Factors Influencing Nail Biting Habit in Children with ADHD

Ruu-Fen Tzang, MD. [1,2*], Yue-Cune Chang, Ph.D.[3], Kate Hsu, Ph.D.[4]

[1]Department of Psychiatry, Mackay Memorial Hospital, Taiwan
[2]Mackay Junior College of Medicine, Nursing, and Management, Taipei, Taiwan
[3]Department of Mathematics, Tamkang University, Taiwan
[4]Department of Medical Research, Mackay Memorial Hospital, Taiwan
*Corresponding author: Dr. Ruu-Fen Tzang
rf.tzang@msa.hinet.net

Abstract

This research aims to identify risk factors for developing nail biting (NB) habits among children with Attention Deficit Hyperactivity Disorder (ADHD). This study recruited 109 children diagnosed with ADHD. Their ADHD relevant components were assessed by questionnaire, and the subjects were divided into NB or non-NB groups. These two groups were compared for their ADHD subtypes, comorbidity (including Oppositional Defiant Disorder (ODD) and anxiety depression), and acquired family risks. From statistical analyses, we found that ADHD children with a nail-biting habit were generally younger, and many belonged to the ADHD combined subtype (ADHD-C). We also noted that many of their parents had marital discord and poorer stress management skills, compared to the parents of ADHD children without a nail-biting habit. Their mothers were generally older than the mothers of ADHD children lacking a nail-biting habit. Logistical regression confirmed that nail biting among ADHD children was correlated with ADHD-C subtype (OR = 2.73; p = 0.016) and parental marital discord (OR = 5.11; p = 0.007). Further, from comorbidity analyses, a nail-biting habit among ADHD children was associated with maladjustment disorder, and not with anxiety disorder commonly seen in ADHD patients. Therefore, nail biting is a possible indication of the presence of the more severe ADHD-C subtype. Our results imply that a nail biting habit among these ADHD children is more related to insufficient parenting skills, rather than being part of general anxiety symptoms.

Keywords : nail biting, ADHD, combined subtype, parental marital discord

Introduction

Nail biting/chewing (NB), a common childhood habit, predominantly affects 28-33% of children aged 7 to 10. The etiology of such a habit remains unknown. Ghanizadeh (2008) linked the habit of nail biting to ADHD, as both are commonly seen in children. Attention Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental disease afflicting 5–10% of school-age children (Scahill & Schwab-Stone, 2000). ADHD could result in great burdens on the afflicted children and their families (Matza, Paramore, & Prasad, 2005; Swensen et al., 2004). Various aspects of ADHD have been extensively studied, but the proposed link between NB and ADHD by Ghanizadeh (2008), remains unclear. Several early studies have found that NB is closely related to emotional issues, anxiety induced by stressful life situations, (Joubert, 1993) stresses associated with unstable moods, (Kleinrok et al., 1990; Yassaei, Rafieian, & Ghafari, 2005), and the states of negative mood (Foster, 1998). In addition,

the habit of nail biting is highly relevant to situations that demand a high degree of concentration (Troster, 1994), particularly among younger children (Klatte & Deardorff, 1981) and among boys (Foster, 1998; Troster, 1994). Thus, the habit of nail biting may be related to anxiety in children. One commonly seen cause leading to the NB habit in children is their being in a tense or anxious mood constantly. Children like to bite their nails when they are anxious. Also, children with ADHD like to bite their nails when they are required to concentrate . However, it is problematic to link ADHD and NB based on anxiety alone, because ADHD often coexists more with the diagnosis of oppositional defiant disorder (ODD) in children, and not the diagnosis of anxiety disorder (Connor, Steeber, & McBurnett, 2010). In particular, for those children living under an adverse family influence, they are often diagnosed with the severe ADHD combined subtype (ADHD-C)(Johnston & Mash, 2001), instead of anxiety disorder. Although recently Ghanizadeh et al. found that 74.6% of children with NB habits also had ADHD (Ghanizadeh, 2008), there is no published study demonstrating that a nail-biting habit is indeed related to anxiety, especially in emotional ADHD children. Thus, one main goal of this work was to find out if nail biting could be related to anxiety, ODD, or other comorbid disorder(s) in ADHD-afflicted children. Because NB and ADHD often coexist, we also aimed to examine if NB habits could be deemed as an endophenotype or a warning marker for ADHD, or as an indicator for grading the symptom severity of ADHD.

Objectives

This study explored potential risk factors for developing NB habits among ADHD children. The risk factors we examined here included overall psychopathological components in the afflicted children and characteristics of their families, as others have pointed out (Petersen, Weymann, Schelb, Thiel, & Thomasius, 2009). We hypothesized that the habit of NB in Taiwanese children could be related to their ADHD subtype, comobidity, or stresses from family lives.

The specific aims of this study were:

(1) to determine the prevalence of NB among children with ADHD in Taiwan MacKay Memorial Hospital; (2) to evaluate the influence of psychopathological risks and/or family-related stresses on NB development among ADHD children. We first grouped the subjects into ADHD children with NB and those without the habit. The overall psychopathological risks, including age, gender, ADHD subtype, comorbidity, and/or acquired environmental stresses (i.e. from school, school performance, and interpersonal relationships), were assessed. We also assessed family risks, including socioeconomic status and marital state of the parents, their stress management capabilities, their understanding of ADHD and compliance to ADHD treatment of their children. Our findings should provide important insights on early signs and diagnostics, as well as design of early intervention programs for ADHD.

Methods

Participants and Procedures

The study population consisted of 109 families, each with a child suffering from ADHD. ADHD was diagnosed, based on DSM-IV, by a child psychiatrist at the Outpatient Department of Mackay Memorial Hospital, Taipei, Taiwan. The inclusion criteria for the pediatric patients were diagnosis of ADHD, and lack of organic psychosis, autism or mental retardation. The children in the study ranged from 7-12 years old (Mean ± SD = 9.14 ± 1.64 years); 82% of them were boys (n = 89), and 18% of them were girls (n = 20). The study protocol was approved by the ethics committee of Mackay Memorial Hospital. A written informed consent was obtained from the parent(s) of each child subject. The parents of the ADHD children

were also asked to participate in a one-hour semi-structured interview using the Mini International Neuropsychiatric Interview Kid (MINI Kid).

Demographic data

The parent(s) of each child subject reported the following demographic data for their child: age, gender, type of schooling (private or public school), school grade levels (I–II, grades 1–2; III–IV, grades 3–4; V–VI, grades 5–6), performance at school (upper, middle, or lower percentiles), quality of the child's interpersonal relationships, and ADHD treatment compliance. The parent(s) also reported their socioeconomic statuses (classes I–IV), (Hollingshead, 1965) and their reactions/responses to stimuli. In order to evaluate the risks for ADHD from the parents, we also recorded their marital state, their abilities to cope with stress, and their understanding of ADHD.. The parents assessed and self-reported nail biting and related habits, such as nail picking and finger sucking, for their ADHD children.

Subtypes and Comorbidity

The diagnosis of ADHD, its subtypes, and other commonly seen child psychiatric disorders (comorbidity) were assessed using the MINI Kid, which was first developed for DSM-IV and international statistical classification of psychiatric disorders, (Sheehan et al., 1998) and translated into Chinese in 2000. The sensitivity of MINI Kid was 0.70, and its specificity, negative predictive values, and efficiency scores were all 0.85. The co-existing psychiatric diagnosis or comorbidity in this study included oppositional defiant disorder (ODD), conduct disorder, anxiety disorder, tics, Tourette's syndrome, dyslalia, and adjustment disorder.

Statistical Analysis

Descriptive statistics was used to summarize basic demographic data for the two groups—NB (n = 51) and non-NB (n = 58). Data are expressed, for continuous variables, as mean ± standard deviation or, for categorical variables, as percentages. The independent t-test was used to compare the differences between with/without nail biting groups. The chi-square test was applied to assess the strength of relationships among different genetic and environmental risk factors (e.g., gender, schooling, school grade levels, school performance, child's interpersonal relationships, socioeconomic status of the family, parental marital state, parents' stress management abilities and responses to stimuli, parents' understanding of ADHD, and ADHD treatment compliance), and compared the differences between the two groups of subjects (ADHD children with or without nail biting). Simple logistical regression analysis was used to investigate the relationships assosciated with nail biting, ADHD-C, comorbidity, and parental marital discord. Differences at p-value < 0.05 were statistically significant.

Results

Characteristics of ADHD children with nail-biting habits

To understand the symptom of nail biting in ADHD children, as shown in Table 1, we divided 109 ADHD children in NB (n=51) and non-NB (n=58) groups, and compared their clinical characteristics. We found that ADHD children who bite their nails were generally younger (8.8 ± 1.6 vs. 9.5 ± 1.6 years; independent t-test with p-value = 0.034). Importantly, significantly higher percentages of nail-biting ADHD children were diagnosed with combined ADHD (ADHD-C) (74.5% vs. 51.7%; p=0.014) and adjustment disorders (7.8% vs. 0%; p=045) than ADHD children who did not bite their nails. There were otherwise no significant differences on gender (boy-to-girl ratio = 4.1:1), types of schooling, school performance, interpersonal relationships, or ADHD treatment compliance between NB and non-NB groups. We also

surveyed the parents, and found that the parents of nail-biting ADHD children had the following characteristics: older mothers (38.7 ± 4.8 vs. 30.5 ± 4.5 years; independent t-test with p-value = 0.047), with a higher incidence of marital discord (27.5% vs. 6.9%; p=0.004), and poorer stress management capabilities (54.9% vs. 34.5%; p=0.032), as compared to the parents of non-NB, ADHD children. In terms of socioeconomic status and understanding/compliance of ADHD treatments, there were no significant differences between parents of the two groups of the ADHD children (Table 1).

Table 1: Comparison of ADHD subtypes, comorbidity, and other risks of ADHD children who bite or do not bite their nails

Child risks	With NB N (%)	Without NB, N (%)	p^a	Child risks	With NB N (%)	Without NB, N (%)	p^a
ADHD	51 (46.8)	58 (53.2)					
Mean age[b]	8.8±1.6	9.5±1.6	0.034†	Father's age[b]	42.0±5.1	43.1 (4.5)	0.236
				Mother's age[b]	38.7±4.8	30.5±4.5	0.047†
Sex				Marital state			
Boy	41 (80.4)	48 (82.8)	0.750	Satisfied	37 (72.5)	54 (93.1)	0.004**
Girl	10 (19.6)	10 (17.2)		Unsatisfied	14 (27.5)	4 (6.9)	
ADHD subtype							
ADHD-C	38 (74.5)	30 (51.7)	0.014†	Parental stress			
ADHD-I	13 (24.5)	28 (48.2)		management			
				Good	23 (45.1)	38 (65.6)	0.032†
Comorbidity				Bad	28 (54.9)	20 (34.5)	
with	34 (66.7)	30 (51.7)	0.114				
without	17 (33.2)	28 (48.2)		Understanding			
				ADHD			
Schooling				Yes	46 (90.2)	50 (86.2)	0.521
Public	45 (88.2)	55 (94.8)	0.300[a]	No	5 (9.8)	8 (13.8)	
Private	6 (11.8)	3 (5.2)					
School grade				Social			
				economic			
				status			
I-II	16 (31.4)	9 (15.5)	0.091	I 14 (27.4)	19 (32.8)	0.812	
III-IV	23 (45.1)	27 (45.6)		II 23 (45.1)	26 (44.8)		
V-VI	12 (13.5)	22 (37.9)		III	8 (15.7)	9 (15.5)	
"(cont)."				IV	6 (11.8)	4 (6.9)	
School							
performance							
Upper	7 (13.7)	9 (15.5)	0.564				
Middle	26 (51.0)	34 (58.6)					

Child risks	With NB N (%)	Without NB, N (%)	p^a	Child risks	With NB N (%)	Without NB, N (%)	p^a
				Treatment			
				compliance			
Lower	18 (35.5)	15 (25.9)		Good	44 (86.3)	45 (77.6)	0.242
Interpersonal				Bad	7 (13.7)	13 (22.4)	
relationship							
Good	22 (43.1)	28 (48.3)	0.591				
Bad	29 (56.9)	30 (51.7)		Response to			
				stimuli			
				positive	23 (45.1)	23 (39.7)	0.566
				negative	28 (54.9)	35 (60.3)	

NB: Nail biting; ADHD-C = ADHD combined subtype; ADHD-I = ADHD inattentive subtype;
[a] Fisher's Exact Test ; [†]< 0.05
[b] Independent t-test

We further analyzed if NB was associated with any of the commonly-seen ADHD comorbidity. The common comorbid disorders seen in ADHD, such as oppositional defiant disorder (ODD), conduct disorder (CD), anxiety, tics, Tourett's syndrome (TS), dyslalia, and adjustment disorder (AD), were individually surveyed and compared (Table 2). Most of the comorbid disorders were irrelevant to nail biting. To our surprise, there was also no significant association between nail biting and anxiety in these ADHD children (Table 2: p = 0.416). Instead, there was a significant association between AD and NB in the ADHD children (p = 0.045). Notably, the parents of the nail-biting ADHD children were also found to be less capable of coping or managing their stress, compared to the parents of the non-NB, ADHD children (Table 1). This suggests that poor adjustment or stress management may foster the habit of nail biting in ADHD patients.

Table 2: Comparison of comorbidity diagnosis in ADHD children with or without the NB habit

Comorbid diagnosis	With NB N(%)	Without NB N(%)	*p*
ODD			
No	24 (47.1)	32 (55.2)	0.398
Yes	27 (52.9)	26 (44.8)	
CD			
No	46 (90.2)	49 (84.5)	0.374
Yes	5 (9.8)	9 (15.5)	
Anxiety			
No	47 (92.2)	56 (96.6)	0.416[a]
Yes	4 (7.8)	2 (3.4)	
Tics			
No	51 (100)	56 (96.6)	0.497[a]
Yes	0 (0)	2 (3.4)	
TS			
No	48 (94.1)	56 (96.6)	0.663[a]
Yes	3 (5.9)	2 (3.4)	
Dyslalia			
No	45 (88.2)	55 (94.8)	0.300[a]
Yes	6 (11.8)	3 (5.2)	
AD			
No	47 (92.2)	58 (100)	0.045[†a]
Yes	4 (7.8)	0 (0)	

NB = Nail Biting; ODD : Oppositional Defiant Disorder; TS : Tourett's syndrome; CD: Conduct disorder; AD: Adjustment disorder; [a] Fisher's Exact Test ; [†]$p < 0.05$; [‡]$p < 0.01$

Associations

We further validated the association between NB and the combined subtype (ADHD-C) by simple logistical regression analyses (Table 3: Odds Ratio = 2.73; $p = 0.016$). ADHD comorbidity combined as a whole did not have strong associations with NB in the inflicted children. However, ADHD children with parents in marital discord were more prone to develop the habit of nail biting (Table 3: Odds ratio = 5.11; p=0.007) (Table 3).

Table 3: Associations between NB habits and the combined ADHD subtype, comorbidity, and marital discord by simple logistic regression

	OR	95% CI		z	*p*
Subtype	2.73	1.21	6.15	2.42	0.016†
Comorbidity	0.54	0.25	1.17	-1.57	0.116
Marital discord	5.11	1.56	16.75	2.69	0.007‡

OR = Odds Ratio; CI = Confidence Interval; † < .05; ‡ < 0.01

Discussion

To our knowledge, this was the first study that critically compared ADHD children with the nail-biting habit and those without the habit. About half of our ADHD pediatric patients (46.8%) in Taiwan Mackay Memorial Hospital had a nail-biting habit, based on the data collected. ADHD children with a nail-biting habit tended to be younger, and diagnosed with the ADHD-C subtype and maladjustment problems. Their mothers were generally older, and a significantly higher percentage of their parents were in marital discord compared with the parents of non-NB, ADHD children. The parents of NB, AHDH children also tended to have poorer stress management skills than the parents of the ADHD children who did not bite nails. From simple logistical regression analyses, we demonstrated that nail biting was significantly associated with the ADHD-Combined subtype, as well as parental marital discord. From the viewpoint of symptom severity, children with ADHD-C are more inattentive, less sustainable in task performance, and less capable of inhibition (Houghton et al., 1999). Consequently, ADHD-C children tend to have more behavioral symptoms (e.g. hyperactivity and impulsivity) (Crystal, Ostrander, Chen, & August, 2001) and poorer performance at school (Carlson & Mann, 2000) than ADHD-Inattentive children. Our study found that the habit of nail biting was frequently associated with the ADHD-C subtype, after excluding all the confounding risks associated with ADHD and NB (Tables 1 & 3). The ADHD-C subtype cannot be easily differentially diagnosed by child psychiatrists, because many of the parents who come to the clinic tend to mask hyperactive and impulsive symptoms of the children during initial clinical assessments. Therefore, based on our findings, the habit of nail biting could be used as an important indicator for assessing behavioral symptom severity in children with ADHD. Another valuable finding from this study is the irrelevance of NB with anxious mood in ADHD children (Table 2). There are conflicting study results on nail biting and anxiety disorder. Some have suggested that anxiety (Joubert, 1993) and/or negative mood states (Foster, 1998) are the main causes of developing the habit of nail biting, while others have suggested the habit of nail biting to be independent of anxiety (Deardoff, Finch, & Royall, 1974). In our pediatric subjects with ADHD, anxiety disorder was not an overwhelming comorbidity compared with ODD (Table 2). Nail biting could not be rationalized by anxiety here. Rather, our analyses on comorbidity suggest that NB is a complex behavioral symptom associated with one's inability to cope with stress shown as maladjustment disorder (Table 2).

Marital discord in the family is a critical psychosocial risk for developing ADHD in children. (Davies, Sturge-Apple, & Cummings, 2004; Vasconcelos et al., 2005) In this study, parental marital discord was found to be associated with

nail biting in ADHD children. Also the senior ages of the mothers and the poor stress management skills of the parents were both found to be related to the nail-biting habit of their ADHD children (Table 1). These parental factors could be regarded as early warning signs for ADHD differential diagnosis. Our findings emphasize the importance of implementing effective parenting programs designed specifically for parents with ADHD children, especially those with the nail-biting habit.

This study had several limitations. The sample population was from a large, teaching hospital in Taipei City (the capital of Taiwan); there might be some variations in rural cases. The nail-biting habit of the ADHD children was reported by their parents, and was not determined by specific measurements. This study was the first general survey of NB in ADHD pediatric patients in Taiwan, so nail biting and related habits were not further differentiated into subcategories. Several demographic variables or acquired environmental risks were recorded by simple questionnaire (yes/no), and not with grading checklists. The MINI Kid diagnostic tool has not been widely used in Taiwan, so further studies using MINI Kid diagnostics will help validate our results. Despite these limitations, this study has demonstrated the associations between nail biting and ADHD-C, and the relevance of poor or incapable parenting in the development of NB habits. Future studies should focus on the detailed relationships between nail biting and developmental psychopathology using a systematic approach.

In conclusion, nail-biting habits tend to be developed in ADHD pediatric patients with the combined subtype. Poor parental functions (i.e. older mothers, marital discord, and poor stress management skills of the parents) appear to foster the habit of nail biting in ADHD children. Therefore, effective intervention should be geared toward family support and parent training to ameliorate pathological development in the afflicted children.

Implications

Nail biting was prevalent among 46.8% of the ADHD pediatric population in Taiwan. Child psychiatrists should regard NB as an early warning sign for the severe combined ADHD subtype, and inquire about family functions (such as marital discord) during initial assessments. ADHD children showing the habit of nail biting may require multimodal therapeutic approaches combined with pharmacological intervention (Chronis, Jones, & Raggi, 2006). We also suggest designing training programs for parents with ADHD children, especially those who bite their nails. These programs should focus on resolving marital discord and enhancing parents' stress management, especially when dealing with, or disciplining, ADHD children. Additionally, parents with ADHD children should be taught to address their children's nail-biting habit using techniques of flexible behavior modification and positive reinforcement, instead of focusing on intentional noncompliance of the children.

References

Carlson, C. L., & Mann, M. (2000). Attention-deficit/hyperactivity disorder, predominantly inattentive subtype. *Child and Adolescent Psychiatric Clinics of North America, 9*(3), 499-510.

Chronis, A. M., Jones, H. A., & Raggi, V. L. (2006). Evidence-based psychosocial treatments for children and adolescents with attention-deficit/hyperactivity disorder. *Clinical Psychology Review, 26*(4), 486-502.

Connor, D. F., Steeber, J., & McBurnett, K. (2010). A review of attention-deficit/hyperactivity disorder complicated by symptoms of oppositional defiant disorder or conduct disorder. *Journal of Developmental and Behavioral Pediatrics, 31*(5), 427-440.

Crystal, D. S., Ostrander, R., Chen, R. S., & August, G. J. (2001). Multimethod assessment of psychopathology among DSM-IV subtypes of children with attention-deficit/hyperactivity disorder: self, parent, and teacher reports. *Journal of Abnormal Child Psychology, 29*(3), 189-205.

Davies, P. T., Sturge-Apple, M. L., & Cummings, E. M. (2004). Interdependencies among interparental discord and parenting practices: the role of adult vulnerability and relationship perturbations. *Development and Psychopathology, 16*(3), 773-797.

Deardoff, P. A., Finch, A. J., Jr., & Royall, L. R. (1974). Manifest anxiety and nail-biting. *Journal of Clinical Psychology, 30*(3), 378.

Foster, L. G. (1998). Nervous habits and stereotyped behaviors in preschool children. *Journal of the American Academy of Child and Adolescent Psychiatry, 37*(7), 711-717.

Ghanizadeh, A. (2008). Association of nail biting and psychiatric disorders in children and their parents in a psychiatrically referred sample of children. *Child Adolescent Psychiatry Mental Health, 2*(1), 13.

Hollingshead, A. (1965). *Two-factor index of social position.* New Haven, CT: Yale University, Department of Sociology.

Houghton, S., Douglas, G., West, J., Whiting, K., Wall, M., Langsford, S., et al. (1999). Differential patterns of executive function in children with attention-deficit hyperactivity disorder according to gender and subtype. *Journal of Child Neurology, 14*(12), 801-805.

Johnston, C., & Mash, E. J. (2001). Families of children with attention-deficit/hyperactivity disorder: review and recommendations for future research. *Clinical Child Family Psychology Review, 4*(3), 183-207.

Joubert, C. E. (1993). Relationship of self-esteem, manifest anxiety, and obsessive-compulsiveness to personal habits. *Psychological Reports, 73*(2), 579-583.

Klatte, K. M., & Deardorff, P. A. (1981). Nail-biting and manifest anxiety of adults. *Psychological Reports, 48*(1), 82.

Kleinrok, M., Mielnik-Hus, J., Zysko-Wozniak, D., Szkutnik, J., Kaczmarek, A., Doraczynska, E., et al. (1990). Investigations on prevalence and treatment of fingernail biting. *The Journal of Craniomandibular Practice, 8*(1), 47-50.

Matza, L. S., Paramore, C., & Prasad, M. (2005). A review of the economic burden of ADHD. *Cost Effectiveness and Resource Allocation, 3, 5.*

Petersen, K. U., Weymann, N., Schelb, Y., Thiel, R., & Thomasius, R. (2009). Pathological Internet use--epidemiology, diagnostics, co-occurring disorders and treatment. *Fortschritte der Neurologie-Psychiatrie, 77*(5), 263-271.

Scahill, L., & Schwab-Stone, M. (2000). Epidemiology of ADHD in school-age children. *Child and Adolescent Psychiatric Clinics of North America, 9*(3), 541-555.

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., et al. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry, 59 Suppl 20, 22-33;quiz 34-57.*

Swensen, A., Birnbaum, H. G., Ben Hamadi, R., Greenberg, P., Cremieux, P. Y., & Secnik, K. (2004). Incidence and costs of accidents among attention-deficit/hyperactivity disorder patients. *Journal of Adolescent Health, 35*(4), 346 e341-349.

Troster, H. (1994). Prevalence and functions of stereotyped behaviors in nonhandicapped children in residential care. *Journal of Abnormal Child Psychology, 22*(1), 79-97.

Vasconcelos, M. M., Malheiros, A. F., Werner, J., Jr., Brito, A. R., Barbosa, J. B., Santos, I. S., et al. (2005). Contribution of psychosocial risk factors for attention deficit/hyperactivity disorder. *Arquivos de Neuro-Psiquiatria, 63*(1), 68-74.

Yassaei, S., Rafieian, M., & Ghafari, R. (2005). Abnormal oral habits in the children of war veterans. *Journal of Clinical Pediatric Dentistry, 29*(3), 189-192.