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Emotions and cognition of children with autism spectrum disorders during the covid-19 pandemic: A Descriptive Study

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ABSTRACT Children with autism spectrum disorder (ASD) often have difficulty controlling emotions, difficulty maintaining attention, relatively poor memory, and difficulty in speaking. Attention, memory, and speech are parts of cognition. During the covid-19 pandemic, individuals with autism feel more stressed because they have lost their routine. This type of research is quantitative descriptive with a cross sectional approach. The sampling technique is purposive sampling. The number of samples used were 59 ASD children aged 5-11 years. Emotional data was collected using the Positive and Negative Affect Schedule for Children, Short Form/PANAS-C-S scale, attention data was collected using the inattention subscale of the Swanson, Nolan, and Pelham scale, version IV (SNAP-IV), memory data was collected using the Observer questionnaire. Memory Questionnaire-Parent Form (OMQ-PF), and speech data were collected using the speech subscale of ATEC. The data obtained were analyzed descriptively. The results showed the average positive emotion (PA) of children with ASD = 18.20; negative emotional level (NA) = 12.42; emotion (PA + NA) = 5.78; inattention = 24.80; memory = 83.51; and speech = 26.71. The mean of positive emotions in ASD children is lower, negative emotions are higher, and overall good emotions are lower than normal children aged 8-11 years. The mean inattention score in children with ASD was included in the criteria for severe attention deficit symptoms. The mean memory of ASD children is lower than normal children aged 5-16 years. The average speech score of children with ASD is lower than the score normally achieved by normal children. The emotions and cognition of children with ASD during the covid-19 pandemic were lower than normal children. Efforts are needed to increase positive emotions and improve cognitive function which include: attention, memory, and speech in ASD children with various therapies that are suitable for each individual. Families must work well together in carrying out the daily activities of children with ASD, especially in maintaining the child's routines that have been created during the COVID-19 pandemic. Performing routine activities in sequence allows children with ASD to predict their environment and develop self-confidence

INDEX TERMS emotion, attention, memory, speech, ASD

I. INTRODUCTION

Autism spectrum disorder (ASD) is a spectrum of several disorders characterized by deficits in social communication and social interaction as well as restricted and repetitive behaviors, interests and activities [1]. One in 160 children worldwide is estimated to have ASD [2]. The prevalence of ASD has increased significantly in a short period of time based on data from various studies, including Autism and Developmental Disabilities Monitoring (ADDM) and the Centers for Disease Control and Prevention (CDC) [3]. In 2014 the prevalence of ASD in 11 locations in the United States, namely: Arizona, Arkansas, Colorado, Georgia, Maryland, Minnesota, Missouri, New Jersey, North Carolina, Tennessee, and Wisconsin based on reports from ADDM was 16.8 per 1,000 (one in 59) children aged 8 years (Baio et al., 2018), while in 2016 it was 18.5 per 1,000 (one in 54) children aged 8 years [4]. There is no official survey on the number of children with ASD in Indonesia. In 2013 the Director of Mental Health Development at the Ministry of Health estimated that the number of autistic children in Indonesia was around 112,000 with an age range of 5-19 years. This figure is based on a calculation of the prevalence of autism of 1.68 per 1000 children under the age of 15 years. According to the Central Statistics Agency, the number of children aged 5-19 years in Indonesia in 2010 was around 66 million, so the figure was 112 thousand [5]. The Director of Child Rehabilitation of the Ministry of Social Affairs, Nahar on April 2, 2018 said that the number of people with autism in Indonesia in 2015 was estimated at 12,800 children, while 134,000 people had the autism spectrum [6].

Children with ASD often have difficulty controlling emotions [7], difficulty maintaining attention [8], relatively poor memory [9], and difficulty in speech [8]. Attention, memory, and speech are part of cognitive [10].

During the covid-19 pandemic, individuals with autism feel more stressed because they lose their routine [11]. Children with ASD really need routine, structured and predictive activities. Hyman, Levy and Myers (2020) concluded that routines and structured activities reduce anxiety symptoms. Anxiety is exacerbated by uncertainty and is associated with insufficient or excessive sensory activity (Wigham et al., 2015). Most individuals with ASD and their families have difficulty managing daily activities. At least one out of every three children has more frequent or more intense behavior problems. Children with behavioral problems prior to the covid-19 outbreak were found to be particularly at risk for exhibiting more intense and more frequent disruptive behaviors [12]. It is necessary to conduct research to determine the emotions and cognitive (which includes: attention, memory, and speech) of children with ASD during the covid-19 pandemic. From research conducted by Russell at al. (2019) showed that the results of measuring emotions in adults with a diagnosis of autism spectrum disorder and depression using PANAS showed that the average positive emotion was 19.2 and the average negative emotion was 28.2 [13]. The results of research conducted by Lilja et al. (2022) in children with ADHD and ASD aged 6 to 17 years using SNAP IV on the inattention subscale obtained an average score of 20.11 [14]. The average memory score of children with ASD at an average age of 14.67 years as measured using the Test of Memory and Learning (TOMAL) is 82.86. This score is lower than that of normal children, which is 107.84 at an average age of 15.39 years [15]. The speech of children with ASD aged 2-16 years as measured using ATEC on the speech subscala obtained an average score of 10.0 [16].

This study measures emotion and cognition which includes attention, memory, and speech in children with ASD aged 6-11 years during the Covid-19 pandemic. Emotions were measured using PANAS-C-S, attention was measured using SNAP IV on the inattention subscale, memory was measured using OMQ-PF, and speech was measured using ATEC on the speech subscale. The purpose of this study was to determine the emotional and cognitive description, which includes attention, memory, and speech in children with ASD quantitatively.

II. METHODOLOGY

This type of research is quantitative descriptive with a cross sectional approach to obtain emotional and cognitive descriptions, which include: attention, memory, and speech in children with ASD. The population in this study were ASD children with the following inclusion criteria: 1) diagnosed with ASD by a doctor or psychologist or therapist/teacher of children with special needs, 2) aged 5-11 years, and 3) parents participated in this research. The sample size is 59 children with the sampling technique using purposive sampling.

Data collection began with socialization to the head of the Regional Technical Implementation Unit for children with special needs in Sidoarjo Regency and in 3 WhatsApp (WA) groups whose members were mostly parents of children with special needs. Then give written informed consent via WA message. Parents of children with ASD who meet the criteria are recorded, then given a questionnaire via google form. Data collection was carried out from April to August 2020. The data obtained were descriptively analyzed using SPSS.

The instruments used in this research are:

1. The instrument for measuring emotion is using the Positive and Negative Affect Schedule for Children, Short Form/PANAS-C-S) scale from Ebesutani *et al.* (2012) to measure emotions. The PANAS-C-S scale was translated by the Language and Multicultural Center of Airlangga University.
   The PANAS-C-S scale consists of 10 items, namely the Positive Affect (PA) scale consists of 5 items, and the Negative Affect (NA) scale also consists of 5 items. The PA scale consists of: joyful, cheerful, happy, lively, and proud; while the Negative Affect (NA) scale also consists of 5 items, namely: miserable, mad, afraid, scared, and sad. The assessment of each item uses a 5-item Likert scale, namely: 1 = very little or not at all, 2 = little, 3 = moderate, 4 = a lot, and 5 = very much. The final score on the PANAS-C-S scale test is the sum of 5 items on the positive affect scale and the sum of 5 items on the negative affect scale. The positive affect scale describes positive emotions and the number of scores on the negative affect scale describes negative emotions. Cronbach's alpha coefficient for the 5-item PA scale is 0.85, while for the 5-item NA is 0.83 [17]. In this study the emotion variable has 3 assessments, namely: 1) emotion, the value is taken from the total score from PANAS, 2) positive emotion, the value is taken from the total score from PA, and 3) negative emotion, the value is taken from the total score NA.
2. Attention measurement instrument using the inattention subscale from the Swanson, Nolan, and Pelham, version IV (SNAP-IV) scale [18] to measure attention. The SNAP-IV scale was translated by the Language and Multicultural Center of Universitas Airlangga. The inattention subscale of the SNAP-IV scale consists of 9 items. Each item is rated on a scale of 0 - 3, namely: 0 = not at all, 1 = only a little, 2 = quite, and 3 = very much.
   Interpretation of attention is divided into three ranges, namely: score < 13 = symptoms of attention disorder are not clinically significant, score 13 - 17 = symptoms of mild attention disorder, score 18 - 22 = symptoms of moderate attention disorder, and score 23 - 27 = symptoms of attention disorder critical. The Cronbach alpha coefficient of the inattention subscale of the Swanson, Nolan, and Pelham scale, version IV (SNAP-IV) = 0.94 [19].
   Observer Memory Questionnaire-Parent Form (OMQ-PF) [20] to measure memory. The Observer Memory Questionnaire-Parent Form was translated by the Language and Multicultural Center of Universitas Airlangga. The Observer Memory Questionnaire-Parent Form consists of 27 items and is rated on a scale of 1 - 5. Items 7, 12, 14, 16, 18, 19, 20, 21, 26, and 27 are rated as follows: 1 = Strongly agree, 2 = Agree, 3 = Uncertain, 4 = Disagree, and 5 = Strongly disagree. All remaining items were scored as follows: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often,

and 5 = Always. The Cronbach Alpha is 0.92 for 27 items [20].

3. The speech measurement instrument is using the speech subscale from the Indonesian version of ATEC (Mahapatra *et al.*, 2018; atec.jatmika.com, no date). The speech subscale instrument from ATEC contains 14 statements, each statement is given a score of 0 – 2, namely 0 = not true, 1 = somewhat true, and 2 = very true, so the total score ranges from 0 to 28 [21].
   The ATEC instrument has been used in several countries and translated into several languages. Pearson's split-half coefficient (internal consistency) produced by the Autism Research Institute based on an evaluation of 1,358 participants revealed an uncorrected r value as follows: subscale I: speaking/language/ communication activity (r = 0.92), subscale II: socialization (r = 0.84), subscale III: sensory/ cognitive awareness (r = 0.88), subscale IV: health/physical (r = 0.82), and total score (r = 0.94) [16]. The results of research conducted by Memari et al., (2013) on 134 children and adolescents with ASD showed high internal consistency with the ATEC total score, namely the Cronbach alpha coefficient = 0.93. The internal consistency of the four ATEC subscales is also very good, namely for the speaking activity subscale the coefficient of Cronbach alpha = 0.89, while the other subscales Cronbach alpha = 0.86 [23]. The Pearson correlation coefficient between the items of the speaking activity subscale and the total scores of the four ATEC Arabic versions ranged from 0.397 to 0.804. The correlation coefficients for each statement are: 0.397, 0.427, 0.408, 0.613, 0.783, 0.781, 0.641, 0.747, 0.765, 0.804, 0.798, 0.776, 0.737 and 0.681. The Cronbach alpha coefficient of the speaking activity subscale is 0.91 [24].

Ethical clearance was approved by The Committee Faculty of Nursing Universitas Airlangga (No: 1905-KEPK).

III. RESULTS

The study was conducted on 59 children with ASD, aged 5-11 years, with the most age being 7 years in TABLE 1. The study was conducted on April to August, 2020. The results showed that the sex of ASD children were mostly boys, namely 49 out of 59 in TABLE 1.

TABLE 1.
Characteristics of children with ASD by sex and age

Characteristics	N	%
Sex		
Boys	49	83,1
Girls	10	16,9
Age		
5 years	7	11,9
6 years	8	13,6
7 years	13	22,0
8 years	10	17,0
9 years	7	11,9
10 years	7	11,9
11 years	7	11,9

TABLE 2.
Descriptive statistics of emotions, inattention, memory, and speech in children with ASD

Description	N	Min.	Max.	Mean	Std. Dev.
Positive emotions	59	5	25	18.20	4.21
Negative emotions	59	6	23	12.42	3.81
Emotion	59	-13	17	5.78	5.90
Inattention	59	10	36	24.80	6.02
Memory	59	47	128	83.51	18.04
Speech	59	17	42	26.71	6.97

TABLE 2 shows that the average positive emotion is 18.20, the average negative emotion is 12.42, and the combination of positive and negative emotions, which in this study are referred to as emotions, is 5.78. The average inattention of children with ASD is 24.80. The average memory of children with ASD is 83.51. While the average speech in children with ASD is 26.71.

IV. DISCUSSION

In TABLE 2 shows that the average positive emotion is 18.20, the average negative emotion is 12.42, and the combination of positive and negative emotions, which in this study are referred to as emotions, is 5.78. This result is commensurate with the results of a study conducted by Russell et al. (2019) who showed that the results of measuring emotions in adults with a diagnosis of ASD and depression using PANAS showed an average positive emotion of 19.2 and an average of negative emotions of 28.2 [13].

This score is lower than the score on 647 normal children aged 8-11 years, where the average score of positive emotions is 19.58, the average score of negative emotions is 8.59, and the average combined score of positive and positive emotions negative of 10.99. It can be concluded that positive emotions in ASD children are lower, negative emotions are higher, and overall emotions Sanmartín et al. (2018) referred to as the ability to fulfill oneself lower than normal children [25]. This condition can be caused by a disturbance in the brain of children with ASD which controls emotions. Children with ASD have disorders of the limbic system, especially the amygdala and hippocampus which are the center of emotions, resulting in them having difficulty controlling emotions, panicking, being overly reactive, prone to tantrums, and anxiety [26]. In addition, abnormal thinning in almost all areas of the mirror neuron system (MNS), which is considered the basis for empathetic behavior, and cortical thinning in areas involved in emotion recognition and social awareness, thus giving a picture of emotions that tend to be more negative than normal individuals [27]. This condition can cause the emotions of children with ASD in this study to be more negative than normal children.

Emotions are complex psychological states involving subjective experience, physiological responses, and behavioral or expressive responses [28]. Paul Ekman and colleagues examined facial expressions related to emotions and stated that there are six basic emotional expressions, namely: 1) anger, 2) disgust, 3) fear, 4) happiness, 5) sadness, and 6) surprise [29].

Grabowski et al. (2019) identify emotions in the valence and arousal spectrum because it is easier and can be done with physiological signal analysis. The spectrum of arousal can be divided into three classes of emotions, namely: calm (sadness, disgust, neutral), moderate arousal (joy and happiness, entertainment), and excited (surprise, fear, anger, anxiety). The valence spectrum can also divide emotions into three classes, namely: unpleasant (fear, anger, disgust, sadness, anxiety), neutral (surprise, neutral), and pleasant (joy and happiness, entertainment) [30].

Persistent emotional and behavioral disturbances in a child may be an early indication of a developmental problem, such as autism, speech and language disorders or a learning disability [31]. Children with autism spectrum disorders have emotional characteristics that are unstable, hyperactive or very passive, like to be alone, laugh or giggle for no reason, have tantrums and hurt themselves [32]. Research conducted by Khoirunnisa & Nursalim (2012) found that feelings of fear, irritation, anger, sadness, joy, and affection were felt by children with ASD [33].

Emotions in ASD children can be classified into positive emotions and negative emotions. Positive emotions include happy [34][35], love, miss, and shame [35], while negative emotions include anger, fear [34][35], sad, surprised [35], and irritated [33].

TABLE 2 also shows that the mean inattention of children with ASD is 24.80. This score is included in the criteria for symptoms of severe attention disorder [19]. The research results are supported by research conducted by Lilja et al. (2022) in children with ADHD and ASD aged 6 to 17 years using SNAP IV on the inattention subscale obtained an average score of 20.11 [14].

Attention is the process of controlling information that enters consciousness; this process has a limited capacity and can be consciously controlled [36]. Attention in autistic individuals shows different characteristics compared to normal individuals. Individuals with autism pay more attention to objects, while normal individuals pay attention to the actions of others and especially to their faces and eyes when they are in a social environment, so that social interactions in individuals with autism are disrupted [37].

Individuals with autism also exhibit certain persistence behaviors [38]. This can be caused by pathological conditions in the form of overgrowth on the surface of the cortex and uneven cortex [39]. This pathological condition causes the ability to function in executive planning to be disrupted and fixated on the first stimulus from the next competing stimulus [40]. They have marked difficulty separating attention and carrying out rapid shifts of attention to stimuli on both sides of the space [41], exhibit mental flexibility deficits [42].

Attention problems in children with ASD have a different pattern from children with attention deficit hyperactivity disorder (ADHD). Children with ASD tend to focus too much on extraneous details and lose meaning. This disorder is called central coherence disorder [43].

Attention allows a person to use his limited mental resources wisely. A person can highlight the stimuli that interest him by reducing the signal to many stimuli from outside (sensations) and inside (thoughts and memories). This high focus increases the likelihood that a person will be able to respond quickly and accurately to stimuli of interest. A person can perceive a lot of sensory information at one point in time. Through the attention process (which can be automatic or controlled), a person filters out information that is relevant to him or her and wants attention. Finally, this leads to his actions based on the information that is followed. The increased attention also paves the way for memory processes. A person is more likely to remember information that is noticed than information that is ignored. Attention plays a causal role for cognition. There are three roles of attention in serving cognition. First, it helps in monitoring interactions with the environment. Through such monitoring, a person maintains his awareness of how well a person adapts to the situations in which he finds himself. Second, it helps connect the past (memory) and the present (sensation) to give a sense of continuity to the experience. Such continuity can serve as the basis for personal identity. Third, assist in controlling and planning future actions. One can do so based on information from monitoring and from the relationship between past memories and current sensations [44].

The average memory of children with ASD is 83.51 (see TABLE 2). The memory has a score range of 47 – 128 which is measured using the Observer Memory Questionnaire-Parent Form (OMQ-PF). The result of measuring memory in 376 normal children aged 5-16 years using the same measurement instrument obtained a mean score of 107.26 with a score range of 57 – 135 [20]. This shows that the memory of ASD children is lower than normal children. These results are supported by the results of a study conducted by Cramond (2012) which showed that the average memory score of ASD children at an average age of 14.67 as measured using the Test of Memory and Learning (TOMAL) was 82.86. This score is lower than normal children, namely 107.84 at an average age of 15.39 years [15]. Memory is the process involved in retaining, retrieving, and using information about stimuli, images, events, ideas, and skills after the original information is no longer present [45]. Memory is a core element of cognition, because all forms of learning from individuals involve memory [46].

The medial temporal lobe is a very important part of normal memory function. In particular, the medial temporal lobe is considered important for memory formation, i.e. consolidating distributed memory elements into a coherent and stable ensemble (coordinates) (a process that can take years) and for memory maintenance over a period of time after learning. Long-term memory elements are stored in the neocortex as a product of domain-specific processing distributed across different regions of the neocortex at the time of learning. The act of remembering involves reactivation of the same neocortical regions that initially process and store what is learned [47].

Individuals with autism have abnormalities in the medial temporal lobe, particularly the amygdala, as well as the hippocampal and perirhinal regions that serve memory [48]. The most distinctive function of the hippocampus is as a central cognitive processor. The hippocampus creates and stores deep and broad semantic associations among various inputs. Flexible and generative language also seems to depend on this hippocampal process. Most children with autism show anatomic abnormalities and impaired function of the neocortex [32]. This can cause selective memory impairment [33], which can cause the average memory score of children with ASD to be lower than normal children. Individuals with autism have selective memory impairment. Memory ability profiles in ASD children are characterized by relatively poor memory for complex visual and verbal information and spatial working memory with relatively intact associative learning abilities, verbal working memory, and recognition memory [34]. Some individuals with autism have extraordinary features, namely increased memory areas and extraordinary visual-spatial and intellectual abilities. They have a very good rote memory. This is partly due to superior memory resulting from nonsemantic perceptual (graphic or phonological) processing [34]. The mean speech in children with ASD was 26.71 (see TABLE 2). Children aged 6 years who are the youngest age of the subject of this study should have a speech score of 28, which is the maximum score of the measuring instrument [49]. The scores obtained by children with ASD in this study were lower than the scores usually achieved by normal children. These results are comparable to the results of a study conducted by Geier, Kern, and Geie (2013) which showed that the speech ability of ASD children aged 2-16 years as measured using the ATEC on the speech subscale obtained an average score of 10.0 [16]. This can be caused by several disorders in the structure and function of the brain found in children with ASD. Children with ASD had a higher mean glial cell density than normal individuals in the brain regions associated with speech production and processing, namely: Wernicke's area (Brodmann 22), Broca's area (Brodmann 44) and the angular gyrus (Brodmann 39). The density of neurons was lower in area 22 and area 39, and the number of lipofuscin-containing cells was significantly greater in area 22 and area 39. Area 22, which is the center of speech production, saw the greatest increase in glial, the largest decrease in neurons and the largest increase in non-cells. specifically containing lipofuscin [50]. This condition causes speech disorders in children with ASD.

There are four language areas conventionally, two are receptive language areas and the other two are language-generating executives. The two receptive areas are closely related to the central language zone. The receptive area functions to regulate the perception of spoken language, namely the Wernicke area and the Heschls gyrus. Wernicke's area is located behind the primary auditory cortex in the posterior part of the temporal gyrus in the temporal lobe, it is the most important region in the entire brain for higher intellectual functions, because almost all intellectual functions are based on language [35]. The area that regulates the perception of written language occupies the angular gyrus (Broadmann area 39), which is part of Wernicke's area. The angular gyrus is needed to visually interpret the received word. If this area does not exist then a person can still have a very good understanding of the language by listening, but not by reading. Broadmann areas 44 and 45, called Broca's area, are the main executive divisions responsible for the motor aspects of speech [36].

Broca's area has neural pathways for word formation. This area is located in the posterior lateral prefrontal cortex and partly in the premotor area. This is where plans and motor patterns for expressing words or even short sentences are initiated and executed. This area of work is also closely related to Wernicke's language comprehension center in the temporal association cortex. This speech area causes the formation of words by stimulating the larynx muscles, respiratory muscles and mouth muscles simultaneously. So, the pattern of motor skills used to regulate the larynx, lips, mouth, respiratory system and other muscles used for speech starts from Broca's area. The facial and laryngeal regions of the motor cortex activate the muscles of the mouth, tongue, larynx, vocal cords and so on which are responsible for the intonation, timing and rapid changes in intensity of sound sequences. The cerebellum, basal ganglia and sensory cortex help regulate the sequence and intensity of muscle contractions by cerebellar feedback mechanisms and function of the basal ganglia [37].

The speaking process involves two main stages of mental activity, namely: 1) forming thoughts to be expressed and choosing the words to be used, then 2) regulating the motor vocalizations and the actual work of the vocalizations themselves [38]. When hearing speech, the air vibrations generated are collected by the pinna and directed to the ear canal. At the end of the ear canal is the tympanic membrane (ear drum), which converts acoustic energy into mechanical energy. The mechanical energy is then transmitted through the middle ear cavity via the ocular chain (malleus, incus, and stapes). When mechanical energy is transmitted through the middle ear, the stapes acts on the oval window of the cochlea, which is in the inner ear. The cochlear space has an important organ of hearing (the organ of Corti) which is filled with fluid and is also surrounded by two other spaces which are filled with fluid. The movement of the stapes causes the fluid in this space to vibrate. The vibrations of the fluid in the cochlea move the receptor cells of the organ of Corti. The result is a nerve impulse. These nerve impulses then travel to the fibers of the cochlear portion of cranial nerve VIII (vestibulocochlear or auditory nerve), where they are then transmitted through the auditory pathway. The auditory pathway includes parts of the lower brainstem, upper brainstem (i.e. midbrain), and the cerebral cortex. It is in the cerebral cortex that sound is finally perceived and interpreted by the angular gyrus, insular cortex, basal ganglia, and Wernicke's area. Then the sound is formulated and channeled in the form of articulation, transmitted to the motor area in the brain that controls speech movements, namely Broca's area. This area causes the formation of speech production by stimulating the muscles of the larynx, respiratory muscles and mouth muscles simultaneously [39].

Communication problems in ASD vary significantly from child to child. There are some children who cannot speak, while there are other children who have a broad vocabulary and are very good at speaking on specific topics according to their interests, but are unable to carry out social conversations [40]. Verbal communication in individuals with ASD often displays certain features, such as:

1. Echolalia: parrot-like repetition of words and phrases, either immediately (immediate echolalia) or after some time (delayed echolalia).

2. Pronoun reversal: difficulty in using pronouns, especially you and I, and other deictic words like this - that; here - there, etc.
3. Very literal: understanding and using language is the literal meaning of the word, not what the speaker means.
4. Metaphorical language: a word that has several personal meanings that differ from the general definition.
5. Neologism: a new word created and understood only by those who created it.
6. Affirmation by repetition: there is no "yes" concept but the whole phrase is repeated to express agreement.
7. Repetition of questions: asking the same question over and over again, not to get information, but to maintain a predictable reaction.
8. Demanding the same verbal scenario: saying (and demanding a response) the exact same word that has been used in a similar situation.
9. Autistic speech style: speech may be too formal, verbose in both vocabulary and grammar.
10. Poor prosodic control: odd prosodic features, such as: flat, monotonous voice and idiosyncratic intonation, rhythm, and emphasis [41].

Knowing the emotions and cognition of children with ASD during the Covid-19 pandemic can help parents and therapists in determining the right care and therapy for children with ASD during the Covid-19 pandemic, especially in managing daily activities that are different from when they are not in a pandemic.

V. CONCLUSION

The purpose of this study was to quantitatively determine the emotional and cognitive features which include attention, memory, and speech in ASD children. The results of the study showed that the emotions and cognition of ASD children which included attention, memory, and speech during the Covid-19 pandemic were lower than normal children. Efforts are needed to increase positive emotions and improve cognitive function which include: attention, memory, and speech in ASD children with various therapies that are suitable for each individual. It is recommended to carry out further research on emotion and cognition in children with ASD which is related to the causal factors and their effects.

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