

## **Evaluation of the dietary behavioral attitudes and common dietary pattern among Children with autism spectrum disorders**

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### **ABSTRACT**

*The main objective of conducting the current study is to investigate the dietary behavioral attitudes and common dietary pattern that occur among autistic children. Fifty-six subjects diagnosed with autism spectrum disorders (ASD) involved in the study aged from 3-20 years old. All the participants filled out a survey that included questions about lifestyle, family history with ASD, dietary patterns of a specific food, allergies, gastrointestinal (GI) symptoms and measured body mass index (BMI). The collected data showed that dietary attitudes of autistic children are almost normal as 50% of participants consume 3 meals per day, and 14.3% have 4 meals per day. In addition, 80.4% (n= 45) of children were having breakfast every day. Also, based on the collected data GI problems were been prevalence among 32% of the participants. Most of the subjects (85.7%) do not suffer from milk allergies; also, most of them (91%) are not following either casein or gluten free diets. There are no significant differences in BMI between the children with and without GI problems ( $p=0.838$ , independent samples  $t$ -test). In addition, BMI is not associated with the severity level of GI problems ( $p=0.884$ , ANOVA test).*

**Keywords:** ASD, dietary pattern, behavior, BMI.

## **INTRODUCTION**

Autism spectrum disorder (ASD), is listed under the pervasive developmental disorders based on the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV diagnostic criteria, is defined as a neuro developmental disorder that usually appears as problems in social interaction, difficulties in the skills of communications and repetitive behaviors (APA, 2013).

Previous studies showed that children diagnosis with ASD according to the DSM-IV criteria have Attention Deficit / Hyperactivity Disorder (ADHD) (Rao and Landa, 2014). Other studies conducted to evaluate hyperactivity disorder among children with ASD found that 29% of children with ASD also demonstrated clinically significant levels of hyper-activity disorder and attention deficit (Sinzig et al., 2009).

Updated prevalence in 2017 by May et al. claimed that the number of the children who are diagnosed with autism spectrum disorder is increasing (May et al., 2017; Hansen et al., 2015). Despite its increasing rate, currently autism remains

untreatable (Sharma et al., 2013). In addition, the dietary habits must be looked for as they can help in finding the high-risk foods that may affect their children (Salhia et al., 2014).

A high prevalence of feeding problems and unusual eating behaviors, partly associated with GI problems, have been reported in ASD (Leader et al., 2020). A meta-analysis revealed that a child with ASD is five times more likely to exhibit feeding difficulties compared a child without ASD. The commonly identified issues include food selectivity, defined as eating only a narrow variety of foods, as well as aggression, or tantrums, during mealtime, or different eating rituals and stereotypes. In children with feeding difficulties, more severe ASD symptoms were observed than in children free of feeding problems (Sharp et al., 2018).

Thus, the present study aimed to investigate the dietary behavioral attitudes and common dietary patterns that occur among autistic children.

## **SUBJECTS AND METHODS**

### **Study design:**

56 Subjects (aged from 3 to 20 years old) were selected from attendees to a random specialized centers of autism spectrum disorder, Shebin Elkom, Menofia governorate, Egypt. Study was excluded some subjects who filled out a piece of incorrect information (such as unmatched height with body weight or age), also who did not meet the inclusion criteria (previous diagnosis with ASD and aged up to 20 years) were excluded as well. The collection of the subject's data (N=56) was cross-sectionally, and all the provided data were self-reported by parents/ caregivers.

### ***Anthropometric measurements***

Height and body weight were measured and the body mass index (BMI) was obtained by dividing body mass in kg by the square of the height (m<sup>2</sup>) based on the WHO formula and classification (WHO, 2004).

### ***Collected data***

Socioeconomic status, health history, food habits, and nutritional intake data were

collected using a validated and reliable questionnaire.

The dietary consumption was estimated by a food frequency questionnaire conducted (two weekdays and a weekend day).

### ***Statistical Analysis***

The results were carried out using the Statistical Package for the Social Sciences program (SPSS software version 10). For descriptive data, frequency and percentage rate was used. The distribution of anthropometric measurements were presented as Mean  $\pm$  SD. Pearson's Chi-square assessed the differences among autistic children. The level of statistical significance was set as (P $\leq$ 0.05) (Gomez and Gomez, 1984).

## **THE RESULTS**

A cross sectional study aimed to evaluate the association between the dietary behavioral attitudes and common dietary patterns that occur among autistic children.

From the Table (1) the mean of age was 9.1 $\pm$  3.8. The mean of body weight was 34.3 $\pm$ 17.9 kg. BMI ranged from 10kg/m<sup>2</sup> to 41 kg/m<sup>2</sup> by mean 20 kg/m<sup>2</sup> for fifty

children. There is no significant difference in BMI between the children with and without GI problems ( $p=.838$ , independent samples t-test). In addition, BMI is not associated with the severity level of GI problems ( $P=.884$ , ANOVA test).

### ***Family history of autistic children***

As shown in figure 2 the results demonstrated that 12.5% ( $N=7$ ) of the autistic children have family members diagnosed with ASD. The monthly income of 40% ( $N=22$ ) of children families was between 5000-10000 pound.

### ***Lifestyle***

The results demonstrated that 62.5% ( $n=35$ ) of children were having hyperactivity, and 12.5% ( $n=7$ ) of them have being Lethargy. Although, 46.4% ( $n=26$ ) of children spent less than 2 hours on screen time per day, while there are 14.3% ( $n=8$ ) were having 4-6 hours or more of screen time per day (figure 2). For sleeping hours, almost half of the children 46.4% ( $n=26$ ) had 6-7 hours of sleeping per day. While 14.3% ( $n=8$ ) were having 4-5 hours of sleeping per day

### ***Dietary patterns and behaviors***

The results showed that the eating style of autistic children is almost normal. Whereas 50% ( $n=28$ ) of children have 3 meals per day, and 14.3 % ( $n=8$ ) consume four meals per day. However, 5.4% ( $n=3$ ) were having only one meal per day (figure 3).

The results demonstrated that 80.4% ( $n=45$ ) of children were having breakfast every day, and 58.9 % ( $n=33$ ) of children does not ignore any meal. In addition, they were 17.9% ( $n=10$ ) were ignore breakfast, 17.9% ( $n=10$ ) were ignore the dinner, and 5.4% ( $n=3$ ) wear ignore the lunch. Also, 62.5% ( $n=35$ ) of children were eating while watching TV (figure 3).

### ***Gastrointestinal problems among autistic children:***

GI problems were been prevalent among 32% ( $n=18$ ) of autistic children. In addition, most of the collected cases evaluated their GI severity problems from mild to moderate (76.5%) based on a pain assessment tool that was attached to the survey. The symptoms mentioned by the subjects were as follows: the difficulty of swallowing, vomiting, constipation, bloating – flatu-

lence, maldigestion, and 23.3% of their symptoms were last between 1-4 days per a week.

The collected data proved that 68.4% of ASD children who practice PA or exercises did not suffer from GI problems. However, 32.6% (n=6) of the autistic children who did not incorporate the PA in their lifestyle suffered from GI disorders issues. Moreover, 31.4% of ASD children, who are hyperactive, suffer from GI problems and 68.6% of hyperactive children did not suffer from GI problems.

#### ***Milk and yogurt consumption:***

The results showed that 85.71% (n= 48) of the subjects do not suffer from milk allergies, and 30.35 % (n=17) of the children do incorporate milk in their diet for more than 3 times a week (figure 4). At the same time, 23.2 % (n = 13) of the children consume the yogurt for more than 3 times a week. However, 41 % (n = 23) of them did not consume milk at all, and 28.5 % (n = 16) also did not include yogurt in their diet (figure 4).

#### ***Specific dietary pattern:***

Based on the data (figure 5) the dietary pattern of most of the autistic children cases did not follow any specific diet (83.9%, n = 47), as shown in the data, 91% (n = 51) are not following either casein or gluten-free diets.

#### ***Supplements:***

In the present data shows that 26.78% (n=15) of the subjects consume supplements as 25% (n=14) consume omega 3 fatty acid supplements, as there are other types of supplementation was mentioned by the parents / caregivers, such as multivitamins, vitamin D, iron and milk formula (figure 5).

## **DISCUSSION:**

The present study aimed to evaluate the dietary behavioral attitudes and common dietary patterns of children with autism spectrum disorders. Families and caregivers of persons with ASD face numerous, challenges due to the diversity, of problems correlating with ASD. GI and nutrition-related problems are often getting less attention in comparison to behavioral or other

clinical concerns (**Hyman et al., 2020**).

The results found that the mean body weight was  $34.3 \pm 17.9$  kg, and BMI by means of 20 kg/m<sup>2</sup>. On the same line, a cross-sectional electronic medical record review with 70 ASD children aged 2 -17 years old found that 86.6% of the samples were in the normal level of BMI, 5.7% were underweight, 15.7% were overweight and 10% were obese (**Sharp et al., 2018**). Children with autism spectrum disorder (ASD) are more likely to become overweight and obese than typically developing children, one critical period that has been identified for obesity development among typically developing children is early childhood, which also coincides with the period of adiposity rebound, occurring between 5 and 7 years of age as illustrated by **Eliaszew et al., (2021)**.

The results demonstrated that 12.5% of autistic children have family members diagnosed with ASD. In autism studies, scientists tend to focus on older siblings, children in families with a history of brain conditions are at increased

odds of being autistic as mentioned by **Xie et al., 2019**. In addition, children who have a first-degree relative, a sibling, or a parent with a brain condition other than autism have up to 4.7 times the usual odds of having autism (**Hansen et al., 2019**).

The current study showed that 62.5% (n= 35) of children were having hyperactivity, and 37.5% (n=21) of children were not having it at the same trend as the findings of **Rao and Landa, (2014)**. Other studies conducted to evaluate hyperactivity disorder among children with ASD found that 29% of children with ASD also demonstrated clinically significant levels of hyperactivity disorder and attention deficit (**Sinzig et al., 2009**). Previous scientific studies conducted to evaluate the hyperactivity disorder among children with ASD have shown that 53% of autistic participants demonstrated a sufficient number of ADHD symptoms to warrant a comorbid diagnosis of ADHD according to the DSM-IV. In the same line, the present results of this study showed that 46.4% (n=26) of children have less than 2 hours of screen time per day. The

recommendation of the American Academy of Pediatrics is no more than 1–2 h of screen-based media per day (AAP, 2001). Moreover, one study showed that the average number of hours for screening was 4.5 (**Mazurek et al., 2013**).

The results showed that 50% of children have 3 meals per day, however, 5.4% were having only 1 meal per day as illustrated in figure 3. In addition, they were ignore breakfast and dinner (17.9%), and 5.4% of them ignore lunch. In addition, 62.5% of children were eating while watching TV. A cross-sectional study by **Elnajjar in (2021)** stated the same feeding problems facing autistic child's parents. The problems stated were refusing new kinds of foods, no fixed time for the meals, eating less than three meals, loss of appetite, and skipping breakfast. The other 50% of the participants' children reported needing assistance during mealtime, skipping dinner, being distracted during the diet, skipping lunch, and preferring appropriate times for meals. Therefore, the study recommended preparing more nutrition education programs that needed to be organized to

increase awareness among the parents to improve the nutritional status of autistic children.

About 70% of children with ASD are reported to have some feeding problems. Besides the “picky eating”, other unwanted, mealtime behaviors noticed in ASD, like adherence to routines, resistance to new or non-preferred foods, or tantrums have been shown to adversely influence the diet composition of numerous children with ASD. In the present study with ASD, high rates of problem behavior related to food intake were demonstrated in boys and girls of all ages that correlated with the severity of ASD symptoms in ADI-R domains. There is evidence that feeding problems in ASD are of multifactorial origin, and they appear to be associated with the core behavioral characteristics of ASD. They reflect repetitiveness and preference for sameness, ritualism, unusual interest in sensory properties of food, but also diminished responsiveness to social reward, and increased reactivity in response to frustration (**Vissocker et al., 2015; Ashley et al., 2020**).

To some extent, food selectivity and feeding disorders are present in neurotypical children, but they are more severe in ASD. A study by **Peterson et al., (2019)** revealed that “picky eating” appears at an early age and escalates more quickly than in typically developing children. The food disfavor does not solve over time as the child grows, for that reason, it is not recommended to wait for the difficulties to fade or that the child will “grow out of the problem” (**Piazza et al., 2020**).

The most frequently omitted food group is vegetables, followed by fruits also the same behavior was reported in the study of **Tomova et al., (2020)**. Selective children with ASD often prefer foods with low nutritional value and high in fat, salt, and sugar (Sharp et al., 2018). Children with ASD were shown to have a lower protein intake, and their diets may be low in micronutrients (**Esteban-Figuerola et al., 2019**). Food has been shown to be a foreteller of the nutritional state of children with ASD. Mealtime problems and unusual dietary patterns are the factors contributing not only to undernutrition but also to a higher

risk of obesity in children with ASD (**Matheson and Douglas, 2017**).

Feeding troubles in ASD may stay disregarded by the healthcare providers. This is because selective eating patterns are not necessarily associated with a higher risk for growth retardation that is a marker of nutritional deficits and triggers clinical attention of pediatricians (**Sharp et al., 2013**). A study conducted in the United States demonstrated that there more GI problems among autistic children, especially those with full curtailed autism than in undiagnosed children. Moreover, increased severity of autism symptoms is linked with evaluated odds of having GI problems (**Wang et al., 2011**). Moreover, a meta-analysis included 15 studies that showed a wide prevalence of GI condition among autistic children (**Mc Elhanon et al., 2014**).

As the collected data showed that the most common GI problem mentioned by the subjects were constipation, bloating - flatulence, and maldigestion. Constipation and painful bowel movements are among the most

frequently GI disturbances reported (**Fulceri et al., 2105**). A cross-sectional study of GI symptoms in children with ASDs examined 50 children with ASD (**Valicenti-McDermott et al., 2006**). The results were that 70% of children with ASD were found to have a history of GI symptoms, including frequent constipation, frequent vomiting, abnormal stool pattern and frequent abdominal pain. Moreover, subjects with ASD were found to have a higher incidence of both constipation, and feeding issues, among the ASD group, 33.9% had constipation (**Ibrahim et al., 2009**).

A systematic review that included 6 trials (214 participants) from autistic children with the purpose to see the effectiveness of a gluten-free and casein-free (GFCF) diet as a treatment for autism spectrum disorders (ASD) in children had established that there were no statistically significant differences in ASD core symptoms between groups, as measured by standardized scales. Overall, they conclude that there is little evidence that a GFCF diet could be beneficial as a treatment for ASD symptoms among

children (**Piwowarczyk et al., 2018**). Moreover, the results of a study summarize that the intervention trials for evaluating the effects of a GFCF diet on autistic symptoms have been so far inconclusive and contradictory. Also, the evidence for supporting the therapeutic value of the GFCF diet is weak and limited, so as a result a GFCF diet should be only administered if there were any allergies or intolerance diagnosed toward nutritional gluten or casein (**Lange et. al., 2015**).

Moreover, a study that included 76 children with autism investigated those autistic participants were significantly less likely to consume the total recommended dairy servings compared to control groups (which included both typically developing children and children with developmental delay). As they indicated, the autism group had lower calcium intake and a higher prevalence of insufficient calcium intake compared to typical controls, likely associated to lower dairy consumption. (**Graf-Myles et al., 2013**).

## CONCLUSION

The current study aimed to identify the nutritional behaviors and common specific dietary patterns among children with an autism spectrum disorder. Children's parents reported the survey, as it was found that a group of autistic children was suffering from GI symptoms. In contrast, most of the children were not following any specific diet whether it was free from casein or gluten. In conclusion, autistic children may suffer from GI problems. However, these children do not follow any specific food pattern, as they believe that it does not have a significant impact on the symptoms of the GI tract. Overall, there is no such evidence that a specific diet such as casein or gluten-free diet can be beneficial for the GI symptoms of autistic children. Further studies are needed to identify the relationship.

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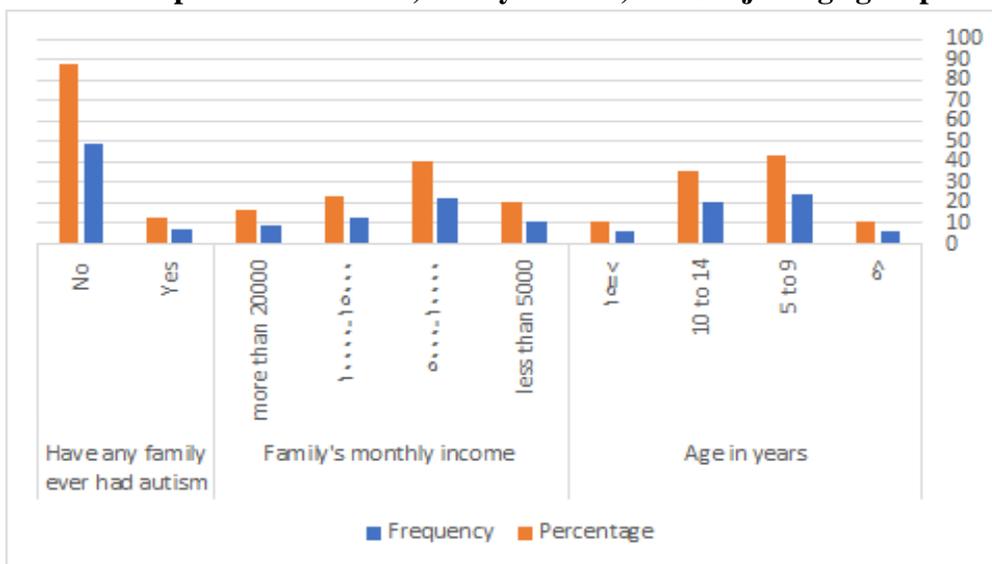
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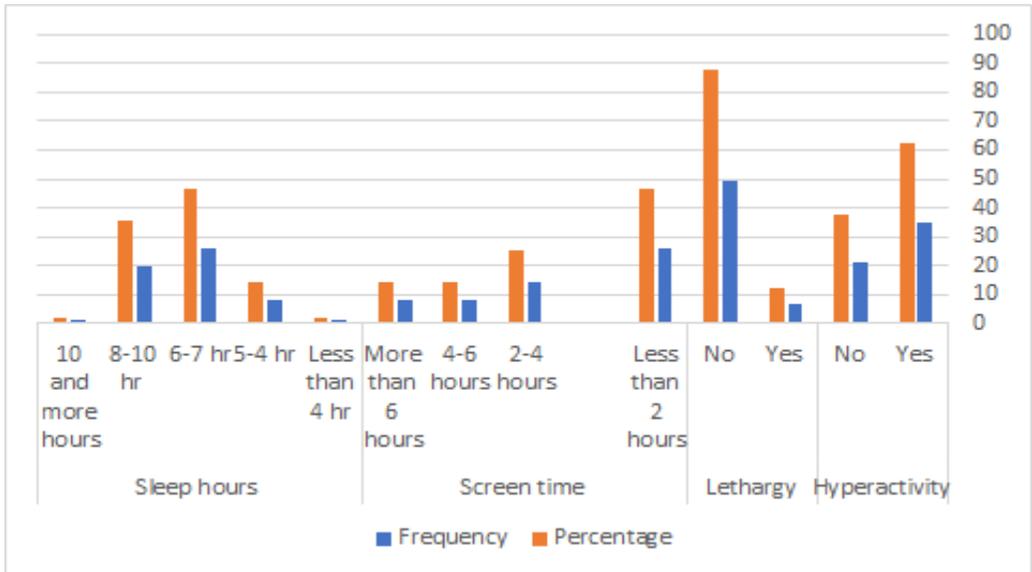
**Table1: anthropometric measurements variables of the children with ASD.**

Variable	N	Minimu m	Maximu m	Mean	Std. Deviation
Age (years)	56	3	20	9.1	3.8
Wt_kg	54	12	80	34.3	17.9
ht_cm	50	60	168	129.7	24.6
BMI kg/m <sup>2</sup>	50	10	41	20	6.21

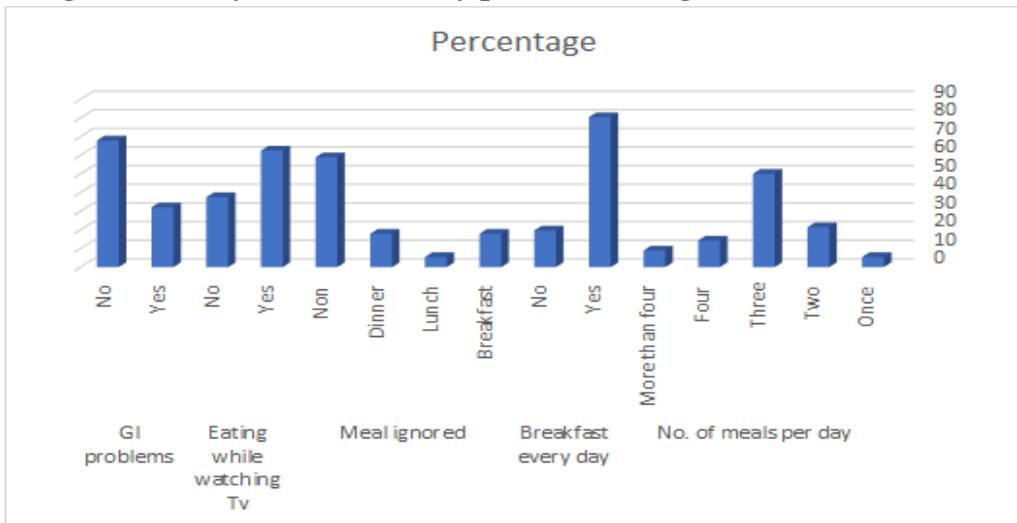
**Figure 1: analysis of general variables related to family history with Autism spectrum disorder, family income, and subject age group.**



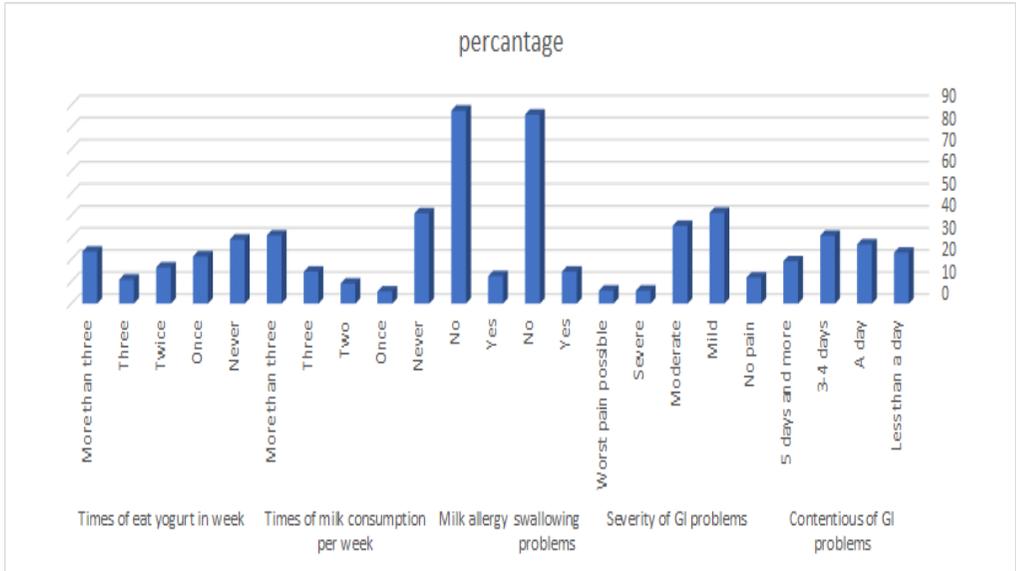
**Figure 2: The variables of sleeping patterns, screen time, lethargy and hyperactivity among autistic subjects.**



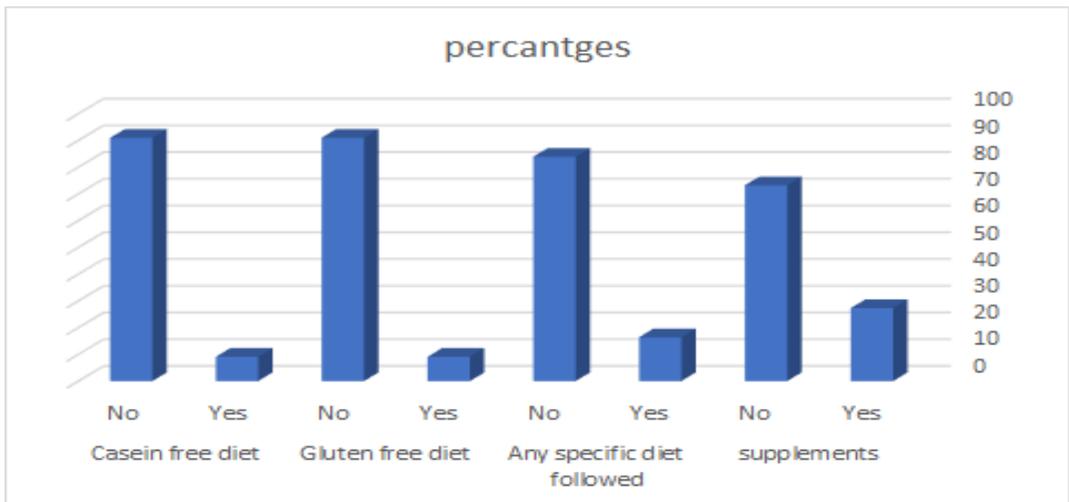
**Figure 3: Analysis of the dietary patterns among children with ASD.**



**Figure 4: comparison between milk and yogurt consumption per week, milk allergies and GI problems.**



**Figure 5: analysis of specific dietary approach and supplementation among autistic subjects.**



## تقييم الاتجاهات السلوكية والنمط الغذائي الشائع بين الأطفال المصابين بالتوحد

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قسم التغذية و علوم الأطعمة، كلية الاقتصاد المنزلي، جامعة المنوفية

### الملخص العربي

الهدف الأساسي من اجراء الدراسة الحالية هو التعرف على السلوكيات التغذوية و الأنماط الغذائية الشائعة لدى الأطفال المشخصين باضطراب التوحد، حيث شملت هذه الدراسة على ٥٦ طفل توحد من الفئة العمرية ٣-٢٠ سنة، وجميع المشتركين قاموا بالإجابة على أسئلة الاستبيان الذي تضمن أسئلة متعلقة بنمط الحياة، التاريخ المرضي للعائلة بالنسبة لاضطراب التوحد، النمط الغذائي للطفل، الحساسية الغذائية ومشاكل الجهاز الهضمي، وبناءً على البيانات التي تم جمعها أظهرت البيانات أن السلوكيات الغذائية للأطفال المصابين بالتوحد طبيعية تقريباً حيث أن ٥٠٪ من المشاركين يستهلكون ٣ وجبات يوميًا، و ١٤,٣٪ يتناولون ٤ وجبات يوميًا. بالإضافة إلى ذلك، كان ٨٠,٤٪ من الأطفال يتناولون وجبة الإفطار يوميًا. أيضًا، بناءً على البيانات التي تم جمعها، كانت مشاكل الجهاز الهضمي هي السائدة بين ٣٢٪ من المشاركين. معظم الأشخاص (٨٧,٥٪) لا يعانون من حساسية الحليب، كما أن معظمهم (٩١٪) لا يتبعون أيًا من النظام الغذائي الخالي من الكازين أو الجلوتين. لا توجد فروق ذات دلالة إحصائية في مؤشر كتلة الجسم بين الأطفال الذين يعانون من مشاكل الجهاز الهضمي والذين لا يعانون منها ( $p = 0.838$ )، اختبار  $t$  للعينات المستقلة). أيضًا، لا يرتبط مؤشر كتلة الجسم بمستوى خطورة مشاكل الجهاز الهضمي ( $p = .884$ )، اختبار (ANOVA).

**الكلمات المفتاحية:** اضطراب طيف التوحد، النمط الغذائي، السلوك، مؤشر كتلة الجسم.