Anxiety Measures and Salivary Cortisol Responses in Preschool Children Who Stutter

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ABSTRACT: Purpose: People who stutter tend to have increased levels of anxiety compared to people who do not stutter, particularly in social situations. Children who stutter (CWS) reported more negative communication attitudes than their fluent peers, and these attitudes appear to worsen with age and stuttering severity. The present study sought to examine whether CWS differ significantly from children with no stuttering (CWNS) when they are evaluated near the onset period of developmental stuttering.

Method: Seven CWS and seven sex- and age-matched CWNS participated in the study. Each child’s anxiety level was measured using salivary cortisol samples and a combination of child-based and parent-based tests of anxiety.

Results: No significant differences in state and trait anxiety were found between CWS and CWNS, and no relationships were evident on measures of stuttering behavior and anxiety.

Discussion: The present group of CWS was not affected by the negative psychological characteristics associated with stuttering that have been found to occur in older CWS and adults who stutter. Any changes in a child’s anxiety level are likely to occur with increased chronological age and stuttering chronicity.

KEY WORDS: anxiety, children, communication, cortisol, stuttering

Anxiety is a negative emotion and consists of state and trait components (Bennett, 2006). State anxiety is specific to a given situation and may be triggered by factors associated with social interactions (Ezrati-Vinacour & Levin, 2004), whereas trait anxiety refers to an individual’s general level of anxiety, regardless of situational factors that are likely to evoke anxiety (Menzies, Onslow, & Packman, 1999). It is commonly believed that anxiety is associated with the disorder of stuttering, despite conflicting evidence in the literature with regard to the nature of this relationship (Blood, Blood, Bennett, Simpson, & Susman, 1994; Craig, 1990; Ezrati-Vinacour & Levin, 2004; Miller & Watson, 1992; Poulton & Andrews, 1994; Weber & Smith, 1990). Adults who stutter (AWS) often report anxiety related to producing particular sounds, words, or speaking situations (Blood et al., 1994; Lincoln, Onslow, & Menzies, 1996). In addition, stuttering severity appears to be dependent on factors such as communication partner and novelty as well as formality of, and familiarity with, the speaking situation (Buss, 1980; Porter, 1939; Siegel & Haugen, 1964).

A generalized anxiety concept has been proposed to suggest that AWS show overall high state and trait anxiety (Craig & Hancock, 1996). However, evidence in support of
this concept is inconsistent (Craig, 1990; Craig, Hancock, Tran, & Craig, 2003; Fitzgerald, Djurjic, & Maguin, 1992; Kraaimaat, Janssen, & Van Dam-Baggen, 1991; Miller & Watson, 1992). Craig et al. (2003), for example, found that chronic AWS showed clear evidence of heightened generalized anxiety compared to adults with no stuttering (AWNS). Ezrati-Vinacour and Levin (2004) found differences between AWS and AWNS on both state and trait anxiety components. In contrast, Kraaimaat et al. (1991), Menzies et al. (1999), Miller and Watson (1992), and Mahr and Torosian (1999) found that anxiety differences between AWS and AWNS were confined to social (state) anxiety.

Heightened state anxiety specific to social situations is termed communication apprehension (McCroskey, 1978). Several questionnaire studies have confirmed the presence of negative communication attitudes in AWS. Bloodstein (1975) and Kelso (1998) both surveyed AWS regarding their state anxiety in communication situations and found heightened levels of anxiety compared to AWNS. Miller and Watson (1992) reported that the communication attitudes of AWS deteriorated with worsening self-ratings of stuttering severity. Neiman and Rubin (1991) found elevated communication apprehension in AWS that decreased following a period of treatment for stuttering.

**Childhood Anxiety and Stuttering**

Children who have been diagnosed with a communication disorder have an increased risk of developing anxiety disorders in early adulthood (Baker & Cantwell, 1987). Indeed, the development of anxiety disorders in early childhood is found to coincide with the initial emergence of stuttering (Wingate, 2002). Similar to findings for AWS and AWNS, the results concerning anxiety and stuttering in children are far from clear. For example, Andrews and Harris (1964) directly examined anxiety in children who stutter (CWS) and children with no stuttering (CWNS) using the General Anxiety Scale for Children (Sarason, Davidson, Lighthall, Waite, & Ruebush, 1960) and found no significant differences between groups. Craig and Hancock (1996) investigated anxiety in CWS and CWNS using the State–Trait Anxiety Inventory for Children (STAI; Spielberger, Gorsuch, & Luschene, 1970). They too found no differences in either state or trait anxiety between age-matched CWS and CWNS. Davis, Shisca, and Howell (2007) used the STAIC to examine persistent CWS, CWNS, and a recovered group of CWS. No differences were identified between groups for trait anxiety; the persistent CWS group showed the highest state anxiety. Blood, Blood, Tellis, and Gabel (2001) administered the Personal Report of Communication Apprehension (PRCA; McCroskey, 1984) and the Self-Perceived Communication Competence scales (McCroskey & McCroskey, 1988) to adolescent CWS and CWNS, finding significantly greater speaking fears in the CWS. Mulcahy, Hennessey, Beilby, and Byrnes (2008) also examined adolescent CWS and CWNS. Using the State–Trait Anxiety Inventory (STAI; Spielberger, 1983), the Fear of Negative Evaluation scale (Watson & Friend, 1969), and the Overall Assessment of the Speaker’s Experience of Stuttering Teen version (OASES–T; Yaruss & Quesal, 2006), Mulcahy et al. found CWS to show greater state and trait anxiety compared to CWNS.

Parent reports have indicated that CWS are aware of their stuttering shortly after its onset, and this awareness has the potential to affect social interactions from an early age (Ambrose & Yairi, 1994; Fowlie & Cooper, 1978; Packman, Onslow, & Attanasio, 2003). Brutten and colleagues completed a series of studies that support a difference in state anxiety (i.e., communication apprehension) between CWS and CWNS (Bernardini, Vanryckeghem, Brutten, Cocco, & Zmarich, 2009; De Nil & Brutten, 1990, 1991; Vanryckeghem & Brutten, 1996, 1997; Vanryckeghem, Brutten, & Hernandez, 2005; Vanryckeghem, Hylebos, Brutten, & Peleman, 2001). CWS as young as 3 years of age have been found to experience more negative or mal-attitudes toward speech than CWNS, and these attitudes appear to worsen with age and stuttering severity (De Nil & Brutten, 1990; Vanryckeghem et al., 2005). In contrast, such attitudes tend to improve with age among CWNS (Vanryckeghem, 1995; Vanryckeghem & Brutten, 1997). Vanryckeghem et al. (2005) piloted the Communication Attitude Test for Preschool and Kindergarten Children Who Stutter (KiddyCAT; Vanryckeghem & Brutten, 2007), a self-report measure of communication attitudes for preschoolers, in 45 CWS aged 3 to 6 years and 63 sex- and age-matched CWNS. They found that the CWS group displayed significantly more negative communication attitudes than their nonstuttering peers. Thus, there appears to be demonstrable evidence that high levels of state anxiety, based on communication apprehension, can be found in CWS at the onset of stuttering.

**Cortisol and Stuttering**

Cortisol, a steroid stress hormone, has been used extensively as a measure of generalized, state, and trait anxiety in various populations (c.f. Abplanalp, Livingston, Rose, & Sandwisch, 1977; Benjamins, Asscheman, & Schuurs, 1992; Wang, Kulkarni, Dolev, & Kain, 2002). Cortisol is the main glucocorticoid hormone in humans that is released from the adrenal cortex during periods of stress and physiological arousal (Lueken, 2000). It is positively associated with fluctuations in anxiety, even in healthy individuals (Axelrod & Resine, 1984; Francis, 1989). Heightened cortisol levels are thus indicative of increased anxiety (Craig & Hancock, 1996).

A limited number of studies have examined cortisol to assess the physiological reaction of stuttering in various situations. These studies have been restricted to adults. Blood et al. (1994) collected saliva samples from 11 AWS and 11 AWNS controls. Samples were obtained at a baseline session and following both a low-stress and a high-stress condition. Participants were additionally required to complete the STAIC and the PRCA. Results revealed significant differences between AWS and AWNS in cortisol levels after the high-stress condition; however, there were no differences in cortisol levels between groups in the low-stress condition, and neither were there any differences between
groups with regard to communication apprehension. Blood et al. concluded that cortisol responses may be elevated in AWS as a result of an increased perception of high stress or anxiety.

A further study by Blood, Blood, Frederick, Wertz, and Simpson (1997) measured communication apprehension and cortisol responses to a laboratory stressor in 11 AWS and 11 AWNS. Participants were administered the PRCA. They were also required to produce a baseline saliva sample to measure cortisol responses and an additional sample following a laboratory stressor. The laboratory stressor involved completing mental arithmetic aloud for a period of 5 min. A final baseline saliva sample was collected several minutes later. Among the entire group of 22 participants (combined AWS and AWNS), those who demonstrated high communication apprehension on the PRCA also showed significantly higher cortisol responses following the laboratory stressor than the individuals who demonstrated low communication apprehension. However, no significant differences in cortisol responses were detected specifically between AWS and AWNS following the laboratory stressor.

The Present Study

Although most studies thus far have indicated some sort of relationship between stuttering and anxiety, it is important to recognize that most research has focused on AWS or adolescent CWS. This being the case, it is difficult to determine (a) whether the heightened anxiety found in these individuals is a consequence of stuttering or (b) whether these individuals show a predisposition for heightened anxiety, regardless of stuttering. If we are to understand the role of anxiety in early developmental stuttering, examining children at the onset of early stuttering behavior is essential. The intent of the present study mirrors that of previous investigations: We were interested in examining the role of state and trait anxiety in stuttering. However, the present study is a unique departure from past studies in that it examined young CWS in an experimental setting and included a physiological measure of anxiety (i.e., cortisol). The present study was designed to address two questions:

- Do young CWS differ significantly from young CWNS on measures of state and trait anxiety?
- Are measures of state and trait anxiety significantly correlated with measures of stuttering?

METHOD

Participants

Seven CWS and seven CWNS were recruited to participate in this study. The CWS group consisted of five males and two females ($M_{age} = 4.1$ [years;months]). The CWS participants were initially identified at the University of Canterbury Speech and Hearing Clinic as a result of their current involvement in stuttering therapy or parent concern regarding their disfluent speech. Once identified, the presence of stutter-like disfluencies (SLDs) was determined on the basis of a 250–300-word conversational speech sample. Single-syllable word repetitions, part-word repetitions, prolongations, blocks, and broken words were considered to be SLDs (Guitar, 2006). Other disfluencies (ODs) consisted of phrase repetitions, interjections, and revisions. The percentage of overall disfluency ranged from 3% to 24%, averaging 10% for the group. In all cases, the CWS recruited for the study exhibited a total number of SLDs that were ≥ 50% of their total disfluencies (as per Yairi, 1997a, 1997b). The time since stuttering onset (TSO) for each CWS and whether they were currently in treatment were determined by parent report.

The group of CWNS was matched to the CWS group according to sex and age. Both the CWS and CWNS displayed age-appropriate speech and language skills as determined by (a) calculation of the mean length of utterance (MLU) in grammatical morphemes, (b) scores on the Peabody Picture Vocabulary Test—Revised IIIA (PPVT–R; Dunn & Dunn, 1981), and (c) informal assessment of speech production skills. All speech and language assessments were performed by the first author, who is a qualified speech-language pathologist (SLP). All children were judged to have normal hearing based on parent report. The general characteristics of the CWS and CWNS groups are listed in Table 1. The study was approved by the University of Canterbury Human Ethics Committee, and informed consent was obtained from the parents of each child.

Anxiety Measures

Each child’s state and trait anxiety were measured using a combination of questionnaire-based and physiological indices.

Parent questionnaire. The Preschool Anxiety Scale (PAS; Spence & Rapee, 1999) was administered to one parent of each participant. The PAS provides an overall measure of anxiety in children and an indication of specific subtypes of anxiety. It consists of five subscales: (a) Separation Anxiety, (b) Physical Injury Fears, (c) Social Phobia, (d) Obsessive Compulsive Disorder, and (e) Generalized Anxiety, as well as a total score. Parents are required to rate their child’s behaviors on a scale from 0 (not true at all) to 4 (very often true), which are later summed and grouped into subtypes of anxiety. Emphasis in the present study was placed on the Social Phobia subscale, which is an estimate of state anxiety, and the Generalized Anxiety subscale, which is an estimate of generalized anxiety. In addition, the total score across all subscales was considered. Among both the CWS and CWNS groups, six mothers and one father completed the questionnaire."
you talk?” “Is it hard for you to say your name?”). Participants are required to answer yes or no to each question, with a score of 1 assigned to each yes response.2

Cortisol measures. Each participant was required to provide three saliva samples as a measure of his or her cortisol level. The samples were collected by having the child chew on a citric acid–flavored salivette dental roll (Aktiengesellschaft & Co. Sarstedt) for approximately 30–60 s. Following collection, the samples were stored at –20 °C. Once all saliva samples were collected, they were analyzed for cortisol by enzyme-linked immunosorbent assay (Lewis, Manley, Whitlow, & Elder, 1992) following minor modifications and saliva extraction with dichloromethane. Sample sets from each participant were analyzed in the same batch to avoid between-assay variation.

Data Collection

Data collection for each child occurred across two sessions that spanned a 1-week period. The same researcher, the first author, collected all data. Each session took place in the child’s home. A flow chart of the sequence of data collection is provided in Figure 1. The first session involved collection of a baseline (basal) saliva sample at approximately 11:00 a.m. The 11:00 a.m. sampling period was selected because it has been found that cortisol levels tend to remain stable between 11:00 a.m. and 12:00 p.m. (Kirschbaum & Hellhammer, 1989). The children were instructed to place the salivette in their mouth and chew it without swallowing. Once the salivette was saturated with saliva, it was removed from each child’s mouth by the researcher using latex gloves. The salivette was stored in a plastic vial and was subsequently frozen.

The second data collection session occurred 7 days later. During this session, two more saliva samples were obtained from each child. A preconversation saliva sample was collected at 11:00 a.m., following the procedure outlined earlier. Once the sample was obtained, the child engaged in verbal play-based activities to allow for a spontaneous conversation sample to be collected. All conversations were audio-recorded using a cassette recorder (Transonic TC656PC) and an external microphone (DSE Z111), which was placed no more than 20 cm from the participant’s mouth. In all cases, each child in the CWS group was observed to produce speech disfluencies during his or her conversational sample. Following approximately 10 min of conversational sampling, a postconversation saliva sample was collected. Approximately 15 min elapsed between collection of the pre- and postconversation saliva samples. After the postconversation saliva sample was collected, the researcher administered the PPVT–R IIIa and the KiddyCAT in randomized order. During this time, one of the child’s parents was required to complete the PAS. Sessions concluded with a play activity of the child’s choice.

The framework for collection of the saliva samples was designed to determine whether a child’s anxiety level changed across time and, if so, whether the anxiety was linked to state or trait components. For example, if the cortisol levels obtained from the CWS group were significantly higher than those obtained from the CWNS group across the three sampling periods, this would be construed as evidence of high trait anxiety among the CWS. If the CWS showed elevated cortisol levels only for the postconversation sample, this would be taken as evidence of high state anxiety because of its relationship to the immediately preceding speaking situation. Finally, if the cortisol levels for the CWS and CWNS groups were not found to differ across sampling sessions, evidence would be provided for no physiologically based differences in state or trait anxiety.

RESULTS

The results are organized in three sections. The first section reports the results obtained for the CWS and CWNS on the two measures of language performance. The second section reports the results obtained for the various measures of anxiety. The final section reports the results of correlational analyses examining relationships between the language and anxiety variables. A number of t tests were performed to examine group differences; therefore, the p values were adjusted using the Bonferroni procedure to reduce the possibility of making a Type I error (Kirk, 1982).
Language Measures

The MLU and PPVT–R results for both groups are reported in Table 1. The mean MLU for the CWS and CWNS groups was 4.02 and 3.85, respectively. A two-tailed $t$ test was performed to determine possible group differences in MLU. The test was not significant, $t(1, 12) = 0.302$, $p < 0.76$. The mean PPVT–R standard score for the CWS and CWNS groups was 110 and 112, respectively. Results of a two-tailed $t$ test indicated no significant difference in PPVT–R between the groups, $t(1, 12) = 0.241$, $p < 0.81$.

Anxiety Measures

Parent questionnaire. The average PAS total score for the CWS and CWNS groups was 20 ($SD = 11.4$) and 21 ($SD = 17.5$), respectively. The scores did not differ significantly, $t(1, 12) = 0.150$, $p < 0.88$, indicating that parents of CWS and CWNS judged their children to have equivalent levels of overall anxiety. The average score on the Social Phobia subscale was 7 ($SD = 5.0$) and 7 ($SD = 6.7$) for the CWS and CWNS groups, respectively. Similar to the results from the total score, the groups did not differ significantly, $t(1, 12) = 0.083$, $p < 0.93$, indicating little difference in state anxiety between the children as judged by parents. The average score for the CWS and CWNS groups on the Generalized Anxiety Disorder subscale of the PAS was 2 ($SD = 3.2$) and 3 ($SD = 3.8$), respectively, and these scores did not differ significantly, $t(1, 12) = 0.210$, $p < 0.83$, indicating little difference in generalized anxiety between children as judged by parents. The means for the CWS and CWNS groups for the PAS total score, as well as the Social Phobia subscale and Generalized Anxiety Disorder subscale scores, are listed in Table 2.

Child questionnaire. The results related to the KiddyCAT are also presented in Table 2. The CWS and CWNS groups were both found to have an average score of 2. As expected, results of a two-tailed $t$ test were nonsignificant, $t(1, 12) = 0.000$, $p < 1.00$, indicating comparable communication attitudes in the CWS and CWNS groups.

Cortisol measures. For the CWS, results for the cortisol analysis at the basal sample ranged from 5.8 to 14.6 nmol/L, with a mean of 9.2 nmol/L ($SD = 2.6$). The preconversation measure ranged from 7.0 to 14.3 nmol/L, with a mean of 9.3 nmol/L ($SD = 2.5$). The postconversation measure ranged from 5.7 to 12.3 nmol/L, with a mean of 8.4 nmol/L ($SD = 2.3$). For the CWNS, the basal sample ranged from 5.0 to 10.9 nmol/L, with a mean of 7.9 nmol/L ($SD = 2.3$). The preconversation sample ranged from 5.3 to 28.8 nmol/L, with a mean of 12.1 nmol/L ($SD = 7.2$). The postconversation sample ranged from 6.5 to 50 nmol/L, with a mean of 14.0 nmol/L ($SD = 14.7$).

In order to determine whether cortisol levels differed significantly between the CWS and CWNS groups, a two-way repeated measures analysis of variance (ANOVA) was calculated. The within-group factor was sampling period (i.e., basal, pre-, postconversation); the between-groups factor was fluency (i.e., CWS, CWNS). The test revealed no statistically significant differences between the CWS and CWNS groups based on sampling period, $F(2, 2) = 0.898$, $p < 0.42$, or fluency, $F(1, 12) = 0.525$, $p < 0.48$, and no interaction between the groups, $F(2, 24) = 1.248$, $p < 0.30$. Mean cortisol values for the CWS and CWNS groups at each of the three sampling periods are displayed in Figure 2.

The CWS and CWNS groups yielded similar cortisol levels across the three sampling periods. However, Participant 7 of the CWNS group was an exception to this pattern. This participant’s preconversation cortisol level taken at Session 2 (28.8 nmol/L) was almost three times greater than her basal sample taken at Session 1 (10.0 nmol/L), and her postconversation level rose to 50.0 nmol/L. To control for the effect of this participant being an “outlier,” on the test day (Session 2), we replaced her cortisol results with the corresponding mean CWNS values derived.
from the remaining six participants. We then performed a two-tailed \( t \) test between the CWS and CWNS groups for the pre- and postconversation sampling periods. The tests revealed no significant differences between groups at the preconversation, \( t(1, 12) = 0.026, p < 0.97 \), and postconversation, \( t(1, 12) = 0.908, p < 0.39 \), sampling points. Results of this adjustment were used as support for the original ANOVA results, indicating no group differences in cortisol levels. Participant 7 also showed the highest PAS scores compared to the other children (CWS and CWNS), so it seems plausible that this particular child was simply the most anxious child observed in the study.

**Correlational Analyses**

A series of Pearson product–moment correlational analyses were performed to determine whether the various language and anxiety variables were related within each group. The resultant correlation matrix for the CWS and CWNS children is shown in Tables 3 and 4, respectively. Some of the noteworthy correlations found for the CWS group were between TSO and PAS total score (\( r = –0.726, p < 0.03 \)), TSO and Social Phobia subscale score (\( r = –0.692, p < 0.04 \)), and PAS total score and KiddyCAT score (\( r = 0.837, p < 0.009 \)). For the CWNS group, significant correlations were found between the pre- and postconversation cortisol measures (\( r = 0.954, p < 0.0004 \)), PAS total score and Social Phobia subscale score (\( r = –0.692, p < 0.04 \)), and PAS total score and Generalized Anxiety subscale score (\( r = 0.967, p < 0.0001 \)).

**DISCUSSION**

Our study revealed no significant differences between CWS and CWNS on measures of trait anxiety. This was confirmed by the Generalized Anxiety subscale scores and the total scores obtained via the PAS as well as the similarity in cortisol levels between CWS and CWNS at each sampling point. Two explanations are offered for the lack of difference in trait anxiety between groups. First, research has found that abundant expression of parental warmth and positivity toward children is linked with lower levels of generalized anxiety in childhood (Dadds, Barrett, Rapee, & Ryan, 1996; Dumas, LaFreniere, & Serketich, 1995). Perhaps both the CWS and CWNS involved in this study were being reared in environments that are rich in emotional warmth and positive regard, thus rendering them no different from each other in terms of trait anxiety. We did not control for this particular environmental variable, so its likely influence cannot be ignored. A second possibility for the lack of difference in trait anxiety between the two groups is to consider the influence of speech therapy. Four of the seven CWS in the present study were currently receiving treatment for their disfluency at the time of data collection.
Craig (1990) found that trait anxiety levels in AWS decreased to within normal limits following intensive treatment for stuttering. Among the present group of CWS, the simple act of receiving treatment for stuttering may have had an additional benefit of reducing any associated anxiety. The CWS and CWNS groups also did not differ in their state anxiety. The Social Phobia measure, taken from the PAS, indicated that parents across both groups judged their children to have low social phobia. Results from the KiddyCAT confirmed that both groups were highly similar in communication attitude, regardless of differences in fluency. Furthermore, cortisol levels at pre- and postconversation sampling periods provided additional support to indicate that there were no significant differences in state anxiety specific to communication situations. Presumably, if CWS showed more communication apprehension than CWNS, their cortisol levels collected at the postconversation sampling period should have been significantly elevated. This was not the case. In general, cortisol levels of the CWS and CWNS groups changed little from the pre- to postconversation sampling periods.

The lack of difference between CWS and CWNS in regard to state anxiety is surprising in view of past research indicating negative attitudes among young and adolescent CWS and AWS toward communication compared to those with no stuttering (Andrews & Cutler, 1974; Blood et al., 2001; De Nil & Brutten, 1991; Guitar, 1976; Vanryckeghem, 1995). Interestingly, there is evidence to suggest that children may not provide attitudinal responses to assessments of communication attitude, but rather report on the overall quality and stuttering severity of their speech in specific situations (Ingham, 1997; Ulliana & Ingham, 1984). Should this be true, it would seem that CWS undertake a subjective evaluation of their speaking ability when completing a communication attitude assessment (e.g., KiddyCAT) rather than judge their attitudes to speaking in specific communication situations. Hence, it may be that CWS and CWNS do not judge their speaking abilities differently during the onset period of stuttering, when speech disfluencies are common among both CWS and CWNS.

A second possibility is that the CWS in this study simply did not have sufficient experiences of frustration with stuttering in social situations in order to have developed communication apprehension. Perkins (1986) found that negative communication attitudes arise from continuous experiences of speech disfluencies in communicative situations. Craig and Hancock (1996) suggested that CWS may not experience anxiety associated with their stuttering to the same degree as AWS because they have not experienced the “long-term effects of an extensive history of negative speech-related experiences” (Craig & Hancock, 1996, p. 35). Although both preschool CWS and CWNS are reportedly aware of the differences between fluent and disfluent speech at the onset of stuttering (Ambrose & Yairi, 1994; Ezrati, Platzky, & Yairi, 2001), it is likely that CWS have not been exposed to the same degree of negative reactions that AWS associate with speaking situations. Accordingly, young CWS may not yet be conditioned to have negative attitudes toward communication or ensuing social anxiety.

### Table 3. Correlation matrix for the CWS group. Correlations are reported for % WS; TSO; cortisol levels at basal, pre-, and postconversation sampling times; T score, SP score, and GA score on the PAS; and KiddyCAT scores.

<table>
<thead>
<tr>
<th></th>
<th>% WS</th>
<th>TSO</th>
<th>Basal</th>
<th>Pre</th>
<th>Post</th>
<th>PAS−T</th>
<th>PAS−SP</th>
<th>PAS−GA</th>
<th>KiddyCAT</th>
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<tbody>
<tr>
<td>% WS</td>
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<tr>
<td>TSO</td>
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<tr>
<td>Basal</td>
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<tr>
<td>Pre</td>
<td>0.39</td>
<td>−0.05</td>
<td>0.43</td>
<td>1.0</td>
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<tr>
<td>Post</td>
<td>0.38</td>
<td>−0.49</td>
<td>0.58</td>
<td>0.25</td>
<td>1.0</td>
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<tr>
<td>PAS−T</td>
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<td>−0.72*</td>
<td>0.38</td>
<td>0.24</td>
<td>0.26</td>
<td>1.0</td>
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<tr>
<td>PAS−SP</td>
<td>−0.02</td>
<td>−0.69*</td>
<td>−0.26</td>
<td>−0.03</td>
<td>−0.22</td>
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<tr>
<td>PAS−GA</td>
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<td>−0.31</td>
<td>0.62</td>
<td>0.50</td>
<td>0.33</td>
<td>0.71*</td>
<td>0.21</td>
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<tr>
<td>KiddyCAT</td>
<td>0.42</td>
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<td>0.47</td>
<td>0.40</td>
<td>0.19</td>
<td>0.83*</td>
<td>0.45</td>
<td>0.96*</td>
<td>1.0</td>
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</table>

* significant correlates beyond the $p < 0.05$ level.

### Table 4. Correlation matrix for the CWNS group. Correlations are reported for cortisol levels at basal, pre-, and postconversation sampling times; T score, SP score, and GA score on the PAS; and KiddyCAT scores.

<table>
<thead>
<tr>
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<th>Pre</th>
<th>Post</th>
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<th>PAS−SP</th>
<th>PAS−GA</th>
<th>KiddyCAT</th>
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<tr>
<td>Post</td>
<td>0.35</td>
<td>0.95*</td>
<td>0.64</td>
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<tr>
<td>PAS−T</td>
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<tr>
<td>PAS−SP</td>
<td>0.40</td>
<td>0.58</td>
<td>0.73*</td>
<td>0.97*</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAS−GA</td>
<td>0.39</td>
<td>0.51</td>
<td>0.68*</td>
<td>0.96*</td>
<td>0.98*</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>KiddyCAT</td>
<td>0.13</td>
<td>−0.60</td>
<td>−0.49</td>
<td>0.32</td>
<td>0.22</td>
<td>0.28</td>
<td>1.0</td>
</tr>
</tbody>
</table>

* significant correlates beyond the $p < 0.05$ level.
In the present study, the frequency of stuttering (% WS) and the duration of stuttering (TSO) were used as indices of stuttering behavior among the CWS. Correlational analyses identified only one significant correlation between measures of state and trait anxiety compared to stuttering. Specifically, TSO was negatively correlated with total score on the PAS (trait anxiety) and the Social Phobia subscale of the PAS (state anxiety), indicating that those children with the most recent onset of stuttering were judged by their parents to be the most anxious. However, this relationship was neither substantiated by the children themselves (via the KiddyCAT) nor by their saliva cortisol measurements. The present results for CWS seem to support past research for AWS showing no strong relationship between state and trait anxiety and measures of stuttering behavior (e.g., Miller & Watson, 1992; Mulcahy et al., 2008). In particular, Mulcahy et al. (2008) found no significant relationship between anxiety and measures of stuttering behavior, suggesting that anxiety may not play a direct role in the severity and typology of stuttering.

Among the group of CWS, the general pattern was one of no strong link between communication apprehension and stuttering. As such, these results do not align with past studies in which a relationship in young CWS was found (De Nil & Brutten, 1990; Vanryckeghem et al., 2001, 2005). We suggest that the lack of relationship between communication apprehension and stuttering in the present study indicates that young CWS simply do not show increased negative communication attitudes (i.e., state anxiety) at the onset of stuttering compared to CWNS. This conclusion is drawn in spite of two possible limitations to the present study: sampling interval and sample size. It is conceivable that the 15-min interval between pre- and postconversation saliva sampling was too short to detect any response. However, Gröschl (2008) has shown that intervals < 15 min are considered adequate to detect changes in salivary cortisol levels. Furthermore, we acknowledge that the present sample size of children does not afford high statistical power, so one cannot rule out the possibility that recruiting more participants would have led to significant group differences. However, the multiple sampling methods for saliva cortisol employed in this study resulted in restricted participation among the young children. This trade-off between participant sample size and measurement of anxiety at the onset of stuttering could be addressed at a later date and hence we consider the present study exploratory in nature.

Conclusion

No significant differences were found in state or trait anxiety between preschool CWS and CWNS. Further, there were no strong relationships between measures of stuttering behavior and state and trait anxiety for the CWS group. Therefore, it appears that at the onset of stuttering, the current group of CWS was not affected by the negative psychological characteristics associated with the disorder, which are found to occur in older CWS and AWS. However, past research indicates that these characteristics are likely to develop over time (Alm, 2004; De Nil & Brutten, 1990, 1991). Any changes in a child’s anxiety level are likely to occur with increased chronological age and stuttering chronicity.

REFERENCES


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