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Disruptive patterns of eating behaviors and associated lifestyles in males with ADHD

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Background: Attention deficit hyperactivity disorder (ADHD) is a neurological/behavioral disorder characterized by inattention or hyperactivity and impulsivity, or combined symptomatology. Children with ADHD are predisposed to irregular and/or impulsive eating patterns often leading to compromised physical condition. The goal of the present study was to statistically evaluate parental scoring of patterned eating behaviors and associated lifestyles within a cohort of 100 boys diagnosed with ADHD in comparison to age-matched male controls.

Material/Methods: The study population consisted of 100 boys aged 6–10 years diagnosed with mixed type ADHD by DSM-IV criteria and 100 aged-matched healthy male control subjects. Patterns of eating behaviors and associated lifestyles were scored by structured parental interviews using a nominal rating scale.

Results: Interview scores indicated statistically significant differences in patterned eating behaviors in subjects with ADHD in comparison to healthy controls. Notably, subjects diagnosed with ADHD exhibited markedly diminished adherence to a traditional breakfast, lunch, and dinner schedule, which was linked to a significantly higher frequency (>5/day) of irregular eating times. In the ADHD cohort, disruptive patterns of eating behaviors were associated with diminished nutritional value of ingested food (expressed as lowered content of fruits and vegetables) and increased consumption of sweetened beverages.

Conclusions: Disruptive patterns of eating behaviors, metabolically unfavorable nutritional status, and diminished physical activities of male children diagnosed with ADHD are linked to compromised growth and development and appearance of metabolic diseases in adulthood.

MeSH Keywords: Attention Deficit Disorder with Hyperactivity – diagnosis • Attention Deficit Disorder with Hyperactivity – psychology • Feeding Behavior – psychology • Life Style • Pediatric Obesity

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Background

Attention deficit hyperactivity disorder (ADHD) is a widespread neurological/behavioral disorder predominantly affecting boys that is characterized by inattention or hyperactivity and impulsivity, or combined symptomatology [1–5]. Children diagnosed with ADHD are predisposed to aberrant or compromised growth and development functionally linked to complex symptomatological factors [6–9]. From nutritional and physiological perspectives, children diagnosed with ADHD are predisposed to irregular and/or impulsive eating patterns [10], often leading to compromised physical condition, high body mass indices (BMIs) [9,11], and, later in life, to associated metabolic disorders such as type II diabetes.

A 2005 meta-analysis of stratified clinical data attempted to statistically evaluate the prevalence of overweight subjects within populations of children diagnosed with ADHD [12]. Subsequently, a similar analysis indicated that a study population of children and adolescents diagnosed with ADD/ADHD and not currently being treated with psychostimulant medication had an approximately 50% greater risk of being overweight in comparison to healthy control subjects [9]. Interestingly, a cohort of children and adolescents diagnosed with ADD/ADHD and currently treated with psychostimulant medication had an approximately 60% greater risk of being underweight in comparison to healthy control subjects [9], indicating the necessity for additional research to elucidate longitudinal and pharmacologic factors that influence the relationship between ADHD and weight status in affected children and adolescents.

A 2006 study attempted to establish functional linkages between childhood exposure to television, ADHD, and obesity and concluded that obesity and ADHD demonstrate significant comorbidity [13]. Proposed overlapping mechanisms of these comorbid conditions suggested that nutritional excess contributes to ADHD and that cognitive hyperstimulation contributes to obesity. A subsequent study cited behavioral impulsivity as a common underlying neurobiological mechanism linking obesity and ADHD [14].

In light of the above, the present study was designed to identify and elucidate potentially important patterns of eating behaviors, nutritional quality of dietary constituents, and lifestyle factors associated with mixed ADHD symptomatology in a cohort of boys.

Previous research suggests there may be a 3:1 to 9:1 ratio in occurrence of ADHD among boys and girls [15–17]. Although there is no clear agreement on the existence and the origin of the gender effect in ADHD [18], most current clinical studies focus predominantly on boys with ADHD. One reason may be the lower occurrence of ADHD in girls in clinical populations. In the present study we focused only on boys with ADHD due to the low number of girls with ADHD identified in our clinical samples; thus, it would not be possible to statistically control gender effects. This is a partial limitation of the study.

Material and Methods

Study population

Data sets were obtained from structured interviews of parents of 100 boys (aged 6–10 years) previously diagnosed with combined type ADHD according to DSM-IV criteria (DSM-IV, 1994) and parents of 100 age-matched male control subjects. Additionally, we utilized a score of Conner's scale version 3 for parents and teachers >2 SD. For children diagnosed with ADHD, exclusion criteria included the presence of comorbid psychiatric, neurological, or somatic disorders. Importantly, all subjects were currently free from psychostimulant medication for treatment of ADHD symptoms. The subjects in the control group were required to meet the same exclusion criteria, absence of ADHD symptoms, and a score on Conner's scale version 3 for parents and teachers <1 SD.

Inclusion and exclusion criteria in both cohorts of subjects were evaluated by a certified physician and a clinical psychologist after the subjects received thorough clinical examinations. The study was approved by the Ethics Commission of the First Faculty of Medicine, Charles University, Prague, and the General Hospital in Prague. All parents of the subjects received oral and written information about the study, which complied with the Declaration of Helsinki, before they provided written informed consent.

Structured interviews

Eating habits were assessed with a structured interview for parents, focused on eating habits and related lifestyle phenomena based on previous research [6–8].

The use of reporting by parents in ADHD children, as well as in other child psychopathology, is currently considered as one of the most important sources for research as well as clinical use [19]. There are limitations to this source of information (e.g., the report may be biased by parent opinion or wishes) but it still is a much more reliable source of information, especially in description of behavioral manifestations, than a description provided by ADHD children who may not perceive their own behavior.

We decided to use a structured interview based on our previous research because there is no standardized questionnaire suitable for the purpose of the study. We also studied occurrence

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Table 1. Number of meals/day in ADHD and control group (in %).

		Group		χ^2	p
		ADHD (%)	Control (%)		
Breakfast	No	24	9	8.165	0.004
	Yes	76	91		
Snack	No	5	0	5.128	0.024
	Yes	95	100		
Lunch	No	7	0	7.254	0.007
	Yes	93	100		
Snack	No	2	7	2.909	0.088
	Yes	98	93		
Dinner	No	45	0	58.065	0.001
	Yes	55	100		
Meal more than 5 times/day	No	13	74	75.699	0.001
	Yes	87	26		

and frequency of specific behavior that may be evaluated by specific questions with no need of standardized instruments.

Randomization of interviewed parents was assured by stratification according to medical, educational, and socioeconomic criteria.

Statistical analysis

Statistical evaluation of data sets was achieved by Pearson's chi-squared analysis using the statistical package SPSS 12.

For further statistical analysis, the structured interview we used to collect data was constructed with the use of category-based answers. Thus, we decided to use Pearson's chi-squared analysis, as it is one of the most suitable statistical methods for this kind of data. First, we calculated frequency distribution of answers within each category and then we used chi-squared analysis to determine how well the data obtained from the ADHD and control groups matched in distribution.

Results

Statistical analysis indicated specific and statistically significant differences in eating habits of ADHD children compared to the control group. The differences were found in quantitative characteristics of eating habits (e.g., the number of daily meals) as well as in qualitative characteristics (e.g., structure of food and beverage intake).

As Table 1 shows, there are significant differences in the number of meals per day between control and ADHD groups. ADHD children frequently skip meals – breakfast ($p<0.004$), lunch ($p<0.007$), and dinner ($p<0.001$) – more often than control children. However, ADHD children eat more than 5 times a day ($p<0.001$). Compared with the control group, they eat less regularly, but more often. This fact may also be associated with the difference in weight parameters and body fat percentage between the 2 groups.

As Table 2 shows, another important finding is that ADHD children drink statistically significantly more sweetened beverages than do control children ($p<0.003$). These sweetened drinks account for almost half of daily fluid intake in ADHD children.

Thirteen percent of parents of ADHD children reported that their children eat fruits and vegetables only about once a week, compared to none of the parents of children in the control group ($p<0.003$). This information is quite alarming (Table 3).

On the other hand, the results show less regular physical activity in ADHD children and more hours spent watching television or a computer. In the control group, the average time spent on sports activities was 8 hours a week and in the ADHD group it was 6 hours, which is 2 hours a week less than in controls (Table 4).

Finally, we found that the duration of breast-feeding provided to a child can play a significant role in their later diet. Our results indicated a statistically significant difference in duration of breastfeeding between control and ADHD children: 70% of control children were breastfed for more than 6 months, but only 42% ($p<0.003$) of ADHD children were breastfeed for more than 6 months. These significant differences can also affect later differences in physical development between the groups (Table 5).

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Table 2. Type of beverages in ADHD and control group (in %).

		Group		χ^2	p
		ADHD (%)	Control (%)		
Water	No	64	34	18.007	0.001
	Yes	36	66		
Milk	No	73	69	0.389	0.533
	Yes	27	31		
Sweetened beverage	No	45	66	8.928	0.003
	Yes	55	34		
Juice	No	92	78	7.686	0.006
	Yes	8	22		
Tea	No	52	58	23.529	0.001
	Yes	48	42		

Table 3. Fruit and vegetable intake in ADHD and control group (in %).

Fruits or vegetables	Group		χ^2	p
	ADHD (%)	Control (%)		
Daily	62	83	18.126	0.003
At least 1/week	25	17		
Less than 1/week	13	0		

Table 4. Number of hours spent watching TV or computer in ADHD and control group (in %).

Hours per week	Group		χ^2	p
	ADHD (%)	Control (%)		
0–3	6	24	14.234	0.003
4–7	47	44		
8–14	38	25		
>15	9	7		

Table 5. The length of breast-feeding by mother.

Number of month	Group		χ^2	p
	ADHD (%)	Control (%)		
< 1	25	6	20.434	0.001
< 3	14	9		
< 6	19	15		
> 6	42	70		

Discussion

We found significant differences in eating habits and related lifestyle phenomena in ADHD children compared to the control group. According to information provided by parents, children with ADHD skip meals, especially breakfast and dinner, significantly more often than children in the control group; however, ADHD children eat more often than 5 times a day. ADHD children eat less fruits and vegetables than control children, but they drink more sweetened beverages. There were also significant differences in the number of hours spent on sports activities. Control group children spend on average 2 hours more time each day on sports activities than children with ADHD. Obviously, lack of regularity in eating, lack of fruits and vegetables, high percentage of sweetened beverages in daily fluid intake, and, on the other hand, less sports activities in ADHD children may affect body weight and body fat percentage and can be associated with overweight or even obesity [20].

Children with ADHD may be a risk group for the development of obesity, thus attention should be directed towards these problematic behaviors, including eating habits. Obesity significantly complicates the lives of both adults and children, not only in the physical, but also in the psychological aspects of health. Obese individuals, whether children or adults, have more difficulties with self-confidence and self-assertion, and are far more to likely experience serious disorders such as depression and anxiety. In children, these problems can significantly disrupt other aspects of psychological development [21,22].

According to Altafas [11], almost half of obese adults meet diagnostic criteria for ADHD. This is in agreement with results of Strimas [23], who found that ADHD symptoms are significantly

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associated with overeating. Davis et al. [24] reported that the relationship between ADHD and overeating was statistically significant.

It was previously described that higher incidence of obesity in ADHD patients can be caused by more serious problems with losing weight, due to less self-control in eating [12,25].

According to some authors [11], people with ADHD may have difficulty with weight reduction. It was mentioned previously that higher prevalence of obesity among children with ADHD can also be associated with more serious difficulty in reducing body weight, diet plan compliance, and control of eating.

Understanding eating behavior of ADHD children is necessary for planning treatment. According to the current knowledge and clinical practice, medication by stimulants can cause decreased appetite and cause weight loss [26]. Lower percentage of fat [7,27], decreased weight [1], and shorter height [26] were found in medicated children with ADHD. Therefore, stimulant therapy for ADHD may be contraindicated in some under-weight patients, especially those with anorexia nervosa. However, the decreased appetite and weight loss during stimulant medication can be caused just by the moderation of the symptoms of ADHD and perhaps impulsivity in eating behavior. Finally, an important finding is that children with ADHD were breastfed for significantly less time than the children in the control group. Duration of breastfeeding can affect subsequent physical development. Several studies suggest that breastfeeding for at least 6 months reduces the risk of later obesity [28]. It is obvious that the short duration of breastfeeding may influence subsequent higher indicators of nutritional status in children with ADHD. Some authors have even reported that breast-feeding can be a possible environmental risk factor for symptoms of ADHD [29]. Were these children breastfed for shorter periods because of their behavior (e.g., inattention) or for other reasons that could affect the potential development of some symptoms of ADHD? These are new questions that at present cannot be clearly answered and probably will not be answered even many studies later, as in the case of issues related to ADHD in general. ADHD is a complex disorder; it is necessary to approach its study with this complexity in mind [30].

Conclusions

ADHD is a disorder that has psychological, social, and somatic aspects. The results of the present study point to several significant differences in eating habits and lifestyle in ADHD children compared to the control group. These findings offer partial explanation of previously described differences in body weight, fat percentage, and higher occurrence of overweight or even obesity in ADHD children.

Detailed research and analysis that can bring new information about these connections could lead to breakthroughs in treatment and prevention of ADHD.

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