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Temperamental Characteristics of Children Who Stutter and Children Who Recovered Stuttering Spontaneously

Kekeleyen ve Kekemeliği Spontan İyileşen Çocukların Mizaç Özellikleri

Ayşe AYDIN UYSAL[a],
Ramazan Sertan ÖZDEMİR[b]

[a]Department of Special Education, Kocaeli University Faculty of Education, Kocaeli, TURKEY
[b]Department of Speech and Language Therapy, Medipol University, Faculty of Health Sciences, İstanbul, TURKEY

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Correspondence:
Ayşe AYDIN UYSAL
Kocaeli University Faculty of Education, Department of Special Education, Kocaeli, TURKEY/TÜRKİYE
ayse.uysal@kocaeli.edu.tr

ABSTRACT Objective: The aim of this study is to compare temperamental differences between children who stutter (CWS), children who recovered stuttering spontaneously (CWRSS) and their age and sex matched children with typical development (CWTD). **Material and Methods:** The sample consisted of 65 CWS, 65 CWTD and 20 CWRSS cases. Turkish adaptation of the Child Behavior Questionnaire (CBQ) was administered to all of the participants. In order to indicate the differences among groups in terms of temperament subtests, one-way analysis of variance was conducted. **Results:** The basic group effect was significant between Approach/Positive Participation, Focusing Attention, Shyness, Frustration Control, Effortful Control and Negative Affectivity subtest scores. When compared in terms of the subscales of the CBQ, the self-recovering group had significantly higher scores than the CWS in the "Effortful Control" subscale, while achieving significantly lower scores on the "Negative Affectivity" subscale. Stuttering individuals received significantly lower scores than the self-recovering group in the "Frustration Control" subtest. There was no statistically significant difference between the severity of stuttering and all of the subscales of CBQ. There was also no statistically significant difference between age and other subscales of CBQ except "Smiling and Laughter" subtest. **Conclusion:** Higher scores in Negative Affectivity and lower scores in "Effortful Control" is thought to be a risk factor for chronicity in stuttering.

Keywords: Stuttering; temperament; child

ÖZET Amaç: Bu çalışmanın amacı kekeleyen, kekemeliği kendiliğinden iyileşen ve yaş ile cinsiyetleri eşleştirilmiş tipik gelişim gösteren çocukların mizaç özelliklerini karşılaştırmalı bir biçimde araştırmaktır. **Gereç ve Yöntemler:** Katılımcılar 65 kekeleyen, yaş ve cinsiyetleri eşleştirilmiş 65 tipik gelişim gösteren ve 20 kekemeliği kendiliğinden iyileşen çocuktan oluşmaktadır. Katılımcıların mizaç özelliklerini ölçmek için Çocuk Davranış Listesi Ölçeği kullanılmıştır. Gruplararası farklılıkları belirlemek amacıyla t-testi ve ANOVA analizleri kullanılmıştır. **Bulgular:** Temel grup etkisi Çocuk Davranış Listesi'nin alt boyutları açısından incelendiğinde, Yaklaşım/Olumlu Katılım, Dikkati Odaklama, Utangaçlık, Engellenme Denetimi, Çabalı Kontrol ve Olumsuz Duygulanım alt test skorlarında anlamlı bulunmuştur. Kekemeliği kendiliğinden iyileşen grubun kekemeliği devam eden gruba göre "Çabalı Kontrol" alt testinden daha yüksek skorlar alırken "Olumsuz Duygulanım" alt testinden anlamlı ölçüde daha düşük skorlar aldıkları görülmüştür. Kekeleyen bireyler "Engellenme Denetimi" alt testinde tipik gelişim gösteren ve kekemeliği kendiliğinden iyileşen gruplara göre anlamlı düzeyde daha düşük skorlar elde etmişlerdir. Kekemelik şiddeti ile Çocuk Davranış Listesi alt test skorları arasında bir korelasyon bulunamamış; yaş ile Çocuk Davranış Listesi alt testleri arasında ise "Gülümseme ve Kahkaha" alt testi skoru dışında herhangi bir korelasyon bulgusuna ulaşılamamıştır. **Sonuç:** Olumsuz duygulanım ve bu duyguları kontrol etme yetisinin kekemeliğin kronik bir seyir izlemesinde risk faktörü olabileceği bulgularına ulaşılmıştır.

Anahtar Kelimeler: Kekemelik; mizaç; çocuk

Developmental stuttering is a neurological disorder characterized by the disruption of normal fluency and flow of speech with repetition of sounds, syllables, words, prolongation of sounds or blocks.[1] Although the exact cause of stuttering is not known yet, current multidi-

mensional models of stuttering explains it based on the interactions between physical, cognitive, linguistic, emotional and social variables.[2-6]

The concept of temperament, on the other hand, stems from the individual differences, which primarily have biological foundations and are influenced by inheritance, maturation and experience, between reactivity and self-regulation behaviors. Rothbart and Derryberry studies temperament as a dynamic process that affects environmental factors and is affected by environmental factors with neurobiological development.[7] The basis of Rothbart's temperament approach is the individual differences among reactivity, ease of arousal and self-regulation. It is argued that these differences have biological bases and they are affected from inheritance, maturation and experience. Rothbart states that temperament is generally investigated under three categories. These categories are Surgency/Extraversion, Negative Affectivity, and Effortful Control dimensions. Extraversion includes traits such as openness to external stimuli, activeness and having positive expectation, sensitivity to cues of winning a reward, targeting and being in the mood of "approach" for these targets, and overall happiness level while Negative Affectivity includes traits such as child's fear, frustration, dissatisfaction, and difficult-soothability. Under the Effortful Control dimension, there are components such as attention, inhibition, perceptual sensitivity and satisfaction with low intensity stimulus. The Effortful Control includes behaviours such as suppressing inappropriate behaviours for target behaviors. These traits carry abilities requiring executive functions such as planning, blocking, error detection or re-regulation.[7]

Temperament is classified under the physical and emotional factors within the multidimensional models of stuttering and is considered to have an important role in the processes such as onset, development, types of non-fluency, and efficiency of therapy for stuttering.[5]

In various studies that examined the relationship between temperament and developmental stuttering, it was indicated that children who stutter in the pre-school period have higher reactivity levels and lower regulation levels when compared to children with typical development (CWTD).[5,8-10] Eggers et al. conducted a study using Child Behaviour Questionnaire (CBQ) with 58 children of 3-8 years old who stutter and 58 CWTD who were matched according to their ages and sex.[11] They found in their study that there were significant differences between the two groups in terms of certain temperament sub-dimensions. In the study, it was stated that the group with stuttering received lower scores on "Impulsiveness" and "Focusing Attention" sub-tests while they received higher scores on "Anger/Frustration", "Approach/Positive Participation" and "Motor Activation" sub-tests. When they were compared according to the total scores at Extroversion, Negative Affectivity and Effortful Control sub-dimensions, it was observed that the children who stutter received significantly higher scores at Negative Affectivity and significantly lower scores at Effortful Control sub-dimensions than those CWTD had.

Anderson et al. used the Behavioural Style Questionnaire to compare temperament traits of 31 CWTD with 31 children who stutter (CWS) aged 3-5 years and their findings in the study indicate that there is no significant difference in activity levels between the two groups.[8] However, in the study by Howell et al. 10 CWS with the age of 3-7 were matched with 10 CWTD according to their ages and sexes; their temperament traits were examined by using the same scale and it was found out that the CWS were significantly more active than the CWTD.[12] It is thought that the limited number of participants in the sample may be a possible cause of reaching conflicting findings in the both studies. Besides, in the studies by Kefalianos et al. by using Short Temperament Scale, they found that CWS at 3 years of age were less reactive than their non-stuttering peers and their response levels to surrounding stimuli were lower.[13]

In the study conducted by Lewis and Goldberg, Behavioural Style Questionnaire was applied to the families of the 11 children aged between 3 and 5 who were at risk of stuttering, and which temperament dimensions could predict the onset of stuttering at the pre-school period were quested

for by comparing their results with the results of the 11 typically developing children who were matched according to age and sex.[14] The authors reported that Rhythmicity/Biological Regularity subscale was found to be the highest predictor of stuttering, among all subscales.

As a result of the findings of Howell et al. and the empirical data of Schwenk et al. it was monitored that the attention span of the children in the pre-school period who stutter were short and that the changes in their environment were adapted for longer periods of time compared to the control group participants.[12,15] However, the study by Anderson et al. suggests that there is no significant difference between the two groups' attention spans.[8] In this study, it was seen that the attention spans of children who stutter were longer in the presence of a distraction than the CWTD. Despite these findings, in the study of Kefalianos et al. it was noticed that the CWS at the age 3 were behind their peers in the ability to carry out any activity.[13] Yet, Howell et al. detected that there was no considerable difference between the two groups in terms of this temperament trait.[12]

Temperament researches are usually carried out through the scales that are filled by the primary caregiver. The number of the researches using measurement tools other than the scale is limited. In the study of Schwenk et al. temperament-related behaviours were examined through observation in the laboratory environment.[15] The performances of 18 CWS and 18 CWTD were compared with regard to the attention span and response to background stimulus. During the dialogue with the primary caregiver, the response time and latency of the child towards the backward camera movements were measured. It was discovered that the CWS had more distractibility numbers and the time of their reactions were shorter. Within these findings, it was seen that the CWS were more reactive, their attention to environmental stimuli was more easily distracted, and they were slower to adapt to these stimuli, compared to the CWTD.

Arnold et al. investigated emotional reactivity and regulation levels in CWS and CWTD by psychophysiological measures (e.g., electroencephalography-EEG) and found no significant difference between the two groups.[16] Likewise, Kazenski et al. measured the level of reactivity in CWS and CWTD in low- and high-level anxiety states by using physiological evaluation tools (jitter, shimmer, fundamental frequency, acoustic startle response) and did not reach a considerable difference between the groups.[17] In the same study, they came to the conclusion that physiological measurements distinguish mild to moderate stuttering in CWS.

As a result of the survey done in the literature, it has been seen that relation between temperament traits in childhood and separation anxiety, peer acceptance, and depression variables was studied in Turkey but any study about researching temperament traits in CWS could not be found.[18] This study that examines the temperament traits in children who stutter and who recovered stuttering spontaneously is thought to be important in terms of its contribution to the stuttering therapies and the literature related to the subject. Thus, the aim of this study is to compare temperemental differences between CWS, children who recovered stuttering spontaneously (CWRSS) and their age and sex matched CWTD.

MATERIAL AND METHODS

PARTICIPANTS

CWS, CWTD and CWRSS were paired with respect to age, sex, and level of education. The ages of the three groups were paired considering ±3 months. In total, 34 girls (29%) and 116 boys (71%) were included in the study (Table 1).

The participants of the group with developmental stuttering and the CWRSS consists of children, who applied the Education, Research and Training Center for Speech and Language Therapy (DILKOM) in Eskişehir Anadolu University with complaints of stuttering, who were diagnosed for stuttering as a result of the preliminary evaluations yet not started a therapy. The participants of the group with typical development are from Eskisehir and from provinces in

TABLE 1: Average values and standard deviations of participant data.

	Gender		Age (months)			
Groups	**Female**	**Male**	**Av.**	**SD**	**Min.–Max.**	
CWS (children who stutter)	14	51	68	16.46	41	95
Typical Development Group	14	51	70	15.63	38	95
Children who Recovered Spontaneously	6	14	77	13.1	60	95
Total	34	116				

the vicinity. Written informed consent was obtained from all participants.

Before commencing with the study, the frequency of stuttering for each participant in the study group was calculated, and the stuttering frequencies above 3% were included in the study as CWS. The stuttering frequencies in speech were obtained by calculating the percentage of the total number of syllables stuttered over a normal speech sample that is composed of at least 400 syllables. It was also considered, due to the information collected from the parents, that the participants in the study group did not have any neurological or psychiatric diagnoses and did not use any medication that could impair their cognitive processes.

The participants of the typical development group was determined by pairing for age and sex subsequent to the formation of the CWS. Such criteria in establishing the study group were structured around the similar considerations that the participants did not have any neurological or psychiatric diagnoses and did not use any medication that could impair their cognitive processes.

The CWRSS group consists of children who applied the Education, Research and Training Center for Speech and Language Pathology (DILKOM) in Eskişehir Anadolu University for complaints of stuttering, however recovered spontaneously without any intervention while waiting for stuttering diagnosis and were fluent for at least two years.

This study was performed according to the principles of the Declaration of Helsinki Approval and was granted by the Anadolu University Research Ethics Committee (27.03.2014 date; 6868).

APPLICATION

In the present study, in order to access the CWRSS, the DILKOM archives were explored and the families of the children who were mentioned to self-recover in the files were invited for interview. During the interviews, information on the uninterrupted fluency of the children was obtained from the parents and the scale and tests were presented as a part of the approval concent for participation in the study. Scales and tests administered to parents were presented in two sessions. As parents were filling the scales and tests, spontaneous speech samples were taken from the children in a separate room and these samples were recorded with Sony DCR-DVD 101E digital camera. In order to receive a natural speech sample, the child was asked to talk about subjects such as introducing oneself, talking about a day, or talking about a favorite cartoon. At least 400 syllables of speech were retreived from the children who participated in the study. Through these records, the percentage of syllables stuttered in speech was determined. The percentage of stuttered syllables was calculated through the ratio of the number of stuttered syllables to the total number of syllables and multiplying this ratio by 100 (Percentage of Stuttered Syllables = ([Number of stuttered syllables]/[Total number of syllables]) x 100).

MEASUREMENTS

Children's Behaviour Questionnaire (CBQ)

The long version of Children's Behaviour Questionnaire (CBQ) was developed in 1994 by Rothbart et al. and is composed of 195 items. Rothbart et al. formed the shorter version consisting of 94 items in 2000. In this version, 15 temperament

traits were tried to be revealed via Likert-type scale.[7,19] These temperament traits are as follows:

1. Activity Level: Level of gross motor activity and rate & extent of movement are surveyed.

2. Anger/Frustration: In relation with interruption to the ongoing activity or the target blocking, negative affectivity's extent is determined.

3. Approach: For expected pleasurable activities, it shows the volume of excitement and positive participation.

4. Attentional Focusing: Tendency to focus and to keep the attentional focus at assigned task and activity is studied.

5. Discomfort: The rate of negative emotion expression about sensory qualities of stimuli related to light, sound, movement, and texture is determined.

6. Falling Reactivity and Soothability: It indicates the degree of cooling high stress, excitement, or general arousal.

7. Fear: It investigates the amount of negative emotion containing unease, sadness, or nervousness in relation to expected high or compelling and/or potentially threatening situation.

8. High Intensity Pleasure: The pleasure and enjoyment levels for situations involving high level stimulus intensity, rate, complexity, novelty, and unconformity are defined.

9. Impulsivity: Speed and volume of initial response is determined.

10. Inhibitory Control: The capacity to suppress and plan inappropriate response against uncertain or new situation, or instructions is measured.

11. Low Intensity Pleasure: The pleasure and enjoyment levels for situations involving low level stimulus intensity, rate, complexity, and unconformity are defined.

12. Perceptual Sensitivity: Level of sensitivity towards stimuli to the five senses is discovered.

13. Sadness: Extent of lowered mood and energy, and negative emotion with relation to pain, disappointment, object loss or threat to loss is identified.

14. Shyness: Hesitant and shy approaches in new and uncertain situations are studied.

15. Smiling and Laughter: Amount of positive emotional response to change in intensity, rate, complexity, and unconformity is measu red

Turkish adaptation of the short form of the scale was carried by Sarı et al.[20]

RESULTS

THE RELIABILITY AND VALIDITY VALUES OF CBQ IN PRESENT STUDY

The reliability in the present study was determined by the internal consistency method (*Cronbach's Alpha*). Evidence regarding validity was determined through the sub-test correlations and the consistency of the factor structure among evaluators based on expert opinion.

In order to determine the internal consistency coefficient of the CBQ, the internal consistency value of the entire test for the stuttering, typical development and self-recovery groups and the Cronbach's Alpha values for each subdimension of the CBQ for all participants were examined (Table 2, Table 3).

TABLE 2: CBQ total score Cronbach's alpha coefficients.

CBQ Admitted Groups	Cronbach's Alpha coefficient
Stuttering Individuals	.58
Individuals with Typical Development	.62
Individuals with Self-Recovery	.53

CBQ: Child behaviour questionnaire.

TABLE 3: Cronbach's alpha coefficients for CBQ subscales.

CBQ Subscales	Cronbach's Alpha coefficient
Extraversion	.63
Effortful Control	.76
Negative Affectivity	.55

CBQ: Child behaviour questionnaire.

CONSISTENCY AMONG EVALUATORS

In the present study, in order to examine the subtest scores among groups under more broad scales, expert opinions were received from two language and speech therapy specialists, two expert psychologists and a child psychiatrist with the aim to determine the three scales, which were examined for validity and reliability in various languages and in the original version of the scale and under which the investigation should be conducted with accuracy. These scales were determined as follows:

Extraversion: This scale generally indicates the activity level, level of happiness and level of curiosity towards external stimuli of the children and includes the subscales of "Impulsivity", "Activity Level", "Satisfaction under High Density Stimulus", "Approach/Positive Participation" and "Smile and Laughter".

Negative Affectivity: This scale reflects the level of introversion, anxiety and negative emotions of a child and includes the subscales of "Anger/Disappointment", "Discomfort", "Unhappiness", "Fear" and "Shyness".

Effortful Control: This scale assesses the child's ability to plan, focus attention, suppress unnecessary stimuli, and prevent inappropriate behaviors and includes the subscales of "Satisfaction under Low Density Stimulus", "Frustration Control", "Perceptual Sensitivity", "Focusing Attention" and "Decreased Response/Calming Down".

In the present study, the overall agreement between five evaluators regarding their evaluations, under which subscales the subtests should be located, was measured in order to increase the reliability of the CBQ test. Fleiss' kappa analysis was conducted to measure the consistency between multiple evaluators and it was established that there was "good agreement" (κ=0.56) among the evaluators as to which CBQ subtests should be placed under which subscales.

COMPARISON OF CWS WITH CWTD IN TERMS OF "TEMPERAMENT SCALES"

In order to demonstrate the relationship between stuttering and temperament, children were classified in two groups as "those with stuttering" and "those with typical development" depending on the existence of stuttering condition and the groups were tested for normal distribution. The group scores were compared with independent samples t-test for temperament subscales with normal distribution determined through the Kolmogorov Smirnov and Shapiro-Wilk tests and the subtests and subscales without normal distribution were compared with Mann Whitney U-test. The magnitude of the effect of the difference between the two groups was determined via the Cohen d statistics. The Cohen d value provides the ability to interpret how many standard deviations the averages diverge from each other. It is indicated that the value of ".2" has a small effect size, the value of ".5" has a medium effect size and the value of ".8" has a large effect size, regardless of the signs of the values (Table 4).[22]

There was no statistically significant difference between the CWS and the CWTD in terms of the average scores of the Activity Level, Anger/Disappointment, Focusing Attention, Unhappiness, Decreased Response/Calming Down, Impulsiveness subscales (Table 5).

According to the Mann-Whitney U test presented in Table 5, there was a statistically significant difference between the group with stuttering and the group with typical development in terms of "Approach/Positive Participation", "Discomfort", "Smile and Laughter" and "Fear" scales of the CBQ test, however, there was no significant difference between these two groups in terms of "Satisfaction under Low Density Stimulus", "Shyness", "Satisfaction under High Density Stimulus" and "Frustration Control" scales.

According to the independent samples t-test used in the comparison of the two groups, there was no statistically significant difference between the CWS and the CWTD in terms of "Extraversion" average scores. There was a statistically significant difference between two groups in terms of the average "Negative Affectivity" scores and the children with stuttering received higher scores for "Negative Affectivity" than the CWTD (Table 6).

TABLE 4: Descriptive statistics and T-test results for the CBQ subtests for the groups with stuttering and typical development.

CBQ Subtest	Groups	N	Av.	SD	Min. - Max.		*t*	*sd.*	Cohen *d*	*p*
Activity Level	SG	65	5.04	1.0	2.57	7.00	.86	128	.15	.39
	TDG	65	4.89	.93	2.86	6.71				
Anger / Disappointment	SG	65	4.46	1.1	2.33	7.00	.10	118	-.00	.91
	TDG	65	4.45	.87	2.00	6.00				
Focusing Attention	SG	65	4.63	1.1	2.00	7.00	-.46	128	-.143	.64
	TDG	65	4.72	.95	2.67	6.50				
Unhappiness	SG	65	4.89	.82	3.00	7.00	1.9	128	.35	.05
	TDG	65	4.59	.87	2.43	6.29				
Decreased Response / Calming Down	SG	65	4.40	1.0	1.17	6.83	.73	106	-.12	.46
	TDG	65	4.51	.64	2.67	5.83				
Impulsivity	SG	65	4.45	.82	2.67	6.83	.57	128	.08	.56
	TDG	65	4.37	.85	2.40	6.17				

SGx CWS; TDG= Typical Development Group. CBQ: Child behaviour questionnaire.

TABLE 5: Descriptive statistics and Mann Whitney-U test results for the CBQ subtests for the groups with stuttering and typical development.

CBQ Subtest	Groups	N	Order of the Arithmethic Mean	Rank Sum	Mann Whitney U	Z	p
Approach / Positive Participation	SG	65	73.54	4780	1590	-2.43	.01*
	TDG	65	57.46	3735			
Discomfort	SG	65	75.63	4916	1454	-3.06	.00*
	TDG	65	55.37	3599			
Satisfaction under Low Density Stimulus	SG	65	65.24	4240	2095	-.07	.93
	TDG	65	65.76	4274			
Perceptual Sensitivity	SG	65	65.60	4264	2106	-.03	.97
	TDG	65	65.40	4251			
Shyness	SG	65	70.22	4564	1805	-1.43	.15
	TDG	65	60.78	3950			
Smile and Laughter	SG	65	58.48	3801	1656	-2.12	.03*
	TDG	65	72.52	4713			
Fear	SG	65	72.31	4700	1670	-2.06	.03*
	TDG	65	58.69	3815			
Satisfaction under High Density Stimulus	SG	65	65.35	4247	2102	-.04	.96
	TDG	65	65.65	4267			
Frustration Control	SG	65	61.92	4025	1880	-1.08	.27
	TDG	65	69.08	4490			

SG= CWS; TDG= Typical Development Group. CBQ: Child behaviour questionnaire.

There exists no statistically significant difference between the group with stuttering and the group with typical development in terms of the "Effortful Control" scale of the CBQ (Table 7).

COMPARISON OF "TEMPERAMENT SCALES" OF SELF-RECOVERED, STUTTERING AND TYPICALLY DEVELOPING CHILDREN

In order to indicate the differences between CWS, CWTD and children who recovered stuttering

TABLE 6: Descriptive statistics and T-test results for the CBQ subscales for the groups with stuttering and typical development.

CBQ Subtest	Groups	N	Av.	SD	Min. - Max.		*t*	*sd.*	Cohen *d*	*p*
Extraversion	SG	65	29.33	3.05	22.24	38.10				
	TDG	65	28.67	2.55	23.35	36.20	1.34	128	0.23	.18
Negative Affectivity	SG	65	23.62	2.65	18.33	31.50				
	TDG	65	22.22	2.65	16.78	28.75	3.00	128	0.52	.00*

SG= CWS; TDG= Typical Development Group. CBQ: Child behaviour questionnaire.

TABLE 7: Descriptive statistics and Mann Whitney-U test results for the effortful control subscale for the stuttering and typical development groups.

Temperament Subscale	Groups	N	Order of the Arithmethic Mean	Rank Sum	Mann-Whitney U	Z	p
Effortful Control	SG	65	63.74	4143	1998	-.53	.59
	TDG	65	67.26	4372			

SG= CWS; TDG= Typical Development Group.

spontaneously in terms of temperament subscales, one-way analysis of variance was conducted. Before conducting the ANOVA test, the data were tested whether they met the necessary assumptions to perform the test. Multiple comparison tests were used to determine which group or groups caused the difference when a significant difference was detected between the ANOVA test results. It was established that group variances were equal for all subtests of the CBQ. The Tuckey test was used for multiple comparisons of CBQ subtest and subscale mean scores among the groups. The eta-square (η^2) correlation coefficient was calculated in order to determine the magnitude of the effect of the significant difference between the groups.

According to the results of the one-way ANOVA applied to each of the CBQ subtests, it was concluded that the basic group effect was significant between Approach/Positive Participation, Focusing Attention, Shyness, Frustration Control, Effortful Control and Negative Affectivity subtest scores (Table 8).

While CWRSS achieved significantly higher scores than their peers in the "Focusing Attention" and "Frustration Control" subtests of the CBQ, they received significantly lower scores than their peers in the "Shyness" and "Approach/Positive Participation" subtests. When compared in terms of the subscales of the CBQ, the CWRSS had significantly higher scores than the CWS group in the "Effortful Control" subscale, while achieving significantly lower scores on the "Negative Affectivity" subscale. CWS received significantly lower scores than CWRSS in the "Frustration Control" subtest.

CORRELATION BETWEEN AGE AND TEMPERAMENT IN CHILDREN WITH STUTTERING

Pearson correlation analysis was performed in order to determine the relationship between age and temperament subscales for the group of CWS. While it is possible to mention the existence of a low level of uni-directional correlation between the age and the "Smile and Laughter" subscale of the CBQ ($r = 0{,}251$, $p < .05$), no statistically significant finding between age and other subscales of CBQ could be achieved (Table 9).

CORRELATION BETWEEN TEMPERAMENT AND SEVERITY OF STUTTERING IN CHILDREN WITH STUTTERING

The results of the Pearson's correlation analysis conducted to determine the correlation between the severity of stuttering and temperament subscales in the group with stuttering are presented in Table 10. There was no statistically significant finding between the severity of stuttering and all of the subscales of CBQ (Table 10).

TABLE 8: Descriptive statistics and ANOVA test results for CBQ subtests and subscales of stuttering, self-recovery and typical developmental groups.

	Source of the Variance	Sum of the Squares	Sd	Average of the Squares	F	p	η2	Multiple Comparisons
Activity Level	Intergroup	5.37	2	2.68	2.10	.13	.06	1 ≈ 2 ≈ 3
	In-group	72.8	57	1.27				
	Total	78.2	59					
Anger / Disappointment	Intergroup	1.83	2	.915	.69	.50	.02	1 ≈ 2 ≈ 3
	In-group	75.1	57	1.31				
	Total	76.9	59					
Approach / Positive Participation	Intergroup	6.82	2	3.41	5.56	.00	.16	1>3 ≈ 2
	In-group	34.9	57	.613				
	Total	41.7	59					
Focusing Attention	Intergroup	21.8	2	10.9	6.92	.00	.19	3>1 ≈ 2
	In-group	89.9	57	1.57				
	Total	111	59					
Discomfort	Intergroup	11.3	2	5.66	2.68	.07	.08	1 ≈ 2 ≈ 3
	In-group	120.1	57	2.10				
	Total	131	59					
Satisfaction Under Low Intensity Stimulant	Intergroup	2.71	2	1.35	1.43	.24	.04	1 ≈ 2 ≈ 3
	In-group	53.8	57	.945				
	Total	56.5	59					
Perceptual Sensitivity	Intergroup	2.36	2	1.18	1.35	.26	.04	1 ≈ 2 ≈ 3
	In-group	49.7	57	.873				
	Total	52.1	59					
Unhappiness	Intergroup	1.51	2	.756	.97	.38	.03	1 ≈ 2 ≈ 3
	In-group	44.2	57	.777				
	Total	45.7	59					
Shyness	Intergroup	28.1	2	14.0	8.14	.00	.22	1>3 ≈ 2
	In-group	98.4	57	1.72				
	Total	126	59					
Smile and Laughter	Intergroup	6.22	2	3.11	2.89	.06	.09	1 ≈ 2 ≈ 3
	In-group	61.2	57	1.07				
	Total	67.4	59					
Decreased Response/ Calming Down	Intergroup	2.57	2	1.28	1.75	.18	.05	1 ≈ 2 ≈ 3
	In-group	41.8	57	.735				
	Total	44.4	59					
Fear	Intergroup	4.22	2	2.11	1.23	.29	.04	1 ≈ 2 ≈ 3
	In-group	97.2	57	1.70				
	Total	101	59					
Satisfaction Under High Intensity Stimulant	Intergroup	2.20	2	1.10	1.15	.32	.03	1 ≈ 2 ≈ 3
	In-group	54.4	57	.956				
	Total	56.6	59					
Impulsivity	Intergroup	.036	2	.018	.02	.97	.00	1 ≈ 2 ≈ 3
	In-group	42.3	57	.744				
	Total	42.4	59					
Frustration Control	Intergroup	18.2	2	9.13	6.47	.00	.18	2>1 ≈ 3
	In-group	80.4	57	1.41				3>1 ≈ 2
	Total	98.7	59					

continued...→

TABLE 8: Descriptive statistics and ANOVA test results for CBQ subtests and subscales of stuttering, self-recovery and typical developmental groups.

	Source of the Variance	Sum of the Squares	Sd	Average of the Squares	F	p	η2	Multiple Comparisons
Extraversion	Intergroup	10.3	2	5.15	.51	.60	.01	1 ≈ 2 ≈ 3
	In-group	570	57	10.1				
	Total	581	59					
Negative Affectivity	Intergroup	128	2	64.1	4.53	.01	.13	1>3 ≈ 2
	In-group	806	57	14.1				
	Total	934	59					
Effortful Control	Intergroup	173	2	86.6	6.20	.00	.17	3>1 ≈ 2
	In-group	795	57	13.9				
	Total	969	59					

CBQ: Child behaviour questionnaire.

TABLE 9: Correlation between age and temperament in children who stutter (n=65).

CBQ Subtest	r	p
Activity level	.21	.09
Anger/Disappointment	.12	.30
Approach/Positive participation	.20	.10
Focusing attention	-.02	.84
Discomfort	.15	.21
Decreased response/Calming down	-.05	.64
Fear	-.17	.17
Satisfaction under high intensity stimulus	.15	.22
Impulsivity	.17	.16
Frustration control	-.03	.76
Satisfaction under low intensity stimulus	-.08	.49
Perceptual sensitivity	-.09	.45
Unhappiness	.10	.42
Shyness	-.06	.63
Smile and laughter	.25	.04

CBQ: Child behaviour questionnaire.

DISCUSSION

TEMPERAMENT DIFFERENCES BETWEEN CWS AND THEIR AGE AND SEX MATCHED PEERS WITH TYPICAL DEVELOPMENT

CWS received significantly higher scores from the subtests "Approach/Positive Participation", "Discomfort" and "Fear" in Child Behavior Questionnaire (CBQ) and from the subscale "Negative Affectivity" with respect to their same aged peers that presented a typical development, while they had significantly lower scores in the subtest "Smile and Laughter."

The higher scores, received from the "Approach/Positive Participation" subtest by the CWS in comparison to their same aged peers with typical development, exhibited parallels with the findings of the study that utilized the same scale conducted by Eggers et al. In the study conducted by Anderson et al. which used the Behavioral Style Questionnaire, it was also found that CWS had higher scores from this subtest when compared to their same aged peers with typical development.[8,11] In the study conducted by Kefalianos et al. in which "approach" behavior in children aged 2, 3, and 4 were examined, the average scores of CWS were found to be above current norms.[13]

Approach behaviors are acknowledged to be associated with basal ganglia and extensions and to be regulated by dopamine neurotransmitters. The relationship between basal ganglia functions and non-fluency in speech is still being studied through brain imaging methods.[22-24] The findings of the studies that focus on this relationship indicated a strong positive correlation between the basal ganglia activation and the severity of non-fluency during language and speech functions.[22,25] This argument could be supported by the fact that children who stutter receive lower scores than the CWTD in the "Frustration Control" subscale, which is considered to be regulated by the basal ganglia pathways.[26]

TABLE 10: Correlation between severity of stuttering and temperament in children with stuttering.

		CSS (%)	
CBQ Subtest	**n**	**r**	**p**
Activity Level	52	-.21	.13
Anger/Disappointment	52	-.15	.28
Approach/Positive Participation	52	.00	.97
Focusing Attention	52	.21	.13
Discomfort	52	.24	.07
Satisfaction Under Low Intensity Stimulus	52	-.04	.78
Perceptual Sensitivity	52	-.00	.96
Unhappiness	52	-.11	.41
Shyness	52	-.07	.59
Smile and Laughter	52	-.01	.92
Decreased Response/Calming Down	52	.26	.06
Fear	52	-.00	.96
Satisfaction Under High Intensity Stimulus	52	-.20	.15
Impulsivity	52	-.09	.51

CSS: Clinical Severity of Stuttering, CBQ: Child behaviour questionnaire.

The scores received from the subscales "Fear" and "Smile and Laughter" in CBQ, by the CWS could be interpreted as a sign of the negative attitudes towards communication. The negative attitude towards communication means that the individual considers oneself as an inadequate communicator, finds communication challenging, thus becomes reluctant in speech.[27,28] The evidence from the relevant literature suggest that stuttering individuals have a higher negative attitude toward communication than the individuals without any stuttering problems at all ages.[29,30]

There exist research findings indicating that the communication attitude in CWS progresses in the negative direction over time, while CWTD progress in a positive direction.[31] Given the relationship between negative attitudes towards communication and anxiety, current findings could be interpreted as such that anxiety could be occurring in early periods in individuals with stuttering problem.

Although there are numerous studies that demonstrate that anxiety levels of people who stutter are higher than those with typical development, the sampling within these studies is largely limited to adults.[32-34] Once all findings are scrutinized in relation with each other, it could be considered that the avoidance behaviors in people who stutter advances with the increase in age, as a result of stuttering.

TEMPERAMENT DIFFERENCES BETWEEN CWS, CWTD AND CWRSS

While CWRSS achieved significantly higher scores than their peers in the "Focusing Attention" and "Frustration Control" subtests of the CBQ, they received significantly lower scores than their peers in the "Shyness" and "Approach/Positive Participation" subtests. When compared in terms of the subscales of the CBQ, the CWRSS group had significantly higher scores that the CWS group in the "Effortful Control" subscale, while achieving significantly lower scores on the "Negative Affectivity" subscale. CWS received significantly lower scores than the CWRSS in the "Frustration Control" subtest.

There exist no studies in literature that compare the performances, namely, attention, approach/positive participation and frustration control of these three groups. However, current findings were found to be parallel with the findings of several research that concluded that children who stutter perform under the norms

regarding various components of attention and frustration control.[4,15,35,36]

In order for speech fluency to be achieved, motor skills (muscle motor control for speech), linguistic faculties (speech formulation and planning), and socio-emotional faculties (speech planning and production under emotional or communicative stress) should necessarily be present.[37] The capability to source all these faculties is attention and its related resources. In other words, attention is the main factor that coordinates all these components necessary for speech fluency.

Attention is considered to be a complex neuropsychological structure. The research suggests that there are three interrelated subcomponents in this complex structure: (a) orienting, (b) alertness, and (c) selective attention and executive attention.[38] Orienting and alertness systems develop early and could be measured within the first weeks and months of life. Anterior neural systems, such as the anterior cingulate cortices and the lateral prefrontal cortex, which are expected to mature posteriorly and continue to develop until puberty, should be developed to measure the selective and executive attention.[39,40] Executive attention functions begin to mature between the months 24 and 36 and a significant leap occurs between the ages of 3 and 5.[38,41] Therefore, these ages are considered as the ranges in which the most active development occurs in terms of executive attention development.[40] These age ranges are as well the periods when developmental stuttering could often present an onset.[35]

In order to achieve speech fluency, the individual should be able to detect errors, such as repetitions, blocks, word additions, false starts, that could interrupt speech fluency and inhibit these errors, monitor them during and before their occurrence and reduce them.[42] Therefore, executive attention and other self-regulation behavior are particularly emphasized within the contemporary models related to stuttering.[5]

In all these models, executive attention mechanisms, which are required for a coordinated operation of motor control, limbic and auditory systems, are defined as a precondition of speech fluency. The fact that the abilities within the self-recovery group were higher than those of the CWS of individuals suggests the possibility that the development of attention and related components could have a compensating role in stuttering.

AGE AND TEMPERAMENT RELATIONSHIP IN DEVELOPMENTAL STUTTERING

Once the degree and direction of the correlation between temperament subscales and age were scrutinized, it could be observed that, among all other subtests of CBQ, only "Smile and Laughter" subtest indicated a statistically significant, low and similar correlation with age. In other words, as the CWS between the ages of 3 and 7 tend to receive increased scores from the "Smile and Laughter" subtest as their ages increase. However, such finding should be interpreted along with the fact that the CWS achieved significantly lower average scores in this subtest than their same-aged peers with typical development. When these two findings are scrutinized together, it becomes evident that, intensity, grade, complexity of the stimulant and the increasing levels of positive emotional response to the change of incompatibility in the CWS measured by the "Smile and Laughter" subtest based on age are lower than their peers with typical development and should be taken into consideration accordingly. The facts that the relationship between age and other temperament subtests for stuttering individuals is not statistically significant, and that the statistically significant subtest results present low levels of correlation, support the findings that temperament measures relatively unchanging features, although affected by environmental and cultural variables.[43,44]

CORRELATION BETWEEN TEMPERAMENT AND SEVERITY OF STUTTERING IN DEVELOPMENTAL STUTTERING

No statistically significant findings were established regarding the correlation between temperament subscales and severity of stuttering. In the literature, there exists only a single study that focuses on the correlation between temperament characteristics and severity of stuttering. The find-

ings of that study support the findings of Eggers et al. which examined the temperament characteristics of children between the ages of 3 and 8 years using CBQ.[10]

Although there exist studies investigating the specific subcomponents of temperament and the severity of stuttering, most samples of these studies are limited to adolescents and adults. Craig et al. concluded that there was no significant relationship between severity of stuttering and anxiety levels of stuttering adults.[45] Blood et al. established that there was no significant relationship between the severity of stuttering and standard anxiety scale scores in adolescent individuals who stutter.[46] In a study conducted by Blood et al. it was indicated that there was a positive correlation between the Stuttering Severity Scale and communication skills in adolescents who stutter.[47,48] According to these findings, it could be argued that the measurements regarding the severity of stuttering in real social settings rather than in in-clinic settings could facilitate a more comprehensive analysis of the possible correlations.

Considering these findings holistically, it could be reflected that the findings regarding the lack of a significant relationship between temperament characteristics and severity of stuttering could be due to the fact that severity of stuttering was measured only through the stuttered syllable rate. The findings of the present study should not be considered as an implication that temperament characteristics are not related to certain features determining the severity of stuttering (e.g., duration of stuttering moments, secondary behaviors). In this regard, it is considered that the research focusing on the investigation of qualitative classification among the types of non-fluency (such as repetitions, extensions, and blocks) and the relationship between the temperament characteristics and non-fluency could provide more detailed information.

Current models of stuttering discuss stuttering as a multi-dimensional concept. Early therapy programs developed for stuttering are based on these models.[49] In all the current models, temperament is considered either as a developmental factor or as an environmental factor, within the context of the characteristics that the child exhibits in its interaction with his/her environment. Researchers report that levels of emotional reactivity and regulation are influenced by the individual's ability to interact with existing brain deficits and affect the formation and prognosis of stuttering. It was also suggested that different levels of emotional reactivity and regulation could be one of the features that presents an effect on self- recovery.[35]

A holistic consideration of the findings of the present study indicate higher scores in the subtests related to the negative affectivity for the children who stutter than the children with the typical development and indicate lower scores in the effortful control domain. Self-recovering children also have lower scores on sub-tests associated with negative affectivity when compared to the children who stutter, while their scores on the effortful control domain are higher. These findings support the current multi-dimensional models of stuttering, which consider temperament characteristics as an initiating factor in the onset and continuation of stuttering.

The study has some limitations. The first limitation is the methodological limitation in determination of the groups. There exists a possibility that the participants in each group could not be representing the population and the parents of the children in the sample could possibly differ from the wider population. The study utilizes a clinical sample selected from stuttering individuals, whose families applied to the clinic due to the fluency disorders in their children. It is suggested that such samples are more probable to present higher severity and secondary disorders in comparison to the general population.[50] Further studies could focus on the comparison of the temperament characteristics of CWS that are admitted to the clinic and CWS that are not admitted to the clinic.

Another limitation of the present study is the methodological limitation in determining the study groups. Inclusion criteria in the study could be insufficient in pinpointing the children who were likely to develop chronic stuttering. Although there exist certain risk factors regarding chronic

stuttering and self-recovery within the stuttering classification system, there is no definite technique to determine which child would self-recover and which would continue to have stuttering.

Further studies are considered necessary for the repetition of the present study through multiple measurements and data sources.

CONCLUSION

Children who recovered stuttering received significantly lower scores in Negative Affectivity and higher scores in "Effortful Control" compared to children with typical development and children who stutter. Temperament is thought to be a risk factor for chronicity in stuttering.

Source of Finance

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Conflict of Interest

No conflicts of interest between the authors and/or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

All authors contributed equally while this study preparing.

REFERENCES

1. Van Riper C. The Nature of Stuttering. 2nd ed. Englewood Cliffs, NJ: Prentice-Hall; 1992. p.279-95.
2. Smith A, Kelly E. Stuttering: a dynamic, multifactorial model. In: Curlee RF, Siegel GM, eds. Nature and Treatment of Stuttering: New Directions. 2nd ed. Needham Heights, MA: Allyn & Bacon, Massachusetts; 1997. p.204-17.
3. Zebrowski PM, Conture EG. Influence of nontreatment variables on treatment effectiveness for school-age children who stutter. In: Cordes, AK, Ingham RJ, eds. Treatment Efficacy for Stuttering: A Search for Empirical Bases. 1st ed. San Diego: Singular Publishing Group; 1998. p.293-310.
4. Riley GD, Riley J. A revised component model for diagnosing and treating children who stutter. Contemp Issues Commun Sci Disord. 2000;27:188-99.
5. Conture EG, Walden TA, Arnold HS, Graham CG, Hartfield KN, Karrass J. A communication-emotional model of stuttering. In: Ratner NB, tetnowski JA, eds. Current Issues in Stuttering Research and Practice. 1st ed. New Jersey: Lawrence Erlbaum Associates; 2006. p.17-46.
6. Walden TA, Frankel CB, Buhr AP, Johnson KN, Conture EG, Karrass JM, et al. Dual diathesis-stressor model of emotional and linguistic contributions to developmental stuttering. J Abnorm Child Psychol. 2012;40(4): 633-44. [Crossref] [PubMed] [PMC]
7. Rothbart, MK, Derryberry, P. Development of individual differences in temperament. In: Lamb ME, Brown A, eds. Advances in Developmental Psychology. 1st ed. Hillsdale, NJ: Lawrence Erlbaum Associastes; 1981. p.37-86.
8. Anderson JD, Pellowski MW, Conture EG, Kelly EM. Temperamental characteristics of young children who stutter. J Speech Lang Hear Res. 2003;46(5):1221-33. [Crossref]
9. Karrass J, Walden TA, Conture EG, Graham CG, Arnold HS, Hartfield KN, et al. Relation of emotional reactivity and regulation to childhood stuttering. J Commun Disord. 2006;39(6):402-23. [Crossref] [PubMed] [PMC]
10. Walden TA, Frankel CB, Buhr AP, Johnson KN, Conture EG, Karrass JM. Dual diathesis-stressor model of emotional and linguistic contributions to developmental stuttering. J Abnorm Child Psychol. 2012;40(4):633-44. [Crossref] [PubMed] [PMC]
11. Eggers K, De Nil LF, Van den Bergh BR. Temperament dimensions in stuttering and typically developing children. J Fluency Disord. 2010;35(4):355-72. [Crossref] [PubMed]
12. Howell P, Davis S, Patel H, Cuniffe P, Downing-Wilson D, Au-Yeung J, et. al. Fluency development and temperament in fluent children and children who stutter. In: Packman A, Meltzer A, Peters HFM, eds. Theory, Research and Therapy in Fluency Disorders. Nijmegen: Nijmegen University Press; 2004. p.250-6.
13. Kefalianos E, Onslow M, Ukoumunne O, Block S, Reilly S. Stuttering, temperament, and anxiety: data from a community cohort ages 2-4 years. J Speech Lang Hear Res. 2014;57(4): 1314-22. [Crossref] [PubMed]
14. Lewis KE, Goldberg LL. Measurement of temperament in the identification of children who stutter. Eur J Disord Commun. 1997; 32(4):441-8. [Crossref]
15. Schwenk KA, Conture EG, Walden TA. Reaction to background stimulation of preschool children who do and do not stutter. J Commun Disord. 2007;40(2):129-41. [Crossref] [PubMed] [PMC]
16. Arnold HS, Conture EG, Key AP, Walden T. Emotional reactivity, regulation, and childhood stuttering: a behavioral and electrophysiological study. J Commun Disord. 2011;44(3):276-93. [Crossref] [PubMed] [PMC]
17. Kazenski DM, Guitar B, McCauley RJ, Falls W, Dutko LS. Stuttering severity and responses to social-communicative challenge in preschool-age children who stutter. Asia Pac J Speech Lang Hear. 2014;17(3):142-52. [Crossref]
18. Erermiş S, Bellibaş E, Ozbaran B, Büküşoğu ND, Altintoprak E, Bildik T, et al. Temperamental characteristics of mothers of preschoolers who have seperation anxiety. Turk Psikiyatri Derg. 2009;20(1):14-21.
19. Putnam SP, Rothbart MK. Development of short and very short forms of the childre's behavior questionnaire. J Pers Assess. 2006; 87(1):102-12. [Crossref] [PubMed]
20. Sarı BA, İşeri E, Yalçın Ö, Aslan AA, Şener Ş. [Reliability study of Turkish version of children's behavior questionnaire short form and d validitiy prestudy]. Klin Psikiyatr Derg. 2012;15:135-43.

21. Büyüköztürk Ş. Sosyal Bilimler İçin Veri Analizi. 4. Baskı. Ankara: Pegem Yayınevi; 2014. p.39-77.
22. Braun AR, Varga M, Stager S, Schulz G, Selbie S, Maisog JM, et al. Altered patterns of cerebral activity during speech and language production in developmental stuttering: an H2(15)O positron emission tomography study. Brain. 1997;120(Pt 5):761-84. [Crossref] [PubMed]
23. Ludlow CL, Loucks T. Stuttering: a dynamic motor control disorder. J Fluency Disord. 2003;28(4):273-95. [Crossref]
24. Alm PA. Stuttering, emotions, and heart rate during anticipatory anxiety: a critical review. J Fluency Disord. 2004;29(2):123-33. [Crossref] [PubMed]
25. Watkins KE, Smith SM, Davis S, Howell P. Structural and functional abnormalities of the motor system in developmental stuttering. Brain. 2007;131(Pt 1):50-9. [Crossref] [PubMed] [PMC]
26. Seiss E, Praamstra P. The basal ganglia and inhibitory mechanisms in response selection: evidence from subliminal priming of motor responses in Parkinson's disease. Brain. 2004;127(Pt 2):330-9. [Crossref] [PubMed]
27. Blood G, Blood I, Tellis G, Gabel R. Communication apprehension and self-perceived communication competence in adolescents who stutter. J Fluency Disord. 2001;26(3):161-8. [Crossref]
28. Mulcahy K, Hennessey N, Beilby J, Byrnes M. Social anxiety and the severity and typography of stuttering in adolescents. J Fluency Disord. 2008;33(4):306-19. [Crossref] [PubMed]
29. Vanryckeghem M, Hylebos C, Brutten GJ, Peleman M. The relationship between communication attitude and emotion of children who stutter. J Fluency Disord. 2001;26:1-15. [Crossref]
30. Erikson S, Block S. The social and communication impact of stuttering on adolescents and their families. J Fluency Disord. 2013;38(4):311-24. [Crossref] [PubMed]
31. De Nil BF, Brutten GJ. Speech-associated attitudes of stuttering and nonstuttering children. J Speech Lang Hear Res. 1991;34(1):60-6. [Crossref]
32. Ezrati-Vinacour R, Levin I. The relationship between anxiety and stuttering: a multidimensional approach. J Fluency Disord. 2004;29(2):135-48. [Crossref] [PubMed]
33. Messenger M, Onslow M, Packman A, Menzies R. Social anxiety in stuttering: measuring negative social expectancies. J Fluency Disord. 2004;29(3):201-12. [Crossref] [PubMed]
34. Blomgren M, Roy N, Callister T, Merrill R. Intensive stuttering modification therapy: a multidimensional assessment of treatment outcomes. J Speech Lang Hear Res. 2005;48(3):509-23. [Crossref]
35. Guitar B. Stuttering: An Integrated Approach to Its Nature and Treatment. 3rd ed. Baltimore: Lippincott Williams & Wilkins; 2006. p.105-37.
36. Karrass J, Walden TA, Conture EG, Graham CG, Arnold HS, Hartfield KN, et al. [Relation of emotional reactivity and regulation to childhood stuttering. J Commun Disord. 2006;39(6):402-23. [Crossref] [PubMed] [PMC]
37. Bosshardt H. [Cognitive processing load as a determinant of stuttering: Summary of a research programme]. Clin Linguist Phon. 2006;20(5):371-85. [Crossref] [PubMed]
38. Berger A, Kofman O, Livneh U, Henik A. Multidisciplinary perspectives on attention and the development of self-regulation. Prog Neurobiol. 2007;82(5):256-86. [Crossref] [PubMed]
39. Davidson MC, Amso D, Anderson LC, Diamond A. Development of cognitive control and executive functions from 4 to 13 years: evidence from manipulations of memory, inhibition, and task switching. Neuropsychologia. 2006;44(11):2037-78. [Crossref] [PubMed] [PMC]
40. Rueda MR, Posner, MI, Rothbart MK. The development of executive attention: contributions to the emergence of self-regulation. Dev Neuropsychol. 2005;28(2):573-94. [Crossref] [PubMed]
41. Posner MI, Rothbart MK. Developing mechanisms of self-regulation. Dev Psychopathol. 2000;12(3):427-41. [Crossref]
42. Levelt WJ. Monitoring and self-repair in speech. Cognition. 1983;14(1):41-104. [Crossref]
43. Jong JT, Kao T, Lee LY, Huang HH, Lo PT, Wang HC. Can temperament be understood at birth? The relationship between neonatal pain cry and their temperament: a preliminary study]. Infant Behav Dev. 2010;33(3):266-72. [Crossref] [PubMed]
44. Neppl TK, Donnellan MB, Scaramella LV, Widaman KF, Spilman SK, Ontai LL, et al. Differential stability of temperament and personality from toddlerhood to middle childhood. J Res Pers. 2010;44(3):386-96. [Crossref] [PubMed] [PMC]
45. Craig A, Hancock K, Tran Y, Craig M. Anxiety levels in people who stutter: a randomized population study. J Speech Lang Hear Res. 2003;46(5):1197-206. [Crossref]
46. Blood G, Blood IM, Maloney K, Meyer C, Qualls CD. Anxiety levels in adolescents who stutter. J Commun Disord. 2007;40(6):452-69. [Crossref] [PubMed]
47. Blood G, Blood I, Tellis G, Gabel R. Communication apprehension and self-perceived communication competence in adolescents who stutter. J Fluency Disord. 2001;26(3):161-8. [Crossref]
48. Riley G. Stuttering Severity Instrument for Children and Adults. 4th ed. Austin TX; 1994. p.1-10.
49. Millard SK, Nicholas A, Cook FM. Is parent-child interaction therapy effective in reducing stuttering? J Speech Lang Hear Res. 2008;51(3):636-50. [Crossref]
50. Goodman SH, Lahey BB, Fielding B, Dulcan M, Narrow W, Regier D. Representativeness of clinical samples of youths with mental disorders: a preliminary population-based study. J Abnorm Psychol. 1997;106(1):3-14. [Crossref] [PubMed]