance is expected to decline, particularly affecting the attentional aspect of mental function, which is more significantly influenced by blood glucose concentration. Low blood glucose impairs concentration, cognition, and energy levels. Numerous studies suggest that meal abstinence, especially the omission of breakfast, is contributing to a deterioration in memory-dependent tasks (Benton & Parker, 1998). Other studies suggest that individuals of differing ages, dietary habits, and task kinds are variably impacted by low blood glucose levels.(Zilberter & Zilberter, 2013) Generally, diminished or erratic glucose levels impair attention and working memory, however the degree of this impact differs among individuals. The advantages of breakfast are contingent upon both biological and situational variables.

Breakfast also facilitates neurotransmitters, particularly acetylcholine, which is essential for memory formation and retrieval. Consuming energy-providing items following an overnight fast has been demonstrated to enhance memory (Galioto & Spitznagel, 2016). This review does not identify a specific brain mechanism; however, animal studies suggest that glucose can augment hippocampal acetylcholine production, thereby providing a physiological basis for its memory-enhancing effects. Research indicates that increased choline consumption correlates with improved cognitive performance over time (Poly et al., 2011). Recent studies indicate that choline-rich meals, including eggs, enhance verbal memory in adults, which illustrates the importance of incorporating these nutrient-dense foods into breakfast to bolster cognitive performance and memory retention throughout the day (Yamashita et al., 2023). This indicates that specific breakfast foods directly facilitate the biochemical processes associated with learning.

A morning meal is critical for maintaining a certain chemical balance, crucial for focus and memory, in addition to glucose and neurotransmitters. The quantity and quality of the breakfast influence various facets of cognitive functioning, including attention, processing speed, and memory retention (Puri et al., 2023). A consistent diet of healthy, low glycemic meals has been associated with enhanced performance in youngsters (Adolphus et al., 2016). Research indicates that high glycemic meals, as compared to low glycemic meals, result in prolonged stability of blood sugar levels. High versus low glycemic meal scenarios illustrate that a diet consisting of nutritious, low glycemic meals fosters steady blood sugar levels, hence preventing energy dips that might impair working memory and

concentration (Ingwersen et al., 2007). Breakfast stabilizes glucose levels, enhances neurotransmitter function, and supplies critical nutrients, so replenishing the brain chemicals necessary for sustained concentration and efficient memory retrieval.

Theoretical Framework

Varieties of breakfast and glycemic index

Recognizing the relationships of breakfast food components and glucose responses is crucial, since a consistent morning energy source enhances attention, working memory, and general cognitive performance throughout the day. Researchers hypothesized that a low glycemic index diet, consisting of foods like oatmeal, whole grains, and high-protein items, can enhance cognitive performance in children and adults by maintaining stable glucose levels in the bloodstream post-meal. Low-GI foods are posited to enhance attention, working memory, and reaction time tasks relative to high-GI foods because fluctuations in glucose levels energize the brain, suggesting that low-GI foods can facilitate superior cognitive performance compared to their high-GI counterparts. To ascertain how a low-GI diet enhances performance, a range of experimental research articles is examined, employing a pretested design with a cohort of volunteers who consume meals with a specified glycemic load. This methodology assesses the effects on specific cognitive tasks, including memory recall, attention, and reaction time, in both short- and long-term intervals post-consumption.

The findings indicated that low-GI breakfast meals produced a more stable blood glucose level, hence enhancing cognitive function. Conversely, participants consuming high-GI meals, such as sugary cereals or pastries, exhibited elevated and variable glucose levels, resulting in diminished attention, prolonged reaction times, and worse working memory capabilities. A study by Philippou et al. (2014) demonstrated that children consuming low-GI meals exhibited more significant enhancements in sustained attention and memory retrieval than adults, suggesting that developing brains are susceptible to fluctuations in blood glucose levels (Philippou & Constantinou, 2014). Meals that integrate low-GI foods with high-protein options, such as eggs, provided consistent energy levels, leading to enhanced attentional performance and greater memory retention during the morning hours. A research assessment indicated that persons with more challenging blood glucose regulation, such as youngsters and the elderly, exhibited the most significant benefits from low-GI meals. The significance of a low-GI, high-protein diet for sustaining cognitive performance during morning hours, as posited by the scholarly article, underscores the necessity for further research on whether the brain derives benefits from a low-GI diet throughout childhood, adolescence, and adulthood, or if the enhanced cognitive development attributed to a low-GI diet is relevant solely during childhood.

The article "How Sugar Spikes & Crashes Influence Brain Chemistry" serves as a valuable complement to the aforementioned findings by examining the impact of sugar fluctuations on brain chemistry (Sheth, 2025) .High-sugar breakfasts cause rapid increases in blood sugar levels, resulting in an insulin surge that subsequently leads to a fall. During a collision, the brain experiences an energy shortage that impacts neuronal function in regions responsible for attention, memory, and various tasks, subsequently influencing neurotransmitters like dopamine and serotonin, therefore impacting alertness and mood.

Conversely, a breakfast regimen comprising low-glycemic carbohydrates, fiber, and protein results in a gradual release of glucose. A breakfast consisting of oatmeal with nuts and berries, with whole-grain toast with eggs, ensures a consistent energy supply that promotes sustained brain activity. The article asserts that regular consumption of meals with high glycemic indices can influence both present and future brain activity concerning neural connections. The article's findings offer a vital elucidation of the differing impacts on

cognitive knowledge associated with low and high glycemic index breakfast foods.(Sheth, 2025)

Philippou and Constantinou (2014) and Sheth (2025) offer complementary insights regarding the correlation between breakfast composition and cognitive function. Specifically, the study by Philippou and Constantinou (2014) demonstrates that low-glycemic, high-protein diets enhance attention, working memory, and reaction times several hours after breakfast, whereas high-glycemic indices lead to significant fluctuations in glucose levels that impair performance on cognitively demanding tasks. The article by Sheth (2025) examines the neurochemical effects of stable glucose levels, indicating that sufficient glucose availability fosters a balanced neurotransmitter equilibrium in the brain, thereby sustaining consistent overall brain activity. The two articles clearly indicate that the impact of meals is crucial for cognitive function, particularly in the morning when tasks requiring attention, working memory, and other cognitive abilities are most demanding. Specifically, low-glycemic, nutritious meals provide consistent energy to the brain, so enhancing working memory, attention, and reaction times, whereas high-glycemic, sugar-laden meals introduce unpredictability in energy levels that may impair cognitive performance and diminish efficiency. While the immediate advantages are most evident in the hours after breakfast, consistent intake of low-glycemic, nutrient-dense meals may also enhance long-term neuronal stability and cognitive performance. These findings emphasize that the effects of breakfast transcend mere energy replenishment and stress the significance of meal composition in enhancing both immediate and possibly cumulative cognitive performance.

Biological mechanisms

Comprehending the impact of breakfast on memory is essential for addressing the primary inquiry of this research paper: Why does morning consumption enhance memory performance? Merely noting that individuals who consume breakfast perform better on memory assessments lacks sufficient explanation. To establish a connection, we must analyze how nutrition intake alters brain chemistry, enhances hippocampus activity, and fosters the physiological conditions necessary for memory formation. The research conducted by Wurtman and by Monti et al. (2014) provide complementary insights into these systems, illustrating how food consumption directly influences the brain processes related to memory.

Wurtman (1994) offers a molecular elucidation of how specific dietary intake may affect the synthesis and secretion of certain neurotransmitters in the brain. This establishes a direct correlation between breakfast and cognitive function.(Wurtman, 1994) Wurtman elucidates that the consumption of breakfast elevates choline and certain amino acid levels in the bloodstream, which subsequently promotes the synthesis of neurotransmitters such as acetylcholine, serotonin, and dopamine. Post-breakfast, elevated food levels can enhance the production and storage of neurotransmitter neurons, since these molecules traverse the blood-brain barrier. This is essential as neurotransmitters regulate the activation of brain circuits associated with attention, learning, and memory formation. The content of breakfast can alter the amino acid balance in the blood, impacting the amounts of neurotransmitters that govern mood, concentration, and cognitive preparedness. Mood is essential to memory, as pupils with greater emotional stability or positive moods exhibit enhanced attention management and superior encoding and retrieval of information, but negative moods can hinder concentration. Wurtman characterizes these effects as genuine physiological alterations rather than mere transient enhancements in alertness, illustrating that nutrient-induced neurotransmitter production is a fundamental mechanism by which breakfast facilitates memory.

Conversely, Monti et al. (2014) analyze nutrition through the lens of hippocampus function and memory systems. An analysis of both biochemical and systemic levels demonstrates the impact of breakfast on memory across various dimensions. The review by Monti et al. (2014) demonstrates that dietary status influences both the structure and functionality of the hippocampus, the brain area crucial to relational and long-term memory. They present evidence from both animal and human studies indicating that nutrition affects hippocampus neurogenesis, metabolic efficiency, and brain plasticity. A referenced study involved the excision of both hippocampi from a patient known as "H.M." due to his intractable epilepsy. Following the excision, he suffered from amnesia and was unable to recall events from years earlier. This outcome has prompted scientists to concentrate on the relationship between the hippocampus and memory. Nutrients including omega-3 fatty acids, antioxidants, and polyphenols enhance neuronal health and stimulate hippocampus cell proliferation, while diets rich in sugar and saturated fats can diminish plasticity and compromise memory efficacy.

Monti et al. (2014) emphasize that the hippocampus possesses significant energy requirements and predominantly depends on glucose to provide immediate advantages, as these effects manifest shortly after consumption and influence memory during the learning phase. While the brain can mitigate short-term variations in glucose, postprandial glucose levels affect the hippocampus's capacity to encode and recall information. They contend that breakfast not only supplies energy but also regulates certain development factors that enhance brain plasticity. These methods extend beyond transient glucose surges and demonstrate enduring alterations in brain architecture. The authors propose employing tasks that are sensitive to hippocampus function, such as relational memory assessments, alongside neuroimaging methodologies to detect the nuanced impacts of nutrition on memory that conventional cognitive evaluations could overlook.

Wurtman (1994) and Monti et al. (2014) collectively offer a thorough elucidation of the role of diet in enhancing memory. Wurtman (1994) emphasizes immediate metabolic alterations, demonstrating that dietary consumption elevates neurotransmitter precursors and augments acetylcholine synthesis, hence facilitating the encoding of new information. Monti et al. (2014) elaborate on this perspective, demonstrating how nutrition sustains hippocampus structure and function over time via processes including neurogenesis, inflammation attenuation, and metabolic support.

Despite the differences between the two techniques, they converge on the notion that breakfast influences memory through physiological alterations rather than merely enhancing alertness. Wurtman (1994) delineates the chemical constituents essential for neurotransmitter-mediated memory functions, whereas Monti et al. (2014) demonstrate how diet supports hippocampus plasticity and energy requirements. Their findings collectively indicate that breakfast increases memory via increasing neurotransmission, boosting hippocampus function, and balancing energy supplies. Understanding these pathways highlights the significance of breakfast content and quality, not only for cognitive performance but also for enhancing learning in educational settings, guiding nutritional guidelines, and influencing public health policy.

Results and Discussion

The immediate effects of memory

Understanding the impact of breakfast on cognition requires recognizing that cognitive performance is particularly sensitive to dietary intake after an overnight fast. Caloric deprivation can affect cognitive skills such as memory, attention, and processing speed. Breakfast replenishes glucose and other nutrients, enhancing short-term memory and attentional capacity. Research consistently demonstrates that breakfast consumption

improves recall, attention, and preparedness for learning, although the mechanisms and extent of these effects differ across demographic groups.

Adolphus et al. (2013) performed a meta-analysis of research examining the correlation between breakfast eating and cognitive performance in children and adolescents. Overall, their findings indicated that breakfast consumption correlated with enhanced memory and attentiveness. Children who consumed breakfast exhibited enhanced sustained attention and working memory compared to those who omitted it. The effects were more pronounced in activities necessitating extended durations of continuous performance or persistent cognitive effort, such as verbal memory tasks. These improvements suggest that consuming breakfast facilitates prolonged cognitive performance following extended mental exertion by postponing exhaustion and maintaining learning throughout the morning.

The text highlights the influence of breakfast on verbal memory, indicating that children who have breakfast perform better in word-list recall and story recall tests, suggesting that breakfast facilitates the consolidation and retrieval of verbal knowledge. Indeed, gains were more pronounced in populations with inadequate nutritional status, suggesting that initial dietary condition influences the magnitude of cognitive enhancement. Adolphus et al. (2013) further indicate that children who forgo breakfast have shorter reaction times and diminished on-task behavior, thus demonstrating that breakfast influences not only memory but also overall alertness and cognitive engagement. Galioto and Spitznagel (2016) investigated the influence of breakfast on memory and attention in adults. This systematic analysis of 38 studies investigating cognitive consequences after an overnight fast revealed a consistent improvement in performance on delayed recall tests, such as recalling word lists and paragraphs. Immediate recall, however, produced less stable patterns. Consequently, it seems that breakfast primarily facilitates memory consolidation and retrieval rather than initial encoding. The variability in immediate recall results is largely attributable to differences in study timing and breakfast composition, which affect the rate at which the brain can capitalize on restored glucose levels.

This review indicates that breakfast eating notably improves attentional performance and reaction time, particularly during cognitively demanding activities. Adults who consume breakfast generally show a smaller decline in performance than fasting controls in the morning. This review emphasizes that the composition of breakfast—particularly protein-rich, low-glycemic meals—can enhance cognitive performance by stabilizing blood glucose levels and supplying amino acids essential for neurotransmitter synthesis, while also highlighting the significance of timing. Cognitive advantages are most pronounced when testing occurs at least 15 minutes post-consumption, suggesting that nutrient absorption enhances cognitive performance.

Both assessments find that breakfast improves memory, attention, and cognitive function, despite differences in demographics and putative processes. Adolphus et al. (2013) highlight advancements in children and adolescents, particularly in sustained attention, working memory, and verbal memory tasks, but Galioto and Spitznagel (2016) acknowledge gains in delayed recall and reaction speeds in adults. The contrasting findings presumably indicate varying metabolic requirements: infants with diminished glycogen reserves rely more on consistent morning glucose availability, whereas adults exhibit heightened sensitivity to cognitive performance tasks that depend on consolidation and retrieval following an overnight fast. Both studies reveal that the most significant effects occur during lengthy or cognitively taxing tasks, indicating that breakfast mitigates mental fatigue and enhances endurance. The limitations of these two reviews include a diverse array of task types, discrepancies in sample sizes, and typically superficial analyses of breakfast composition. Both indicate that a healthy meal, especially one rich in protein and low-glycemic carbs, may enhance cognitive advantages. The synthesis of these studies

corroborates the assertion that breakfast serves as a straightforward yet potent intervention for improving immediate cognitive performance, particularly for tasks that demand attention and memory. Collectively, these studies lay the groundwork for the theories explored in this study regarding the impact of specific breakfast compositions on memory outcomes.

Individual variability and limitations

Individual variability in biological and developmental factors influences the cognitive impact of breakfast. Adolphus et al. (2016) note that younger students, particularly those who are undernourished, experience greater cognitive improvements compared to adults, as breakfast helps stabilize their energy. Additional factors such as sleep quality, daily routines, school climates and metabolism further contribute to differences in cognitive performance, indicating that identical breakfasts do not yield the same results. These variables affect the accuracy and generalizability of research findings.

Although recent studies demonstrate a link between breakfast consumption and improved memory, there are still many limitations. Many studies today are narrowly focused, only capturing small snapshots of the bigger picture. Studies are usually small and focused on people with similar backgrounds, so it's difficult to account for all students. Memory is often measured with tasks like recalling vocabulary which may not accurately reflect real classroom learning environment. Additionally, inconsistent definitions of "breakfast", ranging from substantial meal to light snacks, contribute to variability in results. While lab settings often provide good control, they do not accurately reflect the conditions of a real school environment and therefore do not represent how students actually learn. These constraints highlight significant gaps in the existing research.

Recognizing these limitations is important to avoid overgeneralizing findings and assuming universal applicability. While evidence consistently indicates cognitive performance benefits from breakfast, the consistency and strength vary across different groups. The inconsistencies are primarily attributable to differences in experimental parameters, including sample characteristics such as age, nutrition status, socioeconomic background, which rezult in diverse cognitive outcomes. The methods used also vary widely among studies, some utilize immediate recall tasks, others use recognition tasks, and still others assess broader academic skills, making direct comparison difficult. Additionally, inconsistent definitions of "breakfast" in terms of macronutrient composition, caloric load, and timing, introduce further variability. All of these factors together show that breakfast is highly sensitive to context, task demands, and methodological choices. Understanding these variables and how they create different outcomes is essential for interpreting global patterns in literature and recognizing why some studies report different memory benefits than others.

Conclusion

This study sought to examine the relationship between breakfast consumption and memory performance in students, focusing on the influence of dietary components, glucose metabolism, and neurochemical processes. Extensive evidence from behavioral, physiological, and neurobiological literature supports the notion that ingesting a balanced, low-glycemic, and nutrient-rich breakfast enhances memory and attention. Numerous studies referenced in this document demonstrate that breakfast consumption significantly enhances memory capacity via glucose metabolism and neurochemical processes, including increased acetylcholine synthesis. This mechanism promotes optimal conditions for memory storage and retrieval through intellectually demanding activities.

The data clearly indicate that the cognitive advantages of breakfast are neither universal nor easily attained. The efficacy and durability of memory enhancements are

contingent upon various factors, including meal composition, biological traits, age, nutritional status, and other elements such as sleep duration and stress levels. Research by Adolphus et al. (2016), Galioto & Spitznagel (2016) and Philippou and Constantinou (2014) indicates that the advantages manifest during prolonged or demanding activities, particularly in younger or nutritionally deficient individuals. This elucidates why certain trials yield mixed or small effects; it is not attributable to the absence of cognitive benefits from breakfast, but rather to the heightened sensitivity of the process. When behavioral findings are integrated with biological information from nutritional neuroscience, it becomes evident that breakfast plays a significant role in augmenting memory.

These findings have significant consequences for educational practice and policy. Facilitating access to nutritious breakfasts in educational institutions may enhance concentration, diminish cognitive tiredness, and mitigate performance disparities associated with socioeconomic inequality. Breakfast can no longer be regarded as a mere lifestyle choice with minimal impact on academic achievement. Breakfast selections may be regarded and marketed as vital components of optimal memory. Protein-rich breakfast options that incorporate whole grains and low-glycemic carbohydrates are a straightforward, efficient, and economical strategy.

Despite recent data indicating a correlation between breakfast and enhanced memory, many knowledge gaps remain to be investigated. One area of information requiring investigation is the evaluation of breakfast's impact on memory over an extended duration rather than in the short term. The majority of existing research has investigated the impact of breakfast on short-term memory, neglecting to address the potential cumulative effects of breakfast on memory or the development of memory functions or structures in the brain.

Ultimately, advancing research across a wider spectrum of ages, cultures, and educational contexts is an essential area of emphasis. The existing body of research depends on a substantial number of homogeneous samples, resulting in challenges about the generalizability of the findings. Additional investigation into the effects of breakfast on memory across early childhood, adolescence, and elderly populations, as well as the role of educational environments and food accessibility on these effects, would be essential for effectively applying existing knowledge to health and educational policy implementation.

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