

Poor Eating Habits and the Attention Deficit-Hyperactivity Disorder during Childhood

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Abstract-Understanding the eating behaviors and attitudes during childhood is very important in terms of children's health. Peers, parents and advertisements have the most important social influence on children's eating habits that can affect them much on the consumption of processed foods which contain natural and artificial additives with some coloring agents such as erythrosine, Tartrazine, Monosodium glutamate, and Benzoate which are known as substances that added to food to preserve flavor or enhance its appearance and taste. It has been claimed that food additives and coloring agents have been related to behavior disorder which is known as Attention-deficit-hyperactivity disorder (ADHD), one of the most common chronic disorders during childhood which is affecting approximately 3% of the children between (4-8) years old. This disorder can be highly related to both environmental and familial disorder as well as many other modifiable risk factors, some studies showed that (ADHD) can be also related also to heavy metal and chemical exposures, lifestyle and psychosocial factors, prenatal substance exposures as well as nutritional factors. Disruptive behavior, inattention, hyperactivity, and impulsivity are common in (ADHD); academic difficulties are common as related problems. It can be difficult to define symptoms as well as to determine the exact normal levels of hyperactivity, inattention, and impulsivity end and the significant levels where interventions are required or should begin. Despite of all the studies done, a controversy about the negative effects of additive substances found in processed foods still exist and people are faced with a choice whether they can consume those products safely or not.

Keywords- ADHD; Food Additives; Artificial Food Colors; Hyperactivity; Child Behavior

I. INTRODUCTION

Understanding the eating behaviors and attitudes during childhood is very important in terms of children's health; many evidences have been indicated that the dietary habits developed during childhood persist through to adulthood [1, 2]. Peers and parents have the most important social influence on children eating habits. Many researchers indicated the influences of parents and peers on children's eating habits and attitude can affect them much on the consumption of processed foods which contain natural and artificial additives with some coloring agents. Additives such as erythrosine, Tartrazine, Monosodium glutamate, and Benzoate, are known as substances that added to food to preserve flavor or enhance appearance and the taste [3]. Researchers have found that both the actual parental presence and the threat of parental monitoring may decrease the children's intake of non-nutritious foods. Accordingly, it can be hypothesized that children would consume less unhealthy food in the presence of their parent than in the company of their friends [4, 5]. Children's food preferences may play a major role in deciding whether their actual diet and eating habits are healthy or not. Food preferences can develop primarily through learning processes. Most children learn about foods they prefer or not through observing different types of food as well as being exposed to a variety of foods and experiencing both the rewards and the consequences of consuming those foods [6-8].

Attention-deficit-hyperactivity disorder (ADHD) is known as a prevalent psychiatric disorder, one of the common chronic disorders during childhood which is affecting approximately 3% of the children between (4-8) years old. It is characterized by impulsivity, difficulties with attention, and over-activity. It can be associated with impaired academic, adaptive, social, and occupational functioning [9-11]. Attention-deficit-hyperactivity disorder can be considered as a psychiatric problem since there is a significant problem related to the attention that makes children act impulsively which are not appropriate for a their age. The symptoms mostly started at school age, can be determined mostly through poor school performance and it takes more than six months to be diagnosed as (ADHD) [12, 13]. In recent decades, changing lifestyles all over the world have led to increased demand for foods with long shelf lives that are cosmetically palatable, appealing, and easy to prepare and consume. Food additives, especially artificial colors and preservatives have been linked to poor attention and hyperactive behaviour in children. Furthermore, the assessment and management of neurodevelopmental behavioral disorders (NDBDs) in children have become essential and significant part in pediatric care [14-18].

However, the color agents added to food products is extremely important since it can influence the perception of both quality and flavour especially when the processed foods lose the attractive appearance due to the enzymatic modification and high temperature. The US congress federal law requires all the additives to be tested before they are added to food, drugs or cosmetics; out of many additives about 200 substances were withdrawn and nowadays only around 35 additives (i.e. coloring agents, preservatives, flavoring agents and sweeteners) are approved by FDA [19-25]. Despite of all the studies done, a

controversy about the negative effects of additive substances found in processed foods still exist and people are faced with a choice whether they can consume those products safely or not.

II. LITERATURE REVIEW

A. *Children's Eating Behavior and Habits*

Understanding the eating behaviors and attitudes during childhood is very important in terms of children's health; many evidences have indicated that the dietary habits developed during childhood persist through to adulthood [1]. A range of explanations has been offered to analyse the causes of children's poor dietary habits. Among which the lack of knowledge as well as being affected by many aspects including parents, peers, and advertisements have been marked as the main causes [2]. Peers and parents have the most important social influence on children's eating habits, although, many researchers respectively study the parents' and the peers' influences on the children's eating habits and attitude [3].

As a primary source of socialization, parents can influence their children's eating behavior. Family meals can be the best opportunity for parents to make certain foods available, models and implement certain feeding practices and reinforce different eating habits. Furthermore, they can also encourage their children to increase their consumption of healthier food options as well as reduce their intake of foods which are low in nutritional value [4]. Researchers have found that both the actual parental presence and the threat of parental monitoring may decrease the children's intake of non-nutritious foods. Accordingly, it can be hypothesized that children would less unhealthy food in the presence of their parent than in the company of their friends [5].

Recently, there has been an increased interest in the effect of peers and friends exert on children's eating behavior and attitude. Peers may be more influential during childhood than any other time duration since it seemed to exert a stronger influence than parental norms [6]. Generally, the quality of diet during childhood is often poor. Many researchers have addressed reasons for this, some studies focused on the modeling which indicated that children may model their peers' eating related attitudes, eating behaviour and also body dissatisfaction [7].

Children's food preferences may play a major role in deciding whether their actual diet and eating habits are healthy or not. Food preferences can develop primarily through learning processes. Most children learn about foods they prefer or not through observing different types of food as well as being exposed to a variety of foods and experiencing both the rewards and the consequences of consuming those foods [8]. Children learn about their social world vicariously, and develop their eating habits, preferences, and attitude, through observation of the media. When watching advertisements, children learn that unhealthy foods which are in high additives and artificial components are great and are enormously rewarding to consume [9]. The problem is that most of the food products highly advertised on television networks is unhealthy and 98% of advertised foods are of low nutritional value. On average, In United State, children view about 15 television food advertisements every day, which is about nearly 5,500 messages per year, which promote totally unhealthy food products. Unhealthy food references also appear during television programming extensively, the most common themes in television food advertising are targeting children are fun, happiness, great taste, and being "cool" [10].

B. *Attention Deficit Hyperactivity Disorder*

1) *What qualifies as ADHD?*

Attention-deficit-hyperactivity disorder (ADHD) is known as a prevalent psychiatric disorder, one of the most common chronic disorders during childhood which is affecting approximately 3% of the children between (4-8) years old. It is characterized by impulsivity, difficulties with attention, and over-activity. It can be associated with impaired academic, adaptive, social, and occupational functioning [11]. Furthermore, this disorder can be highly related to both environmental and familial disorder as well as many other modifiable risk factors. Some studies showed that (ADHD) can also be related to heavy metal and chemical exposures, lifestyle and psychosocial factors, prenatal substance exposures as well as nutritional factors [12]. Attention-deficit-hyperactivity disorder can be considered as a psychiatric problem type since there is a significant problem related to the attention that makes children act impulsively which are not appropriate for their age. The symptoms mostly started at the school age can be determined mostly through poor school performance and it takes more than six months to be diagnosed as (ADHD) [13].

2) *Sign and Symptoms of ADHD*

Disruptive behavior, inattention, hyperactivity, and impulsivity are common in (ADHD); academic difficulties are common as related problems. It can be difficult to define symptoms as well as to determine the exact normal levels of hyperactivity, inattention, impulsivity end and the significant levels where interventions are required or should begin [14]. Based on the presenting symptoms of ADHD, it can be classified into three subtypes: predominantly hyperactive-impulsive, predominantly inattentive, or a combined one when the criteria for both types are overlap.

Children with inattentive concentration may develop the following symptoms : having difficulty maintaining focus on one task, not listening when spoken to, struggling to follow instructions, daydreaming, becoming easily confused, moving slowly, having trouble completing or turning in homework assignments, losing things (e.g., pencils, toys, assignments), becoming

bored with a task after only a few minutes, having difficulty in processing information as quickly and accurately as others, being easily distracted, miss details, forget things, and frequently switch from one activity to another as well as have difficulty focusing attention on organizing and completing a task or learning something new [15].

Different symptoms might be experienced with other children who are having hyperactivity, these symptoms can include: squirming in their seats, being constantly in motion, talking nonstop, having difficulty in doing quiet tasks or activities [16]. On the other hand, those children who are suffering from ADHD with impulsivity symptoms may develop very impatient attitude, having difficulty waiting for things they want or waiting their turns in games, often interrupting conversations or others' activities and blurt out inappropriate comments, showing their emotions without restraint, and acting without regard for consequences [17].

In general, children with ADHD usually have difficulties with social skills including social interaction, forming and maintaining friendships. Compared to non-ADHD children, about half of children with ADHD experience social rejection by their peers, since those with ADHD experience attention deficits that can lead to difficulty in processing verbal and nonverbal language and may negatively affect their social interaction such as missing social cues and drifting off during conversation [18]. The most difficult part would be managing their anger which is so common in children with ADHD since they may develop poor academic performance and handwriting, delaying motor development, language, and speech. Despite that children with ADHD experience significant impairments, many children with ADHD still can have a good attention and performance but only for specific tasks that they find interesting [19].

3) *Associated Disorders with ADHD*

Children with ADHD may suffer from other disorders at the same time, some of those commonly associated disorders and conditions include: Learning disabilities which have been found to have occurred in 20–30% of children with ADHD can trigger speech and language as well as academic skills disorders. ADHD is not considered as a learning disability but it can significantly impact children's academic performance [20]. Primary disorder of vigilance can be considered as another associated disorder which is characterized by poor concentration and attention with difficulties in staying awake. Mostly children tend to fidget, stretch and appear to be hyperactive in order to remain active and alert. Restless legs syndrome is also more common in those with ADHD and often occurs due to iron deficiency anemia. Although, this disorder can be a part of ADHD and requires careful assessment in order to differentiate from each other [21]. Conduct disorder (CD) and Oppositional defiant disorder (ODD) are common disorders which occur in the ADHD with a percentage of about 20% and 50% respectively. They are both characterized by antisocial behaviors such as aggression, deceitfulness, stubbornness, stealing, lying, and frequent temper tantrums [22]. Anxiety and mood disorder; children diagnosed with ADHD are more likely to have significant mood changes and even depression. Furthermore, sleep difficulties can also occur as a result of ADHD or as a side effect of medications used to treat ADHD. Children with this disorder would often have deep sleeping with significant difficulty getting up in the morning [23].

C. *Food Additives*

1) *General Overview of Additive Substances*

Food additives are substances added to food in order to preserve flavor or enhance its appearance and taste and of them additives have been used for centuries from both artificial and natural origin [24]. Food coloring or color additive is known to be dye, pigment or substance that imparts color when it is added to drinks or food. They can come in many different forms consisting of powders, liquids, pastes and gels. Food coloring is usually used both in domestic cooking as well as commercial food production. Due to its safety and general availability, it is also used in a variety of non-food applications including home craft projects cosmetics, medical devices and pharmaceuticals [25]. In general, those substances are varying from natural and artificial food additives (i.e. coloring agents, preservatives, flavoring enhancer, and sweeteners) [26].

2) *Linkage between Food Additives and ADHD*

In recent decades, changing lifestyles all over the world have led to demand for foods with long shelf lives that are cosmetically palatable, appealing, and easy to prepare and to consume. Food additives, especially artificial colors and preservatives have been linked to poor attention and hyperactive behaviour in children. Furthermore, the assessment and management of neurodevelopmental behavioral disorders (NDBDs) in children have become an essential and significant part in pediatric care. According to the British Food Standards Agency, parents and children need to be advised to limit the unnecessary food additives and consume a healthy food items rich in essential nutrients. And more complete studies are expected to be further explored [27].

One of the more current controversies in the field of artificial food colorings is their effect on children's behaviors and attitudes. Although the idea that food hypersensitivities lead to learning and behavior problems dates back to the 1920s; a specific hypothesis regarding this relationship was not developed until the 1970s [28]. The American Medical Association proposed that pediatric learning problems and hyperactivity are due to certain foods additives and components, and he have advised such a special diet known as 'K-P' or "Kaiser Permanente" which was totally free of substances. Two more preservatives were eliminated because he claimed that they can lead to hyperactivity and about 60-70% of the children were

improved after eliminating those preservatives including butylated hydroxyanisole and butylated hydroxytoluene [29]. Many parents who were following the 'K-P' diet recommendations reported that there was an improvement in their children's behavior, and many other evidences have determined that many neurophysiological disturbances can be developed in children when they are consuming certain chemicals including natural or artificial food additives such as salicylates [30].

However, the color agents added to food products is extremely important since it can influence the perception of both quality and flavor especially when the processed foods lose the attractive appearance due to the enzymatic modification and high temperature. The US congress federal law requires all the additives to be tested before they are added to food, drugs or cosmetics; out of many additives about 200 substances were withdrawn and nowadays only about 35 additives (i.e. coloring agents, preservatives, flavoring enhancer, and sweeteners) are approved by FDA [31].

One type of color dyes known as Erythrosine (E 127/ Red No. 3) is a cherry-pink coal tar-based food dye; It has been found that it can cause allergic reactions and sensitivity as well as learning difficulties with increasing thyroid hormone levels and that lead to hyperthyroidism. It has been found that 'erythrosine' acts as a potent neurocompetitive dopamine inhibitor of the dopamine uptake via nerve endings when exposed in vitro on a rat brain [32]. Another study showed that 'erythrosine' can act as an inhibitor on many other neurotransmitters which results in an increased concentration of the neurotransmitters near the receptors, therefore functionally augmenting the synaptic neurotransmission. Nowadays, there is some evidence that it can reduce the dopamine turnover and may lead to childhood hyperactivity [33].

Tartrazine (E 102/Yellow No. 5) is another coloring agent which gives yellow and orange colorant for both food and drugs. A study has been done on 122 patients suffering from allergy-related disorders. They were given about 50 mg of Tartrazine, as a result of that; they have evoked some reactions including weakness, palpitations, urticarial, pruritus, and rhinorrhea. The 50 gm of Tartrazine may be considered as a substantial dose since a specific quantity of it can be easily consumed through drinking only a few cans of soft drinks per day. Some research has linked Early Childhood hyperactivity disorder to Tartrazine which has been banned in both Austria and Norway, while is still legally used in the UK but whenever added to the foods, it must be listed on the product's labels [34].

Benzoates (E 210-219) is considered as one of the most commonly chemicals used as food preservatives for the prevention of yeast and molds growth. (WHO) has determined that the maximum concentrations of the benzoate used as food preservatives should not exceed 2000 mg/kg. Benzoates have been found to be linked to childhood hyperactivity, provoke urticaria, asthma, and angioedema [35].

Monosodium glutamate (MSG/E621) is a flavor added mostly to enhancer the soups, sauces, and meat-preparation products. It originates from the tastiness of the Far East cuisine. The usage of MSG has been controversial in the past 30 years because of reports of those who consumed foods containing MSG were involved in severe food reactions. A study of one double-blind trial has determined the short-term responses to MSG. In this study, healthy individuals who had consumed 5 g of MSG, was found to be associated with many irritant feelings including burning sensation, chest pain, palpitations, and headache while the long-term effects were difficult to find [36]. Therefore, MSG was banned from the infant foods products because of the occurrence of irreversible retinal lesions in neonatal rodents. The Acceptable Daily Intake (ADI) for MSG is 120 mg/kg/d, but even lower doses still associate with acute syndrome in sensitive individuals [37].

III. CONCLUSION

Since peers, parents and advertisements have the most important social influence on children's eating habits. Therefore, a special control should be there to eliminate or decrease the processed foods consummated by children since those products normally contain natural and artificial additives with some coloring agents especially erythrosine, Tartrazine, Monosodium glutamate, and Benzoate. It has been noted that food additives are not the main cause of ADHD but still they may contribute significantly to some cases, and in some cases may additively make the situation even worse [37]. Since the deleterious effect does not appear to be confined to ADHD, so AFCs may be more a general public health problem than an ADHD problem. Therefore, results from previous studies done extremely call for more studies in the same field for exact determination of food additives effects on ADHD and other related children behavior disorders.

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