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Research Article

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Growth Mindset Theories According to Students' Nutritional Behaviors

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Abstract

This study aims to explore the students' growth mindset theories in terms of nutritional behaviors. The study sample consists of 3782 students studying at high schools in different regions of Türkiye. While 61.9% of the students in the sample are females, 38.1% are males. 79.2% of the students study at Anatolian High School, 16.4% at Vocational High School, and 4.4% at Science and Social Sciences High School. In this study, which was designed with the quantitative research method and analyzed with the SPSS 18.0 program, The Mindset Theory Scale (MTS) was used to describe the mental structures of high school students. According to the research results, while the students' meat consumption behaviors did not make a significant difference in the growth mindset theories, the egg and milk consumption behaviors made a significant difference. Agricultural group (vegetable, fruit, and grain) nutritional behaviors made a significant difference in students' growth and fixed mindset theories. The growth and fixed mindset theory dimension mean scores do not differ significantly according to the chocolate, sugar, and salty consumption behaviors of the students. According to the results of the research, the nutritional behaviors of the students affect the growth mindset theories. Therefore, actions can be developed for students' awareness of healthy eating behaviors. Similar studies can be carried out by collecting students' food consumption on the same subject with the data obtained with ratio scales.

Key Words

Fixed Mindset • Growth Mindset• Nutritional Behaviors • Student

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Introduction

The mindset theory is the belief that individuals can improve their abilities and characteristics in the process of realizing and doing certain situations. This belief consists of variables such as self-vision, self-evaluation, self-regulation, self-motivation, and success (Dweck, 2016; Haimovitz & Dweck, 2017, Yılmaz & Güven, 2022). There are two dimensions to students' mindset theories: fixed and growth mindset theory. The fixed mindset is the belief that an individual is born with the characteristics and that they cannot be changed or improved. The growth mindset theory is the belief of the individual that basic human characteristics can be developed, that is, individual differences such as intelligence, talent, disposition, and interest can be developed (Dweck, 2012; Dweck, 2016). These beliefs of individuals can be influenced by their diet.

Nutritional behaviors of individuals express the tendency that emerges with their food consumption patterns (Öztürk, 2010). In other words, nutritional behavior is an individual's eating-drinking habits and preferences (Duyff, 2006). The studies in the literature have evaluated nutrition as a factor that affects the genetic structure and determines brain development and personality (Bayar, 2018). Consumed foods provide the body's metabolic energy needs and affect many brain functions, including mind and cognition functions. Studies indicated that foods and nutrition affect mood and behavior and contribute to both physical and emotional well-being (Flaskerud, 2015; Özenoğlu, 2018). Nutrition is considered a factor that affects the genetic structure and determines brain development (Gültekin, 2013). Our lifestyle and diet have a dramatic impact on brain plasticity and neuronal function. For healthy thinking, healthy eating is a fact. There is an increasing evidence that foods regulate neural plasticity and neuronal function, which change our short/long-term cognitive and emotional behaviors, and this issue has even become the subject of a new and very important science called "nutritional neuroscience" (Dauncey, 2009). Nutritional behaviors of students can affect their beliefs about their intelligence and abilities. No study has been found in the literature examining the relationship between students' nutritional habits and growth mindset theories. The findings of the study will contribute to the field in this respect.

This study aims to examine the growth mindset theories of students in terms of nutritional behaviors. For this purpose, answers to the following questions were sought:

• Do the growth and fixed mindset theory scores differ according to the nutritional behaviors of the students' animal product group (meat, egg, and milk)?

• Do the growth and fixed mindset theory scores differ according to the students' agricultural group (vegetable, fruit, and grain) nutritional behaviors?

• Do fixed and growth mindset scores differ according to the chocolate, candy, and salty group food consumption behavior variable?

• Do students' nutritional behaviors affect the variability in growth and fixed mindset theory?

Theoretical Framework

In the theoretical structure dimension of the study, theoretical explanations were made about the relationship between the growth mindset theory, nourishment, and beliefs.

The Mindset Theory

Mindset is the cognitive framework we use while making our meanings and interpretations with the cognitive activities related to the work we perform (French, 2016; Mather et al., 2013). Mindset theory is an individual's positive-negative belief that personality traits such as intelligence, talent, and temperament can be developed (Haimovitz & Dweck, 2017). Belief, on the other hand, is the unidimensional organization of perceptions and cognitions that an individual develops as a result of experiences related to a phenomenon, event, or situation (Erden & Yıldız, 2023). These beliefs are; one of the most important factors affecting the personality and potential of individuals is their way of thinking (Dweck, 2016). According to the mentality theory, the belief systems that an individual develops for personality traits such as their abilities and intelligence take place in two dimensions. These are fixed mindset and growth mindset (Dweck, 2016, Dweck, 2012; Güven & Yılmaz, 2017; Haimovitz & Dweck, 2017; Yılmaz, 2021)

The fixed mindset dimension of mindset theory is the belief that qualities such as intelligence or talent are unchangeable (Yeager & Dweck, 2012). This belief is the belief that the basic characteristics of individuals are innate and cannot be changed or developed later (Dweck, 2016; Yeager & Dweck, 2012). Students with a well-developed fixed mindset, above all, care about how they will be judged in the choice of "Intelligent" or "Not Intelligent". These students often do not know or do not believe that they can know and correct their mistakes, and they try to hide the error instead of correcting it. These students are afraid to put in the effort because making the effort makes them feel like a failure. According to them, if a person has talent, he does not need effort and talent alone can bring success (Bayrakçeken et al., 2021). A fixed mindset can drag students to procrastination. These students may prefer inaction and inaction to do and change something (Yılmaz, 2021). Students who are in procrastination do not easily give up their truth and value judgments (Schein, 1990). At the same time, individuals who are in procrastinate do not easily give up their old habits and thoughts and do not accept that change and innovation can support them (Çankaya & Demirtaş, 2010). Negative reactions to change can create resistance (Zaltman & Duncan, 1977). Students with fixed mindsets are resistant to change. These students do not want to act, insist, and overcome obstacles (Yılmaz, 2021; 2022).

The growth mindset is a belief that a trait such as intelligence or talent can be grown or developed over time (Beere, 2016; Dweck, 2012; Keenan, 2018; Orosz et al., 2017; Yeager & Dweck, 2012). Students with a growth mindset perceive perseverance, decisiveness, effort, and study as learning tool. Such students also use feedback to improve, and students with a growth mindset are inspired by the success of others and focus on learning with these characteristics (Dweck, 2012). Students with advanced growth mindsets try different learning strategies and try to get meaningful feedback and think that these contribute to their learning (OECD, 2021). This feature can enable them to develop an awareness of their learning processes. Therefore, they are under the control of their learning (Stec, 2015). Thus, growth mindsets enable students to increase their self-efficacy by increasing their learning and academic

success (Keenan, 2018). According to O'Rourke et al., (2014), students with developed growth mindsets are aware of their learning ways and learn in that way, they try to overcome difficulties and make an effort to learn. These students tend to be lifelong learners and are motivated by their personal development, they do not see failure as a threat, and they continue to learn to succeed (Dweck, 2012; Ng, 2018).

Table 1

Comparison of Growth Mindset and Fixed Mindset

Dimensions	Growth mindset	Fixed mindset
Grit	He/she does not shy away from difficult tasks.	He/she thinks that he will not be able to cope with difficult tasks.
	Despite the obstacles, he/she tries to reach his goal.	When faced with obstacles, he/she stops reaching goals.
	He/she is persistent.	It's a tendency to give up.
Variance	He/she thinks that talents can be developed.	Talents are stagnant and hard to develop.
	It can develop intellectual abilities.	It is impossible to develop intellectual abilities.
	Intelligence can develop.	Intelligence is in the form it is innate.
	He/she enjoys trying new things.	Don't try new things because it creates stress.
	The brain has a developing structure.	Improving the brain is impossible to change.
Feedback	He/she sees feedback as an opportunity to learn.	Feedbacks are meaningless.
	Use feedback to improve.	Doesn't care about feedback.
Comparison	Takes inspiration from others.	The success of others has come from their talents.
	Trying to learn from the success processes of others.	It's none of her business how others succeed.
Patience	Getting started takes patience.	It is useless to deal with difficulties.
Error	The error is an experience and an opportunity to learn.	If I made a mistake, I have to try this job again.
	There are different ways a job can be done.	If I've made a mistake, other ways won't work for that job either.
Ability	It works with effort.	If there is talent, there is no need for effort.
Action-taking	They think that if there is work, it must be done immediately and overcome.	They enter procrastination in their work.
	He/she motivates himself while doing work, he is self-confident.	Feels threatened while doing business.
Learning process	They can control and manage learning processes.	They are passive in their learning processes.
	Experimentation and meaningful feedback are important.	My learning and academic achievement are a measure of my abilities. There's nothing that can be done.

The difference between individuals with a growth mindset and those with a fixed mindset is seen in Table 1. Individuals with a growth mindset exhibit superior behaviors in all dimensions (grit, variance, feedback, comparison, patience, error, ability, action-taking, and learning process). Research supports the growth mindset theory, stating that the brain's plasticity increases over time, learning leads to significant development in human intelligence, and

individuals make significant progress when they face obstacles and demonstrate effort and perseverance (Au et al., 2015). Dweck (2016) suggests that individuals with a growth mindset are courageous, are not discouraged by failure, and are more resilient in the face of challenges, which leads to greater success.

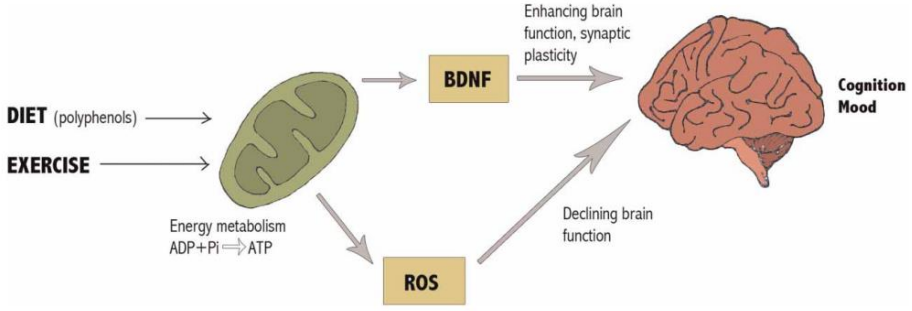
Nutrition and growth mindset

Nutrition and its effects on neuroscience have become a research area. Nutritional cognitive neuroscience is a rapidly expanding interdisciplinary field that seeks to understand the impact of nutrition on cognitive and brain health (Zamroziewicz & Barbey, 2016). Studies in this field have found that nutrition affects brain structure and function across a wide range of diets, from specific nutrients to whole diets (Polidori et al., 2021).

Food intake stimulates metabolic processes found in mitochondria, which are the main vessels of energy metabolism that convert organic matter in the body into available energy. Mitochondrial activity can modulate neural signaling pathways and molecules depending on neuronal function. This relationship between metabolic activity and neuronal function suggests that our nutritional and exercise habits can influence the molecular mechanisms that define our mental learning capacity. BDNF (Brain Derived Neurotrophic Factor) is the most active neurotrophin in brain regions associated with cognition, such as the hippocampus and cerebral cortex. BDNF is known for its effect on the maintenance, survival, growth, and differentiation of neurons. BDNF is critical for normal neural development, as it enhances learning capacity and memory formation by stimulating synaptic plasticity in neurons (Zuccato & Cattaneo, 2009)

Figure 1

Energy Metabolism and Cognition (Gomez-Pinilla ve Nguyen, 2012).



BDNF affects various aspects of energy metabolism and a mutation in the BDNF receptor tyrosine kinase can lead to metabolic disorders such as obesity by causing extremes in brain energy balance. BDNF demonstrates close involvement in energy metabolism processes, and neuronal plasticity indicates a connection between diet intake and brain function. Nutrition and exercise can affect cellular metabolic activity which also affects neuronal plasticity and cognitive processes. It is possible for ATP produced by energy metabolism to activate BDNF, a molecule that increases synaptic plasticity. Energy production also produces oxidative byproducts known as ROS, which can lead to excessive levels of oxidative stress. Oxidative stress weakens synaptic plasticity and cognitive function (Gomez-Pinilla & Nguyen, 2012). Synaptic plasticity is related to brain development and can indirectly be associated with

intelligence. There is a significant relationship between brain volume and intelligence. Brain volume can be associated with nutrition, and nutrition can also be assumed to affect a person's growth mindset.

METHOD

Research Model

The model of the study was designed with the causal comparison research model within the scope of quantitative research methods. The causal comparison model is a model that aims to determine which variables cause the differences between groups and the results of these differences without changing the conditions and participants (Büyüköztürk et al., 2013). The independent variables of the research are the consumption behaviors of animals, agriculture, and the chocolate-candy-salt group. The dependent variable of the study is the mental structure (growth and fixed mindset) characteristics of high school students.

Universe-Sample

The universe of the study is 6 million 543 thousand 599 students studying in high schools in Türkiye. While determining the number of people in the sample, a simple random sampling method was used to provide the quantitative representation power of the high school students in the universe. The number of people in the sample was reached with the sample calculation formula (Özdamar, 2003).

$$n = \frac{N.\sigma^2.Z\alpha}{(N-1).d^2}$$

While making calculations based on the sampling formula, the number of people in the population (N)=6.543.599, the standard deviation of the population ( )= 7,10; Z = 0.05, a value of 1.96 was accepted as an acceptable error level (d)=0.5, $n = \frac{6.543.599*7,10^2*1,96}{(6.543.599-1)*0,5^2}$ =395. The minimum number of students that should be in the sample was calculated as 395.

Table 2

Statistical Data About the Sample Group

Gender	Frequency (f)	Percentage (%)
Female	2340	61,9
Male	1442	38,1
The type of the school		
Anatolian High School	2997	79,2
Vocational High School	617	16,4
Science and Social Sciences High School	168	4,4
Grade		
9	1259	33,3
10	1485	39,3
11	1038	27,4
Region		
Mediterranean	641	16,96
Black Sea	316	8,35
Aegean	412	10,89
Marmara	1175	31,07
Central Anatolia	723	19,12
Eastern Anatolia	207	5,47
Southeast Anatolia	308	8,14
Total	3782	100

The sample of the study consists of 3782 students studying at high schools in different regions of Turkey. While 61.9% of the students in the sample are girls, 38.1% are boys. 79.2% of the students study at Anatolian High School, 16.4% at Vocational High School, and 4.4% at Science and Social Sciences High School. 33.3% of the students are in the 9th grade, 39.3% are in the 10th grade, and 27.4% are in the 11th grade. 16.96% of the students are in the Mediterranean Region of Türkiye, 8.35% in the Black Sea Region, 10.89% in the Aegean Region, 31.07% in the Marmara Region, 19.12% in the Central Anatolia Region, 5.47% of them study at schools in the Eastern Anatolia Region and 8.14% in the Southeastern Anatolia Region.

Data Collection Tools

In the study, the "Mindset Theory Scale" was used to describe the mental structures of high school students and the "Personal Information Form" was developed by the researchers to determine some demographic characteristics.

Mindset Theory Scale

The Mindset Theory Scale (MTS) developed by Yılmaz (2021) was used to describe the mental structures of high school students. MTS consists of 13 items. Exploratory (EFA) and confirmatory factor analysis (CFA) was applied to determine the construct validity of the scale. The four-factor structure of the scale was confirmed by CFA. In addition, the differences between the averages of the upper and lower groups of 27% in the scale items were significant. The results of the reliability analysis found .72 for the procrastination sub-dimension of the fixed mindset dimension, .80 for the belief in invariance, .70 for the effort sub-dimension of the growth mindset dimension of the Mindset Theory Scale (MTS), and .77 for the belief in improvement. The internal consistency coefficient for the fixed mindset dimension of the Mindset Theory Scale was .72, and .71 for the growth mindset dimension. MTS can

be scored separately with its dimensions and its sub-dimensions. A score between 7 and 35 is taken from the fixed mindset dimension of the MTS, and between 6 and 30 from the growth mindset dimension of the MTS (Yılmaz, 2021). This study used the fixed and growth mindset dimensions of MTS. In the study sample, the internal consistency coefficient for the fixed mindset dimension of the MTS is .83 and .84 for the growth mindset dimension. The reliability coefficient of the whole MTS is .87.

Data Collection

"Mindset Theory Scale" and "Personal Information Form" have been turned into online forms. The link of the data collection tools was sent to the sampled people. On the other hand, verbal explanations were made through messages and calls where people who wanted to voluntarily answer the questions in the data collection tool had difficulties in understanding or wanted an explanation.

While determining the food consumption of the students, answers were obtained by creating categories based on units for fruit, eggs, sugar, and salty foods, glasses for milk, plate units for meat and meat products group, and vegetables and grains group. The Plate Model has been recommended by the Swedish diabetes association and the British nutrition group committee diabetes association since 1987. The Plate Model is an effective method used in improving the intelligibility of visual messages, placing them in memory, and estimating the portion amount without errors. It is an effective model for measuring, determining, and calculating the amount of food consumed by people whether at home or outside (Haven et al., 2006; Neuman, 2011).

Data Analysis

The presence of missing data in the data collected within the scope of the research was examined. According to Acuna and Rodrigue (2004), it can be tolerated if the missing data rate is less than 5% and shows a random distribution. Considering this criterion, 15 missing data were removed from the data set with this review. While examining the assumption of normality in the collected data set, one-way outliers can be checked by converting the scores for the items into Z scores (Tabachnick & Fidell, 2007). Firstly, 53 data whose Z value was outside the range of +3 and -3 were accepted as univariate outliers and were removed from the data set. Then, the normality of the data set collected in the study was tested with the skewness and kurtosis coefficient.

Table 3

Normality Values of Study Data

Dimensions and sub-dimensions of MTS	Average	Median	Mode	Skewness Coefficient	Kurtosis Coefficient
Fixed mindset	17,21	17	16	.365	-.362
Growth mindset	23,68	24	24	.047	-.184

According to George and Mallery (2016), if the skewness and kurtosis values are between -2 and +2, the distribution can be accepted as the normal distribution. The skewness coefficients of the fixed and growth mindsets are respectively .365 and -.362. The kurtosis coefficients of the Constant and Growth mindsets are respectively .47

and -.184. Since these values are in the range of -2 to +2, it is accepted that the data set provides normality assumptions.

Factorial ANOVA was tested on the differentiation of students' Fixed and Growth Mindsets according to their meat-meat products, dairy-dairy products, eggs, grains, vegetables, and fruits. A one-way ANOVA test was used to differentiate students' fixed and growth mindsets according to their chocolate, candy, and salty consumption behaviors. The homogeneity of the groups was tested with the Levene test. Tukey test was used to determine the source of differentiation in the dimensions that differed as a result of the ANOVA test. The significance level of the study was accepted as p<.05. IBM SPSS Statistics for Windows was used in the analysis of the data. According to Cohen (1988), the effect size is "low" in the range of 0.01 - 0.06, a range of 0.06 - .138 is defined as "medium", and .138 and greater is defined as "large".

FINDINGS

Factorial ANOVA was conducted to compare the interaction effect of mindset theories on growth mindsets according to the protein animal product group (meat, egg, and milk) nutritional behaviors of the students.

Table 4

The Results of the Factorial Anova Test Show the Comparison of Growth Mindsets According to the Nutritional Behaviors of the Students' Animal Product Group (Meat, Egg and Milk)

Source of Variance	Sum of Squares	df	Mean Square	F	η^2
Meat and meat group	58,59	3	19,53	1,50	,001
Egg	196,72	3	65,57	5,05**	,002
Milk	109,51	3	36,50	2,81*	,001
Meat and meat group * Egg	95,00	9	10,55	,81	,001
Meat and meat group * Milk and dairy products	145,04	9	16,11	1,24	,002
Eggs * Milk and dairy products	253,05	9	28,11	2,16*	,003
Meat and meat group * Eggs * Milk and dairy products	458,86	27	16,99	1,30	,005
Error	95410, 75	7351	12,97		

*p < .05; **p < .01

According to the results of the analysis, the meat consumption behaviors of the students did not make a significant difference in the growth mindsets (F=1.50; p>.05). Egg consumption behaviors of students on growth mindsets made a significant difference (F=5,05; p<.01, $\eta^2 = .002$). Milk consumption behaviors of students with growth mindsets made a significant difference (F=2,81; p<.05, $\eta^2 = .001$). The egg and milk consumption behaviors of students have a low level of influence. The interaction of the students' egg and milk consumption behaviors made a significant difference in the students' growth mindsets (F=2,16; p<.05, $\eta^2 = .003$). Meat*egg, meat*milk, and meat*milk*egg interactive consumption behaviors of students did not make a significant difference in growth mindsets (p>.05).

Tukey's multiple comparison tests were applied to determine which group or groups had a significant difference. The number of students who consume eggs every day is significantly higher than the students who have eating behaviors that do not consume once every two days, once a week, and never (p<.05).

Table 5

Factorial ANOVA Test Results Showing the Comparison of Fixed Mindset According to the Nutritional Behaviors of the Students' Animal Product Group (Meat, Egg and Milk)

Source of Variance	Sum of Squares	df	Mean Square	F	η^2
Meat and meat group	319,906	3	106,635	4,62**	,002
Egg	183,455	3	61,152	2,65*	,001
Milk	109,474	3	36,491	1,58	,001
Meat and meat group * Egg	507,138	9	56,349	2,44*	,003
Meat and meat group * Milk and dairy products	409,419	9	45,491	1,97*	,002
Eggs * Milk and dairy products	255,186	9	28,354	1,23	,002
Meat and meat group * Eggs * Milk and dairy products	751,737	27	27,842	1,20	,004
Error	169326,829	7351	23,035		

*p < .05; **p < .01

According to the results of the analysis, the meat consumption behaviors of the students with fixed mindsets made a significant difference (F=4;62 p<.01, $\eta^2 = .002$). Meat consumption behaviors of students have a low level of influence. The fixed mindset scores of the students who show meat consumption behaviors every day are significantly higher than those of the students who have eating behaviors that do not consume once every other day, once a week, and never (p<.05).

The egg consumption behaviors of the students with fixed mindsets made a significant difference (F=2,65; p<.05, $\eta^2 = .001$). Students' egg consumption behaviors have a low level of influence. The students who do not show egg consumption behaviors have significantly higher fixed mindset scores than the students who consume it every day, every other day, or once a week. The fixed mindset scores of the students who show egg consumption behaviors every day are significantly lower than those of the students who consume once a week and do not consume eggs (p<.01). The fixed mindset scores of the students who showed egg consumption behaviors at intervals of one day were significantly lower than those of the students who showed egg consumption every day and once a week, and behaviors that did not consume eggs at all (p<.01). While the fixed mindset scores of the students who have egg consumption behaviors once a week are significantly higher than those who do not show any egg consumption behaviors, it is significantly higher than those who consume it every day and every other day (p<.01).

Milk consumption behaviors of students with a fixed mindset did not make a significant difference (F=1.58; p>.05). The interaction of the students' meat and egg consumption behaviors made a significant difference in the students' fixed mindset (F=2,44; p<.05, $\eta^2 = .003$). The interaction of the students' meat and milk consumption behaviors made a significant difference in the students' fixed mindset (F=1,94; p<.05, $\eta^2 = .002$). Egg*milk and

meat*milk*egg interactive consumption behaviors of students did not make a significant difference in growth mindsets (p>.05).

Table 6

Factorial ANOVA Test Results Showing the Comparison of Growth Mindsets According to the Students' Agricultural Group (Vegetable, Fruit and Grain) Nutritional Behaviors

Source of Variance	Sum of Squares	df	Mean Square	F	η^2
Fruits	274,82	3	91,60	7,06**	,003
Vegetables	108,29	3	36,09	2,78*	,001
Grain	287,26	3	95,75	7,38**	,003
Fruits * Vegetables	231,37	9	25,70	1,98*	,002
Fruits *Grain	146,11	9	16,23	1,25	,002
Vegetables *Grain	113,24	9	12,58	,971	,001
Fruits * Vegetables * Grain	393,69	27	14,58	1,12	,004
Error	95410,75	7351	12,97		

*p < .05; **p < .01

According to the results of the analysis, the fruit consumption behaviors of the students with the growth mindset made a significant difference (F=7,06; p<.01, $\eta^2 = .003$). According to the multiple comparison analyses, the growth mindset scores of the students who display fruit group consumption behaviors every day are significantly higher than those of the students who do not consume at all, consume once a week, and consume every other day (p<.05). The growth mindset scores of the students who show fruit group consumption behaviors with one-day interval are significantly higher than those of the students who do not consume fruit at all and show consumption behaviors once a week (p<.05). Fruit group consumption behaviors of students have a low level of effect on their growth mindsets.

The vegetable group consumption behaviors of the students and their growth mindset scores made a significant difference (F=2,78; p<.05, $\eta^2 = .001$). The vegetable group consumption behaviors of the students have a low effect on the growth mindset. Grain group consumption behaviors and growth mindset scores of the students made a significant difference (F=7,88; p<.01, $\eta^2 = .003$). Grain group consumption behaviors of students have a low effect on growth mindset. The interaction of the fruit and vegetable consumption behaviors of the students made a significant difference in the growth mindsets of students (F=1,198; p<.05, $\eta^2 = .002$)

According to the multiple comparison analyses, students who eat vegetables and grains every day have growth mindset scores that are significantly higher than those who either never consume these foods, eat them once a week, or eat them every other day, based on their fruit and vegetable consumption categories (p<.05). The growth mindset scores of the students who showed consumption behaviors of vegetables and grains in one-day intervals were significantly higher than those of students who did not consume any vegetable and grain group foods and showed consumption behaviors once a week (p<.05). The growth mindset scores of the students who showed grain group food consumption behaviors once a week were significantly higher than those of the students who did not show any consumption behaviors (p<.05).

Table 7

Factorial ANOVA Test Results Showing the Comparison of Fixed Mindsets According to the Students' Agricultural Group (Vegetable, Fruit and Grain) Nutritional Behaviors

Source of Variance	Sum of Squares	df	Mean Square	F	η^2
Fruits	253,08	3	84,36	3,65 *	,001
Vegetables	236,79	3	78,93	3,41 *	,001
Grain	526,31	3	175,43	7,59 **	,003
Fruits * Vegetables	112,16	9	12,46	,54	,001
Fruits * Grain	388,20	9	43,13	1,86	,002
Vegetables * Grain	135,63	9	15,07	,65	,001
Fruits * Vegetables * Grain	622,68	27	23,06	,99	,004
Error	95410,75	7351	12,97		

*p < .05; **p < .01

According to the results of the analysis, fruit consumption behaviors of the students made a significant difference in the fixed mindset scores (F=73,65; p<.05, $\eta^2 = .001$). Fruit group consumption behaviors of students have a low level of effect on their growth mindsets. According to the multiple comparison analyses, the fixed mindset scores of the students who display fruit group consumption behaviors every day are significantly lower than those of the students who do not consume it at all and consume it once a week (p<.01). The fixed mindset scores of the students who showed fruit group consumption behaviors at intervals of one day were significantly lower than those of the students who did not consume fruit at all and showed consumption behaviors once a week (p<.01).

The vegetable group consumption behaviors of the students and their fixed mindset scores made a significant difference F=3,41; p<.01, $\eta^2 = .001$). Grain group consumption behaviors of students and fixed mindset scores made a significant difference F=7,59; p<.01, $\eta^2 = .003$). The grain group and vegetable group consumption behaviors of the students each have a low effect on the growth mindset.

The fixed mindset scores of the students who show vegetable and grain consumption behaviors every day are significantly lower than the students who do not consume at all and consume once a week (p<.01). The fixed mindset scores of the students who showed consumption behaviors of vegetables and grains at intervals of one day were significantly lower than those of the students who did not consume any vegetable group foods (p<.01) and who showed consumption behaviors once a week (p<.05). The growth mindset scores of students who show grain and vegetable group food consumption behaviors once a week are significantly higher than those of students who do not show any consumption behaviors (p<.01).

Table 8

Findings Related to Comparisons between Fixed and Growth Mindset Scores According to Chocolate, Candy, and Salty Group Food Consumption Behavior Variable

Mindset theory	**Chocolate, Sugar, and Salty Consumption**	**n**	$\overline{X}$	**ss**	**Levene's Test; p**	**F**	**Difference Between Groups (Tukey)**
Fixed mindset	A. Never	348	17,36	4,74	2,38;p>.05	7,73**	B<D C<D
	B. Once a week	1839	16,89	4,72			
	C. Every other day	2612	17,10	4,72			
	D. Every day	2616	17,55	4,91			
Growth mindset	A. Never	348	24,41	3,69	1,70; p>.05	8,46**	A<B, A<C, A<D, B<D
	B. Once a week	1839	23,87	3,58			
	C. Every other day	2612	23,63	3,60			
	D. Every day	2616	23,51	3,68			

*p < .05; **p < .01

According to the results of the analysis, the fixed mindset dimension score average does not differ significantly according to the chocolate, candy, and salty consumption behaviors of the students (F=7.73; p>.01). As a result of the Tukey test, the fixed mindset scores of the students who consume chocolate, candy, and salty groups every day are significantly higher than those of the students who consume it once a week and every day (p<.05). There was no significant difference between the other groups (p>.05)

When the results of the one-way ANOVA test are examined, the growth mindset dimension average score does not differ significantly according to the consumption behaviors of the chocolate, candy, and salty groups (F=8.46; p>.01). As a result of the Tukey test, the growth mindset scores of students with behaviors of never consuming chocolate, candy and salty foods were significantly higher than those of students in other groups (p<.05). Similarly, the growth mindset scores of the students who have the behavior of consuming chocolate, candy and salty group foods once a week are significantly higher than those of the students who have the behavior of consuming every day (p<.05). There was no significant difference between the other groups (p>.05).

Discussion, Conclusion and Recommendations

While meat consumption behaviors of students did not make a significant difference in growth mindsets, egg, and milk consumption behaviors made a significant difference. The growth mindset scores of the students who consume eggs every day are significantly higher than those of the students who have eating behaviors that do not consume once every two days, once a week, and never. According to the results of the analysis, the meat and egg consumption behaviors of the students with fixed mindsets made a significant difference. While the fixed mindset scores of the students who show meat consumption behaviors every day are significantly higher, the fixed mindset scores of the

students who consume eggs every other day are significantly lower. The animal product group (meat, egg, and milk) of the students have a low level of influence on the growth mindsets of their nutritional behaviors.

Some studies have shown that nutrition and interactive food groups have positive effects on cognitive performance from many nutrients, mediated by cortical volume in certain brain regions (Gomez-Pinilla & Nguyen, 2012; Zamroziewicz et al., 2015; Zamroziewicz & Barbey, 2016). Positive changes in nutritional behaviors, cognition, and brain volume of individuals may lead to beliefs that they can improve their intelligence and abilities. A study by Suzuki et al. (2019) found that animal-based foods such as cheese negatively affect cognition. Boyle et al. (2019) found that products derived from bovine milk reduce stress and positively affect cognitive performance, attention, and concentration. The positive effect of egg consumption on the growth mindset is a remarkable finding of the research. The egg is a food rich in vitamin D (Barnkob et al., 2020; Baysal 2014; Eskici, 2020; Morse 2012) also vitamin D3 and 25(OH)D3 are found in animal foods such as fish, meat, offal, eggs, milk, and dairy products (Ovesen et al., 2003). Vitamin D has positive effects on cognitive skills (Ma et al., 2019; Owusu et al., 2019; Sultan et al., 2020; Zajac et al., 2020). As can be understood from these explanations, feeding behaviors based on animal products can affect growth mindsets.

Agricultural group (vegetable, fruit, and grain) nutritional behaviors made a significant difference in the growth and fixed mindsets of the students. The growth mindset scores of the students who show nutritional consumption behaviors in the agricultural group every day and every two days are significantly higher. The students' agricultural group (Vegetable, Fruit, and Grain) nutrition behaviors have a low level of influence on their growth mindsets. The fact that students have no and low level of the agricultural group (vegetable, fruit, and grain) nutrition behaviors causes a significant increase in fixed mindset scores but has a low level of effect.

Studies have found positive effects of fish, grains, fruits, and vegetables on individuals' cognition and neurological skills. In particular, the traditional Mediterranean diet is considered to be particularly beneficial (Alcalay et al., 2012; Dauncey, 2015; Edwards et al., 2020; Kuroda et al., 2019; Psaltopoulou et al., 2013; Uenobe et al., 2019). According to the results of this research, we can assume that the positive effects of agricultural product consumption behaviors on cognition may also affect growth mindsets. It is rich in plant-based polyphenols, anthocyanins, carotenoids, flavonoids, folic acid, vitamins, and fiber, and these are also necessary for normal brain function (Dyall et al., 2015; Román et al., 2019).

Growth mindsets are associated with greater self-confidence, resilience, and positive emotions, while fixed mindsets are associated with greater anxiety, stress, and self-devaluation. Growth mindsets lead to higher serotonin levels, and fixed mindsets lead to higher cortisol levels (McCarthy, 2022). People with growth mindsets are generally less stressed, live happier, and continue to work hard despite setbacks (Andrews, 2014). Since serotonin is synthesized from the amino acid tryptophan in the brain, consuming foods containing tryptophan (meat, fish, chicken, eggs, milk, yogurt, cheese, nuts, fruit, and vegetables) helps people feel calmer, happier, and more energetic (Eskici, 2020). Furthermore, certain food groups such as fruits and vegetables, legumes, whole grains, nuts, and olive oil included in the diet can improve cognitive function (Mottaghi et al., 2018; Román et al., 2019; Theodore et al., 2021). According to these explanations, students' nutritional habits based on agricultural products may affect their growth mindsets.

The fixed mindset dimension point average does not differ significantly according to the chocolate, candy, and salty consumption behaviors of the students. The fixed mindset scores of the students who consume chocolate, candy, and salty groups every day are significantly higher than those of the students who consume it once a week and every other day. The growth mindset scores of students with behaviors that never consume chocolate, candy, and salty foods are significantly higher than those of students in other groups. Longitudinal studies have shown that unhealthy Western dietary habits, including consumption of sugary drinks, refined foods, fried foods, processed meat, refined grains and high-fat dairy products, biscuits, appetizers, and pastries, are associated with an increased risk of depression (Mengi, 2016; Özenoğlu, 2018). These findings support the research results. It may cause students to develop negative feelings towards the abilities of chocolate, sweets, and salty foods. As a result, nutrition, nutritional management, and strategies may be effective in preventing cognitive impairment (Gutierrez et al., 2021), and it shows that certain food groups regulate the engagement of neural systems (Key et al., 2019). From all the discussions, we can think that the nutritional behaviors of the students affect both their cognition skills and their emotional states. Growth mindsets are an individual's belief in their abilities. Both the cognition and the affective dimensions of this belief can be affected by the individual's eating behaviors.

According to the results of the research, growth mindsets affect the nutritional behaviors of students. Actions can be developed for students' awareness of healthy eating behaviors. When the effects of chocolate, sweets, and salty foods on fixed mindset and the nutritional opportunities of students in schools are evaluated together, measures can be taken to reach school-based healthy nutrition products and develop policies related to this.

In the study, the nutritional behaviors of the students were measured according to the answers they gave through the questionnaire and collected in the form of categorical data. Similar studies can be carried out by collecting the food consumption of students on the same subject with the data obtained with proportional scales.

This study was conducted with a sample of high school students. A similar study can be carried out on children studying at different educational levels.

Ethic

I declare that the research was conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Author Contributions

This article was written with the joint contributions of two authors.

Conflict of Interest

The authors declare that they have no conflict of interest.

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