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Verbal Output Profile in Children with Attention Deficit Hyperactivity Disorder

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Abstract

Communicative differences are a feature of ADHD and measuring differences in verbal behavior can elucidate critical features of the disorder. This study focuses on quantity of verbal output through investigating the verbal productivity and length of turns in children with ADHD compared to age-matched typically developing (TD) children. The participants were twenty Saudi 4-5 year old boys. Ten were typically developing and ten had a diagnosis of ADHD. A 30 minute sample of speech during free play was collected from each child in conversation with an unfamiliar adult interlocutor (UI). All sessions were filmed and audio-recoded, the interactions transcribed then number of turns and whole words per turn counted. The results were statistically analyzed and showed that children with ADHD had a reduced verbal output with respect to total number of words, total number of verbal turns and average number of words per turn compared to typically developing children of similar age. It is argued that the differences are evidence of the negative effect of the core behavioral characteristics of ADHD on verbal pragmatic skills.

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) refers to a cluster of pronounced difficulties in the areas of inattention, distractibility and hyperactivity that lead to significant impairment in academic and social functioning [1]. A diagnosis of ADHD is therefore made on the basis of the existence of behavioral patterns assessed by specialized professionals. The prevalence estimate of ADHD is as wide as 3%-10% in school age children [2,3] and it is identified as one of the most commonly diagnosed clinical conditions affecting the student population [4]. Two-thirds of children with ADHD have an additional coexisting disorder [5] and more than one-third have at least three comorbid conditions [6] e.g., anxiety, conduct disorders, depression, and learning disability. Estimates of the overlap between speech and language disorders and ADHD vary from as low as 8% to as high as 90%, depending on the source and type of sample. In their seminal review of language deficits that are associated with ADHD, highlighted the predominance of difficulties in the area of verbal pragmatics (i.e., difficulties in social use of language) [7].

Verbal output

The quantity of verbal output in children has been investigated in various studies for different purposes (see Table 1 for a summary of verbal productivity studies). According to Miller [8] the total number of words produced during an interaction period in typically developing children increases steadily with age and can be considered as a general measure of verbal productivity. Zentall [9] concluded that the total number of words can be used as the best representation for the quantity of verbal output (verbal productivity). The DSM criteria include the amount of verbal output as a possible symptom of ADHD. Tannock [10] claimed that the quantity of verbal output is one of the pragmatic difficulties in children with ADHD.

Different research studies have adopted different methodological approaches to study the verbal output in children with ADHD in terms of quantity parameters. For example the total number of words as in Zentall [9], the total number of utterances as in Barkley et al. [11], Purvis et al. [12] and the mean length of utterances in morphemes, as in Redmond [13]. It is important to note that the vast majority of empirical research that aimed to study the quantity of verbal output in children with ADHD was all carried out between 1979 and 1997. Since that time researchers have tended to rely on this research, rather than conducting their own studies. The Diagnostic and Statistical Manual Fifth Edition (DSM 5, 2013) stated that the child with ADHD "Often talks excessively". No restrictions were placed on the statement either on the setting or the interlocutor. The DSM 5 makes no attempt to support this statement with references; however the following studies seem to support it: Copeland [14] Barkley et al. [11] Zentall et al. [15] and Zentall [9].

Copeland [14] studied the types and the amount of 'private speech' during free play for 16 hyperactive and 16 nonhyperactive boys (the mean age was 8.5 years), by allowing the subjects to play alone in a room without any instruction about the activity for three minutes. The results revealed that hyperactive boys talk more than nonhyperactive ones. The measure of "number of verbalizations" was defined as "a word, phrase, or sentence that was independent from the preceding and following one in meaning and/or time" Copeland [14]. The period (during which the subjects were recorded) was very short, but Copeland believed it was enough to provide information about the verbalization profile of her subjects. It is important to mention that Copeland's study can be judged as influential because it has been used as a reference by many subsequent studies that investigated the amount

of verbal output in children with ADHD. However none of these studies questioned its methodology, especially the short free play time.

Barkley et al. [11] studied verbal output in ADHD by comparing 18 participants with ADHD with 18 TD boys (the mean age was 9.25 years) during 15 minutes free play and 15 minutes of "task periods" with their mothers. The results showed that participants with ADHD produced significantly more utterances than TD participants during free play and there were no notable differences in mean length of utterance between the ADHD and the TD subjects. However the results for the structured task periods showed no significant differences between the groups in the means for the mothers or their children on any of the dependent measures.

It is important to mention that the main purpose of this study was to compare the speech of children with ADHD interacting with their mothers before and after medication with a stimulant drug (methylphenidate). In a second part of the study, Barkley and his colleagues examined the effects of a stimulant drug on the language of 12 of these participants with ADHD in both free play and structured tasks in a drug-placebo crossover design. Drug treatment was associated with declines in the frequency but not the complexity of utterances in both hyperactive boys and their mothers in both situations (free play and task periods).

Zentall et al. [15] investigated the verbal output in children with ADHD by comparing them with TD children. The research subjects were 13 participants with ADHD and 13 TD boys aged 3:10 to 7:5 years old, selected on the basis of high (14 to 29) and low (0 to 9) ratings on the Conners Abbreviated Teacher Questionnaire. All children were administered three forms of the referential communication task, using procedures, tasks, and a task order based on the referential communication task that was developed by Glucksberg et al. [16]. All verbalizations of each child for each task were assessed using different language measures such as number of words, number of sentences, and mean length of sentence.

The results revealed that children with ADHD were more verbal than TD children in all tasks. Also the children with ADHD spoke more than TD children during transition periods. Zentall [9] studied the difference in verbal output during elicited conditions (storytelling) and non-elicited conditions (transitions between tasks) in 22 children with ADHD and 22 TD children (the mean age was 9.25 years). All data were collected via interaction with an examiner. The results revealed that the ADHD group was more talkative during the non-elicited conditions, which means during transitions between activities, i.e., when they were not asked to talk but they were less talkative during elicited conditions, particularly during organization and planning activities (e.g., storytelling) when they were asked to tell stories.

On the other hand, Tannock et al. [17] studied the narrative abilities of children with ADHD (30 boys aged 7-11 years) versus TD, matched in age and sex. Tannock and her colleagues concluded that the participants with ADHD produced significantly fewer units (a unit was defined as one which contained an idea) and less information overall than the TD boys' group, which they counted as evidence of a production deficit in the children with ADHD. Also, the stories of the children with ADHD were more poorly organized and less cohesive and contained more inaccuracies. Accordingly, they judged the stories of the children with ADHD as often confused and hard to follow. They concluded that these results were caused by an underlying deficit in executive processes. Another study by Purvis et al. [18] investigated the language abilities in children with ADHD, children with reading disabilities, children with both ADHD and reading disabilities and TD children.

Participants were asked to recall a lengthy narrative and knowledge of semantic aspects of their language in tests were assessed. The study was conducted with 50 boys (14 ADHD, 14 ADHD and reading disability, 8 reading disability only, and 14 TD) with an age range of 7-11 years. The results revealed that the children with ADHD produced less of what they called "verbal production" than TD, although this was a measure of the number of "idea units". Purvis et al. concluded that ADHD deficits were consistent with higher-order executive function deficits.

According to Tannock [10] and Tannock et al. [19], they concluded that in the quantity of the verbal output in children with ADHD, there are two patterns: "1) excessive verbal output during spontaneous conversations, during task transitions, and in play settings, 2) decreased verbal output and more dysfluencies when confronted with tasks that require planning and organization of verbal responses, as in story retelling or when giving directions" (p. 138). This has become the established and accepted view. Brown [3] completely agreed with Tannock's description and Perkins [20] used Tannock's exact words when commenting on the quality of verbal output of children with ADHD.

The authors of the current study believe that considering Tannock and her colleagues and Purvis and Tannock's [18] research findings as evidence of either reduced verbal output in children with ADHD during formal communication tasks or increased output in informal situations is misleading, as they counted the number of idea units, not the actual quantity of verbal output. Taken together, the outcomes of these research studies do not amount to a clear or uniform answer to the question of differential verbal output of ADHD and typically developing children.

Despite the confident assertion about the talkativeness of children with ADHD in the DSM manual the authors of the current study hypothesized that the verbal output of children with ADHD aged 4-5 years would be lower than that of typically developing children of similar age based on clinical observation and parental report. We would also argue that the findings of Andreou et al. [21] lend some indirect support for this view. They found that children with ADHD had significantly lower scores on all the WISC-III verbal scales. We have not encountered a child with low scores on these scales who also seems to be abnormally talkative and it seems to me very unlikely (Table 1).

Study	Subjects and Age Range	Sitting and Procedures	Findings
Copeland [14]	16 hyperactive and 16 nonhyperactive participants (the mean age is 8.50 years)	'Private speech' during free play (alone) for three minutes.	Hyperactive participants talk more than nonhyperactive.

Barkley et al. [11]	18 participants with ADHD and 18 TD participants (mean age is 9.25 years).	Verbal output in ADHD during 15 minutes free play and 15 minutes task periods with their mothers.	Participants with ADHD produced significantly more utterances than TD participants during free play only.
Zentall et al. [15]	13 participants with ADHD and 13 TD participants' ages 3:10 to 7:5 year old.	Administered three forms of the referential communication task with examiner to study verbal output in ADHD.	Children with ADHD were more verbal than TD children in all tasks.
Zentall [9]	22 children with ADHD and 22 TD children (mean age is 9.25 years).	The difference in the verbal output during elicited conditions (storytelling) and nonelicited conditions (transitions between tasks) during interaction with an examiner.	ADHD group more talkative during nonelicited condition but less talkative during elicited conditions.
Tannock, Purvis, and Schachar [17]	Children with ADHD (30 boys aged 7-11 years) versus TD that matched in age and sex.	Narrative abilities in children with ADHD during interaction with an examiner.	Participants with ADHD produced significantly fewer units and less information overall than TD group.
Purvis and Tannock [18]	50 boys (14 ADHD, 14 ADHD and reading disability, 8 reading disability, and 14 TD) with age range of 7-11 years.	Investigated the language abilities in children with ADHD, reading disabilities, and TD.	Participants with ADHD produced less of what they called "verbal production" than TD participants.

Table 1: Summary of verbal productivity studies.

Turns

In all cultures, in most situations, there is a convention that only one person speaks at a time. Sacks [22] defined a turn as the shift in the direction of the speaking 'flow', that is characteristic of normal conversation. Sacks' definition is adopted by these researchers as useful for the current study. Klecan-Aker et al. [23] examined the use of language functions in a structured setting in normal preschool children. The researchers interviewed 240 preschoolers aged 2 to 5 using toys and pictures and elicited eight language functions: labeling, description, revision, affirmation/negation, personal information, requesting, greetings, and turn taking. The researchers found that appropriate responses increased with age and targeted language functions were in most preschoolers' repertoire by 3.5 years. Bedrosian et al. [24] investigated conversational turn-taking violations and corresponding repair mechanisms in mother-child interaction in 30 mother-TD child dyads, in a free play situation. The results revealed 246 overlaps; the majority was single and nonconsecutive. Both within and following the majority of overlaps, mothers and children maintained the same topic. Utterances consisting of informative statements were interrupted more often than those consisting of requests. The overlapping talk of children with ADHD however has been less investigated.

Conversational competence requires paying attention to what the partner says, and making appropriate replies, which is arguably one of the core problems in ADHD. Ervin-Tripp [25] wrote that the incompetent speaker would not gaze at or orient to partners, would display random gaps and overlaps in conversation, and would talk about objects and thoughts on a whim without any regard to what has been said. According to Kim et al. [26] research study, children with ADHD produce more inappropriate pragmatic behaviors than TD children at the level of absence of response to questions or requests, overlap and interruption during conversation, less feedback to the speaker, unspecific vocabulary use and lack of cohesion.

The DSM 5 (2013) diagnostic criteria for ADHD include difficulty waiting on turns as one of the main symptoms. The specific criteria for impulsivity include "g) often blurts out answers before questions have been completed; h) often has difficulty waiting turn; i) often interrupt or intrude on others". Tannock et al. [17,10] mentioned that the pragmatic problems in children with ADHD include difficulties in the appropriate timing and quantity of language within social and learning contexts. Kim et al. [26] reported problematic behaviors that were associated with language use in children with ADHD compared to TD children, which includes interrupting and overlapping speech. It is important to establish output in Arabic speaking children with ADHD, in order to find out how their verbal productivity is distributed across the conversational turns by studying the average number of words per turn.

The motivation for this study is to begin the process of identifying verbal behaviors that distinguish children with a diagnosis of ADHD from those who are typically developing. The following hypotheses were investigated in Arabic-speaking 4-5 year old children with ADHD: Hypothesis one: The verbal output (as represented by the total number of words produced in a controlled session) of children with ADHD is significantly less than that produced by typically developing children in the same age range. Hypothesis two: The total number of verbal turns is significantly greater in TD children as opposed to the children with ADHD. Hypothesis three: The average number of words per turn produced in a free-play session by children with ADHD is significantly less than that produced by typically developing children in the same age range.

Method

Participants

This study focused on twenty Saudi 4.0-5.0 year old males from Jeddah (western province of Saudi Arabia); ten had a diagnosis of ADHD and ten were typically developing children. ADHD and TD participants were divided into two age bands for the purpose of matching. Five participants from each group were included in each age band. The first age band was from four years to less than four years and six months. The second age band was from the age of four years and six months to less than five years. The age of the child could be considered as a confounder so comparison between age (in months) was performed between the two groups and it revealed that age in the TD group ranged from a minimum of 50 to a maximum of 59 months with a median of 54 and an IQR of 5.5 months while in the ADHD group it ranged from a minimum of 50 to a maximum of 59 months with a

median of 54 and an IQR of 5.75 months. The Mann-Whitney U test score was 49.5 with a Z value of 0.038 (p=0.485). This indicates a non-significant difference in age between the two groups.

Participants with ADHD

Participants with ADHD were recruited first via direct referral from the Psychiatric Departments of five main medical centres in Jeddah were contacted. These are King Fahad Hospital (KFH), King Abdul-Aziz University Hospital (KAYH), King Faisal Specialist Hospital and Research Centre (KFSHRC), Erfan and Bagdo General Hospital (EBGH), Saudi German Hospital Group (SGHG). All the participants in this group had been diagnosed with ADHD by a psychiatrist. ADHD subtype was not considered in the current research; the term ADHD was used in the general sense to include any severity of ADHD and all three subtypes of the disorder, namely inattentive, hyperactive and impulsive. No child was included who had previously received or was taking any medication for ADHD. No child with other medical issues (i.e., cognitive or physical difficulties) was included. No child was included who had previously received any kind of speech and language intervention. All participants were required to pass a hearing screening.

Typically developing participants

Typically developing children were recruited from an advertisement in brochures distributed in two regular preschools. The main inclusion and exclusion criteria for the TD participants were: normal speech and language skills (the participant's speech skills, including articulation, fluency, voice, and prosody and language skills, including receptive, expressive, pragmatic, were screened by the researcher and were required to be within normal limits to participate in the study), normal behavioral pattern and cognitive skills (the participant's behaviors were evaluated by a psychiatrist and were required to be within normal limits to participate in the study), and all participants were required to pass the hearing screening.

Data collection

The study was carried out in a sound treated and carpeted therapy room. The therapy room had two cabinets and one shelving unit which contained toys that reflected the interests of the target age population. The same arrangement of seating and materials was used for all interactions. A children's table and a set of chairs were provided, with the unfamiliar interlocutor (UI) at one side and the participant sitting at the other side facing the camera.

The UI was seated in a position where the fixed camera had a side view of them, so that all interactions would all be recorded. Two portable cameras were used to record the UI and the participant. Both audio and video were used for the purposes of accuracy and representativeness. One camera was placed in a corner, attached to the ceiling of the room and was focused on the interaction area. It provided a complete view of the interactions between the participant and the UI. The other camera followed the participant and focused on all UI/participant interactions.

Two directional microphones were used. One was fixed to the ceiling and the other was on the mobile camera as it captured conversations. Materials in the room were prepared in such a way as to stimulate the participant's attention and encourage him to start a conversation. All the objects were out of the participant's reach in order to encourage him to start the conversation with the UI. All

participants were sitting facing the camera directly to facilitate easier scoring. All interactions were taped on DVDs using two video cameras.

These procedures yielded a 30-minute sample for every ADHD and TD participants. For all participants the videotaping procedures were exactly the same. The data collection procedure included five steps. In step one, the researcher met with the participant's family individually, explained the study to them, and obtained their approval to participate in the study by reading and signing the consent form. In step two, all participants (ADHD and typically developing) underwent hearing screening. In step three, only typically developing participants underwent speech and language screening that was carried out by the researcher. In step four, an UI escorted the participant and his mother from the reception area to the therapy room. The mother left her son in front of the therapy room and went to the observation area. All process was done under the supervision of the main researcher via the control room. In step five, An UI collected a 30-mintue verbal sample from the participants using free interaction by following the child's lead. During interaction, free play with a variety of action figures (dolls, puppets, transportation set, animal set, food item set and vehicle set). The child was allowed to freely select from these toys. Conversation between child and UI typically included information about the child's family and interests.

Data analysis

The researcher followed the techniques of the categorical observational tool. This is a closed system that defines in advance the target categories into which all participants' verbal behaviors are coded by the researcher during observation of the recorded audio-visual data. The coded categories are then added together, so that observations can be described quantitatively. The measurements included the number of turns and the number of words per turn. A turn was counted as any topically coherent spoken vocal expression that included one word or more from the participant that was directed towards the interlocutor. If the participant spoke about a topic and subsequently introduced a new topic or comment without input from the interlocutor, two turns were coded for the participant. The researcher then counted the number of words in each turn.

To determine inter-observer reliability, two external senior speech-language pathologists independently recoded 10 minutes of six randomly selected video sessions (three ADHD and three TD) using the same coding protocol. Agreement of 94.7% was found. The Kappa Coefficient was 0.93. One-tailed between-group tests were used to compare the two participant groups in terms of the total number of words produced in the session, the total number of verbal turns produced in the session, and the average number of words per turn when the child interacts with the UI. A normality test was performed and most of the variables resulted in a significant Kolmogorov-Smirnov (K-S). After all using non-parametric statistics is more conservative than using the parametric statistics.

Results

The total number of words

The total number of words with UI in the TD group ranged from a minimum of 150 to a maximum of 978 with a median of 533 and an IQR of 288 while in the ADHD group it ranged from a minimum of 10 to a maximum of 795 with a median of 76 and an IQR of 107. The

Mann-Whitney U test revealed that the total number of words in the ADHD group was significantly lower when compared with the TD group (Mann-Whitney U=10, Z=3.024, p=0.001).

In the box plot, the thick horizontal line represents the median, the box represents the inter-quartile range (between the 25th and 75th percentiles) which contains 50% of the data, while the whiskers represent the minimum and maximum values after excluding the outlier values which are represented by dots with a number denoting the case identifier (Figure 1).
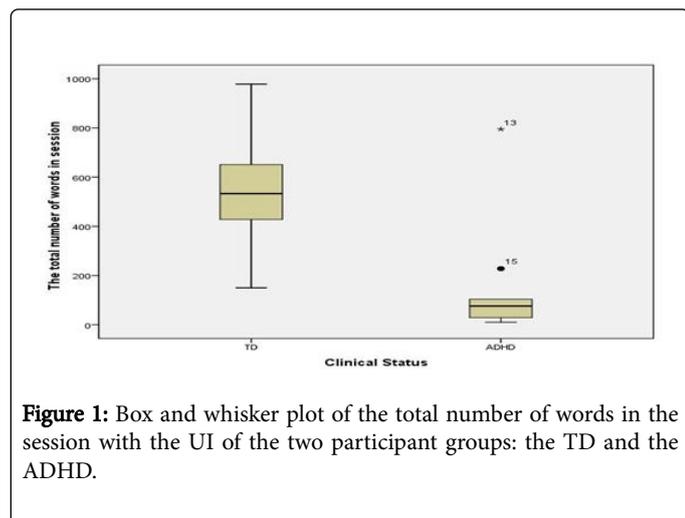

Figure 1: Box and whisker plot of the total number of words in the session with the UI of the two participant groups: the TD and the ADHD.

The total number of verbal turns

The total number of verbal turns with UI in the TD group ranged from a minimum of 74 to a maximum of 252 with a median of 218 and an IQR of 67 while in the ADHD group it ranged from a minimum of 9 to a maximum of 238 with a median of 39.5 and an IQR of 78. The Mann-Whitney U test revealed that the total number of verbal turns with UI in the ADHD group was significantly lower when compared with the TD group (Mann-Whitney U=11, Z=2.949, p=0.001) (Figure 2).
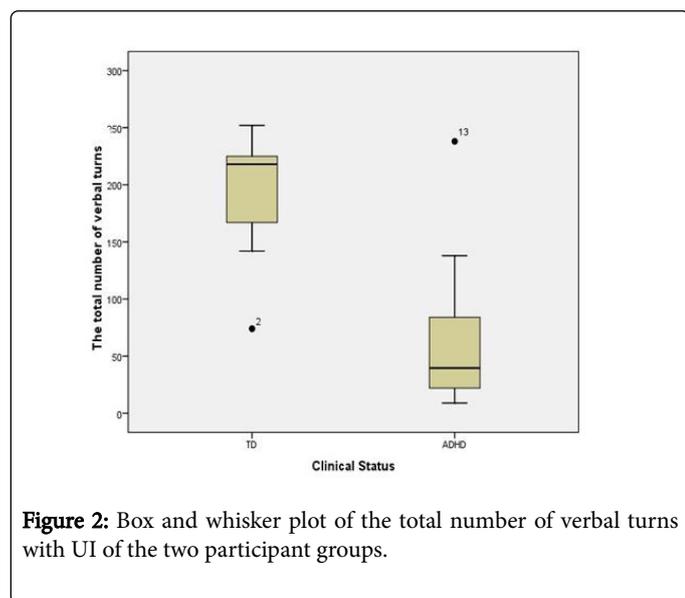

Figure 2: Box and whisker plot of the total number of verbal turns with UI of the two participant groups.

The average number of words per turn in the recorded sessions

The average number of words per turn in the sessions with UI in the TD group ranged from a minimum of 1.9 to a maximum of 4.425 with a median of 2.467 and an IQR of 1.444 while in the ADHD group it ranged from a minimum of 1.111 to a maximum of 3.340 with a median of 1.618 and an IQR of 0.620. The Mann-Whitney U test revealed that the average number of words per turn in the ADHD group was significantly lower when compared with the TD group (Mann-Whitney U=10, Z=3.024, p=0.001) (Figure 3).
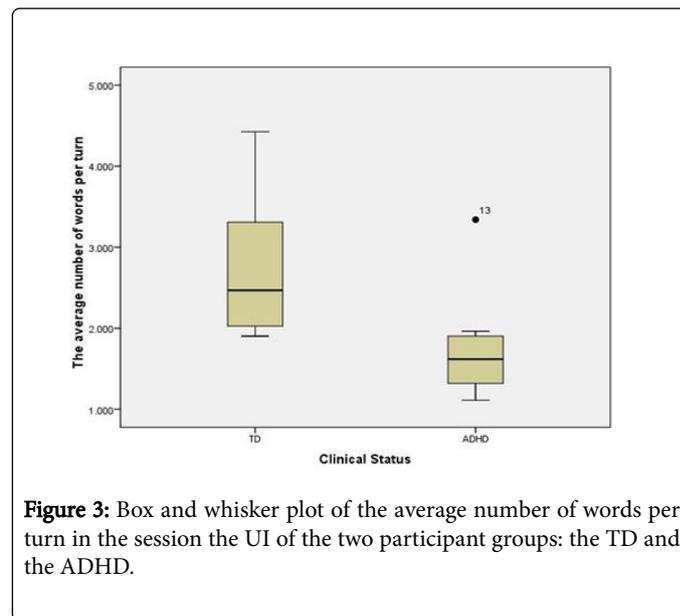

Figure 3: Box and whisker plot of the average number of words per turn in the session the UI of the two participant groups: the TD and the ADHD.

Discussion

The research questions that motivated this study asked if there were differences in the verbal productivity between children with a diagnosis of ADHD and their typically developing peers that were matched in age and gender. The current study attempts to extend our understanding of verbal pragmatic skills in children with the diagnosis of ADHD at the quantitative level. The unique contribution of this study is that it provides evidence of verbal differences between ADHD and TD, especially in the reduced amount of verbal output in participants with ADHD compared to TD participants.

The study reiterates some previous findings related to the difficulties experienced by children with ADHD at the level of verbal output and contradicts others with regard to verbal performance in children with ADHD. This hypothesis stated that the verbal output (as represented by the total number of words produced in a controlled session) of ADHD Arabic speaking 4-5 year old children is significantly less than that produced by typically developing children in the same age range.

During the session subjects with ADHD showed a significantly lower total number of words compared to TD subjects, thus upholding this hypothesis. The finding that the children with ADHD had less verbal productivity than the TD children contradicts the Diagnostic and Statistical Manual Fifth Edition (DSM 5, 2013) which state, without qualification, that the Child with ADHD "Often talks excessively". Comparing the participants' results in the current study showed that only one participant produce more than the TD average

output. Accordingly, we can conclude that participants with ADHD talked considerably less than TD participants and the ranges hardly overlapped which would lead to an opposite conclusion from that stated in DSM 5. Our findings are very different from those of previous research studies. Zentall [9] found that children with ADHD talked less than TD children during elicited-language conditions but he also found that they talked more than TD children during free play.

According to Zentall [9] "it is rare to find a crossover of significant group differences (i.e., hyperactive children displaying significantly more behavior than normal in one setting and significantly less than normal in another)" [9] which we agree is unexpected but it provides evidence about the lower amount of verbal output during elicited-language conditions compared to free play. The methodological difference between Zentall's study and the current study which may have affected the results is that only the hyperactive subgroup was included in Zentall's study; however the ADHD subtype was not used as criteria in the current study as there have been changes in the diagnostic criteria from DSM-III-R (Zentall) to DSM-IV-TR in the current study. The third Diagnostic Statistical Manual (DSM-III-R) that identifies attention-deficit hyperactivity but with a single diagnosis without subtypes and undifferentiated ADD. The age ranges are also different as in the current study it is 4-5 years however in Zentall's study the range was 7-10 years.

The remaining three studies which measured verbal productivity (Copeland [14]; Barkley et al., [11] & Zentall et al., [15] all found it was greater in children with ADHD compared to TD children. This incompatibility is arguably due to methodological differences previously described. Copeland [14] studied the types and amount of private speech in hyperactive boys compared to nonhyperactive boys (at the time of Copland's study the criteria for diagnosis was DSM-II which was mainly focused on hyperactivity symptoms) which was defined as "audible talking that is not addressed to another person" (Copeland, 1979: p.169) during play for three minutes. The difference in age range between Copeland's study (8.5 years) and the current study (age range 4-5 years) may also have affected the outcomes. Zentall et al. [15] studied the language and activity level in children with ADHD during five tasks and during the transition periods between tasks that was free interaction. There was a wider age range in Zentall's study (3:10 to 7:5 years) which may have affected the results. The findings reveal inconsistency between Zentall's studies of 1983 (ADHD are more verbal than TD) and 1988 (children with ADHD talked less than TD children during elicited-language conditions but he also found that they talked more than TD children during free play). These may have been caused by methodological differences by using storytelling and retelling in 1988 study but referential communication tasks and free interaction during transitional periods in 1983 study.

However the question remains about why the present findings are so different from previous studies. We believe that the research community needs to revisit the hypothesis of excessive talk in children with ADHD. The results of the current study provide evidence that children with ADHD's verbal output are lower than that of TD children in the same age range.

The average number of words per turn produced in the session differentiated participants with ADHD from TD participants in a way that showed evidence of weak discourse skills in children with ADHD. Comparing the ADHD and TD participants' results showed that eight participants out of ten with ADHD produced less than the minimum found in the TD participants during interaction with UI. All participants with ADHD produced a lower number of words per turn

than the maximum found in the TD participants in both interaction sessions with UI. The vast majority of the ADHD answers were single words. Accordingly, we can conclude that participants with ADHD talked considerably less using shorter sentences than TD subjects and the ranges hardly overlapped.

The data has been further analyzed qualitatively but is reported elsewhere. Briefly it was observed that the interruptions during conversation with the UI by participants with ADHD were more than those by the TD subjects, which is consistent with the DSM diagnostic criteria for ADHD. Other indicators not reported here showed key pragmatic differences reflected in the reduced verbal output.

Limitations and Future Research Suggestions

Apart from the limitation of this study to the nature of verbal pragmatic language skills in ADHD Arabic speaking boys specifically for the age range of 4 to 5 years in the Jeddah Region of Saudi Arabia, there are methodological limitations that must be mentioned. One major limitation of the study is the small sample included. There is a lack of studies that provide solid information about the development of pragmatics in typically developing Arabic speaking children, and a lack of studies that target the language skills in the ADHD population in Arabic speaking children. The current study did not take measures of vocabulary and syntax in the participants with ADHD or control for them as inclusion criteria. However, it is important to emphasize that there are no available norms in Saudi Arabia. The time and resources of the current study did not permit the recruitment and involvement of further groups of children (e.g., ADHD without language impairment, language impairment alone), although such information may have been advantageous. Another limitation was related to ADHD subtypes: predominantly inattentive type, predominantly hyperactive and impulsive type, and combined type which were not considered in the current research study.

Despite the limitations of the current research, strengths lie in the detailed analysis and coding of verbal pragmatic behaviors for children with ADHD and their age and gender matched typically developing peers. Using the same setting arrangements as in the current study, would have the advantage of replication and thus could be used for comparison purposes.

Further research is urgently needed to enrich our knowledge of the pragmatic characteristics of Arabic speaking children with ADHD by employing a larger number of participants. A more naturalistic setting and context, and subtypes of ADHD in addition to more qualitative analysis should be included in future studies.

Conclusion

According to the DSM5 diagnostic criteria for ADHD, a child with ADHD often does not seem to listen, does not follow through on instructions, is easily distracted by extraneous stimuli, and interrupts others. The reduced amount of verbal output and shorter turns that were produced by the children with ADHD in the current study are evidence of the effect of inattentive and impulsive behavioral characteristics of children with ADHD.

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