Associations between Psychological Factors and the Presence of Deleterious Oral Habits in Children and Adolescents

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Objectives: *This study aimed to evaluate the associations between psychological factors and the presence of deleterious oral habits in children and adolescents.* ***Study Design:*** *147 students aged 8 to 14-years-old were divided in two groups concerning the presence and absence of DOH: Habit group (HG) and Habit free group (HFG). Participants were asked about the presence of DOH using the domain III (Oral Habits) of the Nordic Orofacial Test-Screening (NOT-S). Symptoms of anxiety and depression were evaluated using the Brazilian Portuguese versions of the Revised Children's Manifest Anxiety Scale (RCMAS) and the Children's Depression Inventory (CDI), respectively. Saliva was collected 30min after waking and at night to determine the diurnal decline in salivary cortisol (DDSC). Data were analyzed using the Chi-squared, Mann-Whitney, Spearman´s correlation and logistic regression.* ***Results:*** *The prevalence of DOH was higher in females than males (65.1 vs 34.9; $p<0.05$). The most frequent DOH was nail biting (58.7%). HG presented more depressive symptoms than HFG ($p<0.05$). There was positive correlation between salivary cortisol levels and age ($p<0.01$). Logistic regression analysis found association between symptoms of anxiety and the presence of DOH ($OR=2.35$; $p<0.05$).* ***Conclusions:*** *In conclusion, children and adolescents with DOH presented more symptoms of depression than their counterparts. Moreover, they were more likely to report symptoms of anxiety.*

Key words: *Adolescent, Anxiety, Child, Depression, Disability evaluation Hydrocortisone, Saliva*

INTRODUCTION

Deleterious oral habits (DOH) are defined as learned patterns of muscular contraction [1]. With practice they become unconscious and frequent and are incorporated to personality [1]. They include sucking habits (such as thumb, pacifier and bottle sucking), nail biting, atypical swallowing, lip biting and others. A wide range of frequencies of DOH are reported in the literature, from 9.9 to 34.1% [2,-4] on international studies, and from 70 to 83.1% on Brazilian ones [5,6]. Oral habits can interfere on stomatognathic system functions [7] and are usually related to be an etiological factor of malocclusions. It is suggested, in the literature, that 35-50% of malocclusions are caused by external factors [8], and the most frequent functional factor that influence occlusion is oral habits[8]. The negative effects of oral habits will depend of their frequency, intensity and duration, as well as the type of habit and individual hereditary growth patterns [6].

Two behavioral theories have been used to explain the etiology of oral habits, especially nonnutritive sucking habits: the psychoanalytic, proposed by Freud, and the learning theory [9]. Both theories believe that some developmentally normal conditions, promote the origin of nonnutritive sucking habits. According to psychoanalytic theory, sucking habits are a pleasurable stimulation of lips and mouth. The learning theory supports that sucking habits are adaptive response [9-11]. It is expected that by the age of three years, the majority of children have ceased with oral habits [9]. For children that continued with habits beyond this age, the psychoanalytic theory suggest that is an indicative of psychological disturbance, caused by an inability to cope with life´s stress [9]. However, the learning theory believes that it is just a learned habit. According to psychoanalytic theory some of the etiological factors for oral habits are: family conflicts, jealousy, school pressure and anxiety and stress [10].

The link between psychological factors and DOH still remains inconclusive in the literature. While, some studies have suggested the influence of anxiety on DOH development [12], physiological evidence of the relation between stress and DOH has not yet been proven. Vanderas *et al*[11] investigated the relationship between digit-sucking habit and emotional stress measured by the urinary catecholamines in six to eight year old children, but found no

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significant association. Recently, salivary biomarkers, such as cortisol, have been used to assess stress reactions [13]. Cortisol, a glucocorticoid hormone, is the end product of the hypothalamicpituitaryadrenal (HPA) axis activation in humans and is secreted in response to increased stress in an individual's environment [14]. The HPA axis is believed to play an important role in physiological coping and can aid in mediating the effects of stress on health, mood, behavior, and stress-related disease [15]. There are many advantages for measuring cortisol in saliva of children: there are strong positive correlations between salivary and blood cortisol levels, it is relatively noninvasive and inexpensive technique, it permits home sampling and non contamination of results by needle stress and attracts participation in studies from those who might not permit blood samples [14-16]. However, to date, there is no study investigating the correlation between salivary cortisol levels and DOH in children and adolescents.

The link between psychological factors and DOH remains inconclusive, so studies including additional psychosocial variables that are frequently observed in children and adolescents, such as depression [17] and stress [18] become important. In this way, the present study aimed to evaluate the relationships between DOH and emotional status, such as symptoms of anxiety and depression and salivary cortisol concentration (as a biomarker of stress), in eight- to fourteen-year-old children and adolescents.

MATERIALS AND METHODS

This project was approved by the Research Ethics Committee of the Dental School of Piracicaba, University of Campinas (protocol number 009/2008). Five hundred fifty authorizations were distributed to 8 to 14-year-old students attending four public schools in Piracicaba city, São Paulo State, Brazil, and consent was obtained from 333 parents/guardians. The exclusion criteria were: systemic and/or mental developmental disorders informed by parents/guardians, non-collaboration with the examinations and fulfillment of questionnaires, refuse in participate of the saliva collection and subjects that take medications (such as antidepressants, muscle relaxants, narcotics or non-steroidal anti-inflammatory drugs) until 15 days before the saliva collection.

The final sample was consisted of 147 children, 50 boys and 97 girls, aged from 8 to 14 years. From the 333 children, eighty were excluded because they did not fulfill all questionnaires and 106 did not adhere to saliva collection procedures.

For assessment of (DOH) it was used the domain III (Habits) of the Nordic Orofacial Test – Screening (NOT-S) protocol, which was developed by Bakke *et al* [19] and was translated and culturally adapted to Brazilian Portuguese by Leme *et al* [20]. This protocol consists of a structured interview and a clinical examination. The domain III of NOT-S´ interview assesses orofacial dysfunction caused by the presence of oral habits and consists of three questions. All subjects answered the interview questions without parental/guardian assistance, based on a pilot test conducted by this research group that verified that children older than 7 years old are able of answer the interview questions by themselves. The subjects were classified as Habit group if they answered YES to at least one of the three questions in domain III of NOT-S and as Habit free group, if they answered NO to all questions in domain III of NOT-S. On asking the questions of domain III, the type of habits informed by subjects was registered, being detected, as following, nail biting, lip biting or sucking, thumb or finger sucking, pacifier sucking, bottle sucking, cheek biting, tooth grinding, tongue biting and pencil or pen biting.

The domain III of NOT-S was applied individually by the same researcher on a vacant class.

Evaluation anxious and depressive symptoms

Anxiety symptom data were collected using the Portuguese version of the Revised Children's Manifest Anxiety Scale (RCMAS) [21] for 6- to 19-year-olds [22] . The RCMAS is a 28-item yes/no self-rating scale that consists of items designed to assess physiological symptoms, social concerns and worry. The items were scored as 1 or 0, which yielded a range from 0 to 28. Higher scores indicated greater anxiety.

Symptoms of depression were assessed using the Portuguese version of the Children's Depression Inventory (CDI) [23], which was originally developed by Kovacs (24). The CDI consists of 27 items designed to assess a variety of symptoms associated with depression, such as sleep disturbance, appetite loss, suicidal thoughts and general dysphoria. Each item consists of three brief statements that describe options ranging from normal responses to responses that indicate moderate or severe symptoms of depression. The items were scored 0 (normal), 1 (moderate), or 2 (severe) for a final range of 0 to 54.

Evaluation of salivary cortisol concentration

Salivary cortisol samples were collected and analyzed considering the circadian rhythm of cortisol [25]. Stimulated saliva samples were collected at home after the subjects and their parents had been given instructions for the collection procedure. They received plastic tubes containing cotton rolls (Salivettes, Sarstedt, Numbrecht, Germany) for collecting saliva. On a weekday, after waking normally, the subjects chewed the cotton rolls for two minutes, until they had been soaked with saliva, and then placed them into the salivettes. The first sample was taken 30 min after waking (fasting) and the second sample was taken at night (bedtime). Samples were kept on ice and transported to the laboratory on the next day, where they were centrifuged (at 3500 rpm for 5 min) and stored at -80˚C for analysis. To minimize variation, all samples from the same subject were assayed in the same batch (in duplicate). Salivary cortisol was assayed in 25 µl samples of whole saliva using a highly sensitive commercial enzyme immunoassay kit (Salimetrics, State College, PA, USA) in a microtiter plate and read at 450 nm (Stat Fax 2100, Awareness Tech. Inc., Palm City, FL, USA), according to the manufacturer's directions. Standard curves were fitted by a weighted regression analysis.

Data analysis was performed using SPSS 9.0 (SPSS, Chicago, IL, USA) with a 5% significance level, and normality was assessed using the Kolmogorov-Smirnov test. Since score distributions were asymmetrical, non-parametrical tests were used in analyses performed.

The diurnal decline of salivary cortisol data (DDSC) (in µg/dl) was calculated as the difference between cortisol levels at 30 min after waking and at bedtime. Individual's gender, age and psychological characteristics (RCMAS and CDI scores and DDSC values) were summarized separately for the two clinical groups (habits and habits free) using frequencies and percentages, means and standard deviations (SD). The Chi-squared test was used for a comparison of proportions and Mann-Whitney test for a comparison of the means of the continuous variables. The correlations between the

psychological variables and age were estimated by group using the Spearman correlation coefficient.

Logistic regression models with the binary endpoint of oral habit (yes, no) were fit to evaluate the association between the presence of at least one oral habit and each of the independent variables. First, univariate models were fit to examine the association between the presence of oral habit (as dependent variable) and gender (male=0; female=1), age (in years) and each of the psychological variables. Median values of the RCMAS and CDI scores and DDSC values were used as thresholds for the outcomes. Next, a multivariable logistic regression model was fit using a stepwise variable selection method to identify a set of variables that were independently associated with the presence of oral habit. Only variables with $P \leq 0.25$ for the univariate analysis were kept in the multivariable models as potential confounders (26).

RESULTS

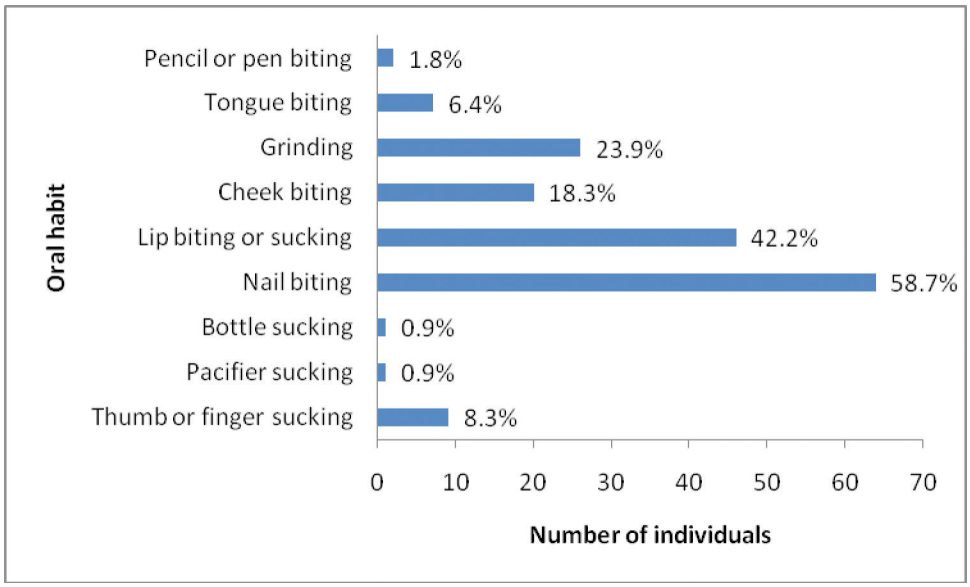
The sample characteristics such as age, gender, RCMAS and CDI scores and DDSC values, are showed on Table 1. Females presented higher prevalence of oral habits than males ($p<0.05$), and mean CDI scores were higher on Habit group ($p<0.05$).

Table 1. Characteristics of sample in accordance with clinical groups.

	Habit free (n=38)	Habit (n=109)
Mean age (SD)	10.1 (1.6)	10.6 (1.7)
Gender (%)		
Male	12 (31.6)	38 (34.9)†
Female	26 (68.4)	71 (65.1)†
Mean RCMAS score (SD)	13.7 (5.6)	16.1 (6.9)
Mean CDI score ± SD	7.5 (4.2)‡	10.4 (7.0)‡
Mean DDSC ± SD (in µg/dl)	0.18 (0.13)	0.18 (0.20)

RCMAS, Revised Children's Manifest Anxiety Scale; CDI, Children's Depression Inventory; DDSC, diurnal decline of salivary cortisol
† Chi-square test; ‡ Mann-Whitney test ($p<0.05$)

Figure 1. Distribution and frequency (%) of the different types of oral habits in the studied sample (n=109).



The habits presented by the participants are list in Figure 1, and the most frequently observed habit was nail biting (58.7% of Habit group) followed by lip biting or sucking, grinding and cheek biting.

There were positive correlations between age and salivary cortisol ($p<0.01$) and between CDI and RCMAS scores ($p<0.01$) in both clinical groups, as seen on Table 2.

Table 2. Spearman's rank correlations between age and psychological variables according to clinical groups.

Group	Variable	Age	Depression	Anxiety	DDSC
Habit free (n=38)	Age	-			
	Depression	0.02	-		
	Anxiety	0.01	0.57*	-	
	DDSC	0.45*	0.07	-0.13	-
	Variable	**Age**	**Depression**	**Anxiety**	**DDSC**
Habit (n=109)	Age	-			
	Depression	0.18	-		
	Anxiety	0.11	0.50*	-	
	DDSC	0.30*	0.15	0.05	-

DDSC, diurnal decline of salivary cortisol
*$p<0.01$

The univariate logistic regression results are showed on Table 3. RCMAS scores were significantly associated with the presence of oral habits (OR=2.35; $p<0.05$). Multiple logistic regression analysis (Table 4) also found statistically significant associations between RCMAS scores and oral habits in children and adolescents (OR=2.35; $p<0.05$).

DISCUSSION

Nail biting was the most frequent oral habit in the evaluated sample, probably due to the fact that this habit can be transference of sucking habits, which tend to be abandoned during the third year of life, when nail biting starts [12]. This finding corroborated previous ones in children [27] and adolescents [2]. On the other hand, other studies reported thumb and tongue sucking as the most frequent oral habit [4,28]. Moreover, it was observed by Tanaka *et al* [12] that the

Table 3. Univariate logistic regression analysis of the association between the presence of oral habit and age, gender and psychological variables (n=147).

Dependent variable	Independent variables	Coef.	p-value	Odds ratio	95% CI
Oral habit	Age	0.156	0.173	1.17	0.93-1.46
	Gender	-0.14	0.713	0.86	0.39-1.90
	Depression	0.48	0.208	1.62	0.76-3.43
	Anxiety	0.85	0.029	2.35	1.09-5.08
	DDSC	-0.01	0.961	0.98	0.47-2.05

DDSC, diurnal decline of salivary cortisol

Table 4. Multiple logistic regression to test the association of independent variables with the presence of oral habits in the studied sample (n=147). Only the independent variables that remained in the final model are shown.

Dependent variable	Independent variables	Coef.	p-value	OR	95% CI
	Constant	0.67	-	-	-
Oral habit	Anxiety	0.85	0.029	2.35	1.09-5.08

OR, odds ratio
Model chi-square: 4.96; P=0.025

prevalence of this habit increases after 10 years-old, whereas around 16 years-old, onychophagia is usually replaced by the habit of lip "pinching," chewing of pencils or other objects, nose scratching, or hair twirling [12].

In relation to gender, the present results found higher prevalence of DOH in females than males. To date, there is no consensus in the literature regarding the prevalence of oral habits and their association with gender. While some studies report that females have more oral habits than males [8,29], others found no difference between genders [6,8,30]. These contradictory results may be explained by psychological characteristics of these individuals. Previous studies have suggested that females experienced more symptoms of anxiety than males [31-33]. Accordingly, the present study also found statistically significant associations between symptoms of anxiety and the presence of DOH (in univariate and multivariate analysis), corroborating with Tanaka *et al* [12]. Some explanations for differences between genders in relation to anxiety are: differences in social pressures related to social competence and body image [31] and hormonal changes [34-35]. Estrogens have been reported to influence anxiety symptoms [36] as hypothalamic pituitary adrenal axis dysregulation [37].

Children and adolescents with DOH also presented more depressive symptoms than their counterparts. Although this difference is statistically significant, the means CDI scores in both clinical groups are lower than normative data suggested by previous Brazilian studies assessing 7 to 17-year-old children and adolescents. Normative data values vary from 14 to 23 [23,38,39]. On the other hand, there was no difference regarding symptoms of anxiety between subjects with and without oral habits. However, both clinical groups presented RCMAS scores higher than normative data previously suggested [21,22]. Positive correlations were also observed between CDI and RCMAS scores in both clinical groups, i.e., children and adolescents who reported higher symptoms of depression were more likely to report symptoms of anxiety, independently of the presence or absence of DOH. This is in line with the American Psychiatric Association [40] and with Brady and Kendall [41] study, which suggest that depressive symptoms may be associated with different psychological disorders, mainly anxiety. They found strong correlation between depressive and anxiety measurements, especially self-report assessment. Moreover, Masi *et al* [42] observed that 56% of patients with generalized anxiety disorder presented depressive disorder as the most frequent comorbidity.

Literature evidence indicates that cortisol hypersecretion is associated with depression and anxiety disorders [43-46]. However, the present study found no difference between DDSC values comparing Habit and Habit free groups. On the other hand, DDSC values were positively correlated with age in both clinical groups. Data on literature are conflicting [47,48], this is because most studies have used a heterogeneous sample of age ranges rather than focusing on defined age groups[16], because of these inconsistent aspects of the literature, conclusions are difficult to draw but salivary cortisol levels may be correlated with age in the period before and during sexual development [16].

CONCLUSIONS

In conclusion, children and adolescents with deleterious oral habits presented more symptoms of depression than their counterparts. Moreover, they were more likely to report symptoms of anxiety.

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REFERENCES

1. Moyers RE. Etiologia da má oclusão. In: Moyers RE. Ortodontia. 3ª ed. Rio de Janeiro: Guanabara Koogan, 1991. p. 127-40.
2. Shetty SR, Munshi AK. Oral habits in children--a prevalence study. J Indian Soc Pedod Prev Dent 16(2): 61-6, 1998.
3. Onyeaso CO, Isiekwe MC. Oral habits in the primary and mixed dentitions of some Nigerian children: a longitudinal study. Oral Health Prev Dent 6(3): 185-90, 2008.
4. Quashie-Williams R, daCosta OO, Isiekwe MC. Oral habits, prevalence and effects on occlusion of 4-15 year old school children in Lagos, Nigeria. Niger Postgrad Med J 17(2): 113-7, 2010.
5. Leite-Cavalcanti A, Medeiros-Bezerra PK, Moura C. Breast-feeding, bottle-feeding, sucking habits and malocclusion in Brazilian preschool children. Rev Salud Publica (Bogota) 9(2): 194-204, 2007.
6. Hebling SRF, Cortellazzi KL, Tagliaferro EPS, Hebling E, Ambrosano GMB, Meneghim MC, Pereira AC. Relationship between malocclusion and behavioral, demographic and socioeconomic variables: a cross-sectional study of 5-year-olds. J Clin Pediatr Dent 33(1): 75-9, 2008.
7. Felício CM, Ferreira-Jeronymo RR, Ferriolli BHVM, Freitas RLRG. Análise da associação entre sucção, condições miofuncionais orais e fala. Pró-Fono 15(1): 31-40, 2003.
8. Stahl F, Grabowski R, Gaebel M, Kundt G. Relationship between Occlusal Findings and Orofacial Myofunctional Status in Primary and Mixed Dentition - Part II: Prevalence of Orofacial Dysfunctions. J Orofac Orthop 68: 74–90, 2007.
9. Johnson ED, Larson BE. Thumb-sucking: literature review. J Dent Child 60: 385-391, 1993.
10. Bayardo RE; Mejia JJ; Orozo S; Montoya BS. Etiology of oral habits. J Dent Child; 63(5): 350-353, 1996.
11. Vanderas AP, Voila P, Papagiannoulis L. Urinary catecholamines as a mesure of emotional stress in children with a digit-sucking habit: A preliminary study. J Dent child; 68(3): 179-182, 2001.
12. Tanaka OM, Vitral RWF, Tanaka GY, Guerrero AP, Camargo ES. Nail-biting: or onychophagia: A special habit. Am J Orthod Dentofacial Orthop 134: 305-8, 2008.
13. Nater UM, La Marca R, Florin L, Moses A, Langhans W, Koller MM, Ehlert U. Stress-induced changes in human salivary alpha-amylase activity -- associations with adrenergic activity. Psychoneuroendocrinology 31(1): 49-58, 2006.
14. Hanrahan K, McCarthy AM, Kleiber C, Lutgendorf S, Tsalikian E. Strategies for salivary cortisol collection and analysis in research with children. Appl Nurs Res 19(2): 95-101, 2006.
15. King SL, Hegadoren KM. Stress hormones: How do they measure up? Biol Res Nursing 4(2): 92– 103, 2002.
16. Jessop DS, Turner-Cobb JM. Measurement and meaning of salivary cortisol: A focus on health and disease in children. Stress 11(1): 1–14, 2008.
17. Belfer ML, Rohde LA. Child and adolescent mental health in Latin America and the Caribbean: problems, progress and policy research. Revista Panamericana de Salud Pública 18(4-5), 359-365, 2005.
18. Marceau K, Dorn LD, Susman EJ. Stress and puberty-related hormone reactivity, negative emotionality, and parent-adolescent relationships. Psychoneuroendocrinology 37(8): 1286-98, 2012.
19. Bakke M, Bergendal B, McAllister A, Sjogreen L, Asten P. Development and evaluation of a comprehensive screening for orofacial dysfunction. Swed Dent J 31: 75-84, 2007.
20. Leme MS, Barbosa TS, Gavião MBD. Versão brasileira do The Nordic Orofacial Test Screening (NOT-S) para avaliação de disfunções orofaciais. Pesq Bras Odontoped Clín Integr;11(2): 281-289, 2011.
21. Gorayeb MAM, Gorayeb R. "O Que Penso e Sinto" – Adaptação da Revised Children's Manifest Anxiety Scale (RCMAS) para o português. Temas em Psicologia 16(1): 35-45, 2008.
22. Reynolds CR, Richmond BO. What I think and feel: a revised measure of children´s manifest anxiety. Child Psychol 6: 271-280, 1978.
23. Gouveia VV, Barbosa GA, Almeida HJF, Gaião AA. Inventário de depressão infantil - CDI - estudo de adaptação com escolares de João Pessoa. J Bras Psiq 44: 345-9, 1995.
24. Kovacs M. The Children Depression, Inventory (CDI). Psychopharmacol Bull 21: 995-9, 1985.
25. Engeland WC, Arnhold MM. Neural circuitry in the regulation of adrenal corticosterone rhythmicity. Endocrine 28(3): 325-32, 2005.
26. Hosmer DW, Lemeshow S. (1989). Applied logistic regression. New York: Wiley.
27. Vasconcelos FMN, Massoni ACLT, Ferreira AMB, Katz CRT, Rosenblat A. Occurrence of Deleterious Oral Habits in Children from Recife, Pernambuco, Brazil. Pesq Bras Odontoped Clin Integr 9(3): 327-332, 2009.
28. Onyeaso CO. Oral habits among 7-10 year-old school children in Ibadan, Nigeria. East Afr Med J 81(1): 16-21, 2004.
29. Winocur E, Littner D, Adams I, Gavish A. Oral habits and their association with signs and symptoms of temporomandibular disorders in adolescents: a gender comparison. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 102(4): 482-7, 2006.
30. Bosnjak A, Vućićević-Boras V, Miletić I, Bozić D, Vukelja M. Incidence of oral habits in children with mixed dentition. J Oral Rehabil 29(9): 902-5, 2002.
31. Fincham D, Schickerling J, Temane M, Nel D, De Roover W, Seedat S. Exploratory and confirmatory factor analysis of the multidimensional anxiety scale for children among adolescents in the Cape Town Metropole of South Africa. Depress Anxiety 25(11): 147-53, 2008.
32. Walsh TM, Stewart SH, McLaughlin E, Comeau N. Gender differences in childhood anxiety sensitivity index (CASI) sensitivity. J Anxiety Disord 18: 695–706, 2004.
33. Broeren S, Muris P. Psychometric evaluation of two new parent-rating scales for measuring anxiety symptoms in young Dutch children. J Anxiety Disord 22: 949-58, 2008.
34. Dell'Osso L, Saettoni M, Papasogli A, Rucci P, Ciapparelli A, Di Poggio AB, Ducci F, Hardoy C, Cassano GB. Social Anxiety Spectrum: Gender Differences in Italian High School Students. *J Nerv Ment Dis* **190**: 225–32, 2002.
35. Mazzone L, Ducci F, Scoto MC, Passaniti E, D'Arrigo VG, Vitiello B. The role of anxiety symptoms in school performance in a community sample of children and adolescents. BMC Public Health 7: 347, 2007.
36. Pigott TA. Anxiety disorders in women. *Psychiatr Clin North Am* **26**: 621–72, 2003.
37. Stroud LR, Salovey P, Epel ES. Sex differences in stress responses: social rejection versus achievement stress. Biol Psychiatry 52: 318–327, 2002.
38. Coutinho MPL, Carolino ZCG, Medeiros E. Inventário de Depressão Infantil (CDI): evidências de validade de constructo e consistência interna. Avaliação Psicológica 7(3): 291-300, 2008.
39. Wathier JL, Dell'Aglio DD, Bandeira DR. Análise fatorial do inventário de depressão infantil (CDI) em amostra de jovens brasileiros. Avaliação Psicológica 7(1): 75-84, 2008.
40. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (4ª ed., texto revisado). Washington, DC: APA, 2000/2002.
41. Brady EU, Kendall PC. Comorbidity of anxiety and depression in children and adolescents. Psychological Bulletin, 111(2): 244-255, 1992.
42. Masi G, Millepiedi S, Mucci M, Poli P, Bertini N, Milantoni L. Generalized anxiety disorder in referred children and adolescents. Journal of the American Academy of Child and Adolescent Psychiatry 43(6): 752-760, 2004.
43. Mantella RC, Butters MA, Amico JA, Mazumdar S, Rollman BL, Begley AE, Reynolds CF, Lenze EJ. Salivary cortisol is associated with diagnosis and severity of late-life generalized anxiety disorder. Psychoneuroendocrinology 33(6): 773-781, 2008.
44. Pariante CM, Lightman SL. The HPA axis in major depression: classical theories and new developments. Trends Neurosci 31(9): 464-468, 2008.
45. Vreeburg SA, Hoogendijk W, van Pelt J, DeRijk R, Verhagen J, van Dyck R, Smit J, Zitman F, Penninx B. Major depressive disorder and hypothalamic-pituitary-adrenal axis activity: results from a large cohort study. Arch. Gen. Psychiatry 66: 617-626, 2009.
46. Vreeburg SA, Zitman FG, van Pelt J, DeRijk RH, Verhagen J, van Dyck R, Hoogendijk WJ, Smit JH, Penninx BWJH. Salivary cortisol levels in persons with and without different anxiety disorders. Psychosom Med 72: 340-347, 2010.
47. Koupil I, Mann V, Leon DA, Lundberg U, Byberg L, Vagero D. Morning cortisol does not mediate the association of size at birth with blood pressure in children born from full-term pregnancies. Clin Endocrinol (Oxf) 62: 661-666, 2005.
48. Tornhage CJ, Alfven G. Diurnal salivary cortisol concentration in school-aged children: Increased morning cortisol concentration and total cortisol concentration negatively correlated to body mass index in children with recurrent abdominal pain of psychosomatic origin. J Pediatr Endocrinol Metab 19: 843–854, 2006.