

Norm-Referenced Standard for Pre-Assessment of Sensory Perception in Children with Autism for Participation in Therapeutic Horseback Riding Activities

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Abstract Therapeutic horseback riding (THR) is undoubtedly beneficial for children with autism spectrum disorders (ASD) because it stimulates the rider's senses. However, it is important to consider the risk of injury associated with THR activities. Safety concerns may arise from the nature of the horse as a herd animal and the challenges associated with autism. Therefore, the purpose of this study is to propose a pre-assessment of sensory perception with norm-referenced standards for ASD children as a pre-requisite for participation in THR activities. The pre-assessment was developed based on the learning pyramid. Children (n=33) aged 5 to 12 years with diagnosed ASD were selected as participants. Data indicate that a minimum score of 23 out of 27 must be achieved for tactile and vestibular perception, while a minimum score of 19 out of 24 must be achieved for proprioception and auditory perception. The passing score is determined by a norm-referenced standard, which is the calculated mean and standard deviation (Tactile: $M=26.4$, $SD=1.3$; Vestibular: $M=26.6$, $SD=1.2$; Proprioception: $M=22.4$, $SD=1.3$; Auditory: $M=22.6$, $SD=1.4$). This norm-referenced standard for pre-assessment is an important early stage of assessment and a key resource for supporting and directing instructors, health professionals and the community.

Keywords Pre-Assessment, Therapeutic Horseback Riding, Sensory Perception, Norm-Referenced Standard

1. Introduction

Therapeutic horseback riding (THR) promotes healing through horse-related activities and leads to positive physical, emotional, and mental outcomes for individuals [1]. THR has long been used as an alternative form of therapy for children with special needs [2]. There are many terms used to describe horse-related therapy activities [3]. In this study, the term 'therapeutic horseback riding' was used because this study is in line with a few components of THR. The other forms of THR can also be known as equine-therapy and hippotherapy. Generally, equine-therapy is known as activities conducted in the presence of a horse [4]. Meanwhile, hippotherapy uses the horse's movement purposefully according to clinical reasoning, to achieve a specific functional outcome [5]. In a distinctive THR activity, mounted and unmounted horse activities are used to improve health condition of people with special needs [6]. It is a prevalent misconception that every rehabilitation activity involving horses has the same orientation when in fact there could be differences in objectives, type of activities and outcomes of the intervention [7].

By utilizing a horse's natural movement, THR activities become one of the complementary rehabilitative aids for

individuals with ASD [8]. Animal-assisted interventions are known to help humans to improve their health and well-being [9]. THR has been recognized in promoting positive horse-human interaction and connection within medical and mental health therapy [10]. Horse-related structured activities in the therapeutic sessions include both work on the ground and riding [11]. It is undeniable that THR activities give benefits to humans. A systematic review conducted summarized the research supporting the use of horse therapy as a multimodal intervention to treat behavioral and sensorimotor comorbidities in ASD patients as well as diagnostic deficits in social communication skills [12].

Horse therapeutic activities give positive effects on cognition and motor development involving sensory systems. Through the horse's rhythmic and repetitive movements, this horse-human related therapy provides sensory stimulation to the rider [13]. Horses help to facilitate communication between rider and instructor to achieve the objective of the treatment. The relationship between the patient-horse-instructor develops throughout the activity, which is why THR is considered an alternative therapeutic tool. This relationship helps to reinforce the learning process by enhancing the development of sensorimotor and cognitive stimulation [14]. Sensory issues are frequently seen in autism spectrum disorders (ASD). The terminology of sensory features in ASD can be categorized as sensory reactivity, sensory perception and sensory integration [15]. Throughout this article, the term 'sensory perception' is used, which can be defined as the ability to recognize and evaluate the characteristics of sensory information or the interpretation of sensations [16,17]. It is also referred to as organizing, identifying, and interpreting sensory information to comprehend the environment [18].

ASD is a developmental disorder that affects social and communication skills and leads to repetitive and stereotyped behaviors [19]. Children with ASD also commonly suffer from sensory function disorders. Sensory abnormalities are one of the most common symptoms of ASD [20]. According to a meta-analysis of prospective research on sensory processing in people with ASD, sensory behaviors were

common [21]. However, evidence from other studies revealed that individuals with ASD differed substantially in terms of the frequency, severity, and topography of these abnormal sensory behaviors [22]. Due to challenges in communication, sensory abnormalities are a highly common trait that frequently goes unreported [23]. Sensory abnormalities of ASD children may impair their behavior and may cause issues with their daily activities [24]. Therefore, autism interventions should incorporate specific strategies for managing sensory-related behaviors to enhance engagement in activities [25]. Hence, assessing sensory perception in ASD children is important before participating in any activity.

Sensory perception in ASD is measured by examining the ability to perceive and understand sensory stimuli. Most research studies focus on auditory, visual, and tactile perception, but there are also data on proprioceptive perception in ASD [26]. Several studies [27,28] have shown that there are various assessments of sensory perception. A previous study concludes with a recommendation of best practice protocols for clinical assessment of sensory features in autism [29]. A systematic review of sensory processing assessment tools provides a current comprehensive list of assessment instruments specific to sensory processing in children [30]. Thus, this study emphasized the pre-assessment of sensory perception of four sensory domains namely auditory, tactile, vestibular and proprioception.

Theoretical approaches [31] suggest a hierarchical organization of higher-order cognitive and sensory processes, with sensory processing influencing some cognitive and executive functions. Difficulties at the level of sensory processing may cause insufficiencies in higher-level integrative functions; consequently, these sensory impairments may interfere with the successful execution of adaptive responses to situational demands such as meaningful engagement in daily activities, social interactions, and play [32,33]. In addition, based on the Sensory Integration Theory, the processing and integration of sensory information is a crucial neurological process that strongly influences development [34].

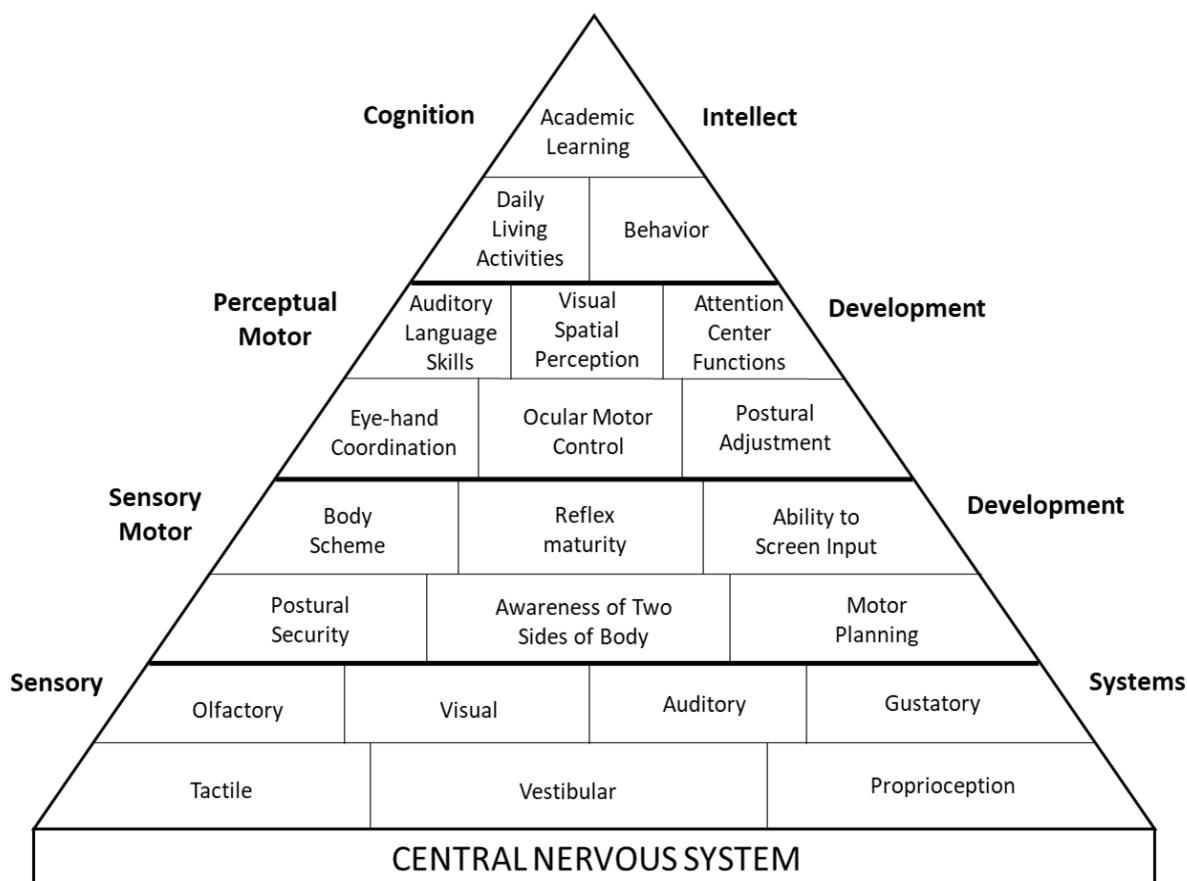


Figure 1. Pyramid of Learning (Williams & Shellenberger, 1994)

The Pyramid of Learning (Figure 1) represents the theoretical approaches to human development and is a learning pyramid in which cognitive and executive functions (higher order processes) depend on sensory systems located in the basal part of the pyramid [35,36]. At the base of the learning pyramid are the sensory systems on which the human cognitive system is built. Difficulties at the base of this bottom-up processing flow could affect the cognition. Therefore, it is important to evaluate the base systems of learning, which refers to sensory perception [37].

As one of the diagnostic criteria for ASD, the DSM-5 by the American Psychiatric Association includes the potential existence of sensory processing issues in ASD [38]. Therefore, this study intends to propose a pre-assessment according to the pyramid of learning theory. The need for pre-assessment is to prioritize safety aspects during THR activities. As identified from the literature, cognition potentially correlates with the sensory systems which affect performance of children with ASD by having difficulties with engagement and interaction. Thus, before recommending this kind of therapy, the risk of injury associated with horse-related therapy activities should be considered [39].

Children with autism have their own behavior while the nature of the horse as prey is a fight and flight response. This response is a common trait of horses that could pose a

potential risk to humans who interact with them. While working with a horse, ASD children have possibilities to scream and become thrills. The horse's instincts may interpret unexpected noises and sudden movements as a threat [40]. There are many other unpredictable things that could happen during THR activities. Any possible risks should be identified at an early stage. There would therefore seem to be a definite need for the pre-assessment to understand the sensory perception of ASD children. Therefore, the objective of the study is to propose a pre-assessment of sensory perception with norm-referenced standards for ASD children, as a pre-requisite before participating in the THR activities. The pre-assessment has been organized in accordance with the literatures to make it simpler for the assessor to decide whether a candidate can meet the minimal requirements to participate in THR activities. The minimal requirement is indicated by the minimum passing scores from the pre-assessment that are graded through norm-referenced standards.

The pre-assessment is adopted and arranged according to the literature which focuses on the sensory domains limited to tactile, auditory, vestibular and proprioception. These sensory perceptions must be evaluated in the pre-assessment as any difficulties regarding the sensory perception might affect the effectiveness of the THR activity and may lead to safety issues. Hence, findings of the pre-assessment are

important for initial evaluation of children with ASD before taking part in THR activities.

The instructors, even though they are typically not medical professionals, should be aware of the rider's health, contraindications, disabilities, and other limitations to ensure the safety and effectiveness of THR activities. They should also be capable of selecting, training, and preparing the appropriate horse [41]. Planning THR activities is important because trainers or instructors need to know the capabilities of the rider or ASD children before participating in THR session [42]. It is important to note that therapeutic horseback riding should not replace traditional medical treatments, but rather complement them as an additional form of therapy [43]. It is crucial to consult with healthcare professionals regarding integrating THR into one's existing treatment plan.

2. Materials and Methods

2.1. Pre-Assessment of Sensory Perception

Based on a study, utilizing physical movement in THR activities require sensory stimulation [44]. It is the reason this sensory-related pre-assessment is proposed. This THR pre-assessment is based on the learning pyramid. At the base of the pyramid are seven sensory systems. However, this pre-assessment gives emphasis on the basic sensations, which are the most ancient and primitive sensations. According to the pyramid of learning, basic sensations consist of the senses of touch, vestibular, and proprioceptive [45]. Above the basic sensations are the sensations that are essential to the individual's daily functioning, namely sight, hearing, smell, and taste. This THR pre-assessment was formed using sensory systems that were relevant to therapeutic horseback riding activities. Thus, this pre-assessment is arranged according to the sensory systems but is limited to the basic sensations of tactile, vestibular and proprioception, while including auditory. Therefore, it is important to include the basic sensations as well as the sense of hearing in the pre-assessment as these sensations are essential for the safety and efficacy of the THR activities.

The pre-assessment was adapted and modified according to the available reliable assessment of sensory perception in children with autism. A considerable amount of previous studies on the assessment of sensory [46]. The systematic review gives information on the assessment tools that considered various aspects of sensory processing by selecting the most appropriate assessment tools to measure sensory perception in children depending on specific sensory components that need to be evaluated. Pre-assessment was developed based on an adaptation and extension of sensory measure by Dunn's Sensory Profile [47]. It was originally divided into six sensory categories; touch, movement, body position, taste or smell, auditory, and visual. One way to measure sensory processing from a behavioral perspective is to obtain a sensory history [48]. Accordingly, the items in THR pre-assessment are adopted from dependable sensory

assessment tools.

An individual could be connected to their environment in a satisfactory manner if the different sensory systems are functioning correctly. Each person has unique sensory capacities that are influenced by various factors including habits, genetics, and environment [49]. Hence, in order to plan appropriate THR activities for the children with autism, it is first essential to understand the individual sensory capacities. It is important to understand the individual sensory abilities to recognize the sensory preference of each individual and identify the characteristics of each sensation that generate discomfort or displeasure [50]. In this way, the children's ability to meet the minimum requirement to involve in THR activities could be obtained. The work on the development of items in the pre-assessment got an additional opinion from three local coaches or instructors that actively work with horses and riders. The feedback regarding the pre-assessment is provided and the content is evaluated.

2.2. Participants

Thirty-three ($n = 33$) children with autism spectrum disorder were recruited for this research. In this study, the selection of participants was done using the purposive sampling method. The inclusion criteria are that they have an ASD diagnosis, are between 5 and 12 years old, and are able to understand instructions given. This study includes both verbal and nonverbal children with ASD. Prior involvement in any horse-related activities is not required. Inclusion of these participants is significant to develop a norm-referenced standard for the pre-assessment. Parents provided informed consent, and the participating child provided consent upon visiting the horse barn. The demographic information of the participants was collected at the beginning of the study, which included their age, gender, ethnicity, and medical history.

2.3. Procedures

Figure 2 shows the flow of the procedures for recruitment of the participant to collect the information of data for this study. In search of the participant for this study, research poster was blasted to local autism society and social media platforms. Interested parents contacted the research team. The interview session was conducted through a phone call. The researcher and the team are in need of the details for the potential participants. Before participants enroll as subjects for this research, they are required to have previous sensory assessment records. It is also essential to have their medical information in detail. The administration of this pre-assessment is by participants' parent or proxy, assisted by the researcher. It takes approximately 15 - 25 minutes to complete the pre-assessment. The proposed pre-assessment for each individual will take place on a specific day at equine facilities. The meeting includes a free-play session just to observe the child's ability according to each sensory element and ensure the child's acceptance of working with horses.

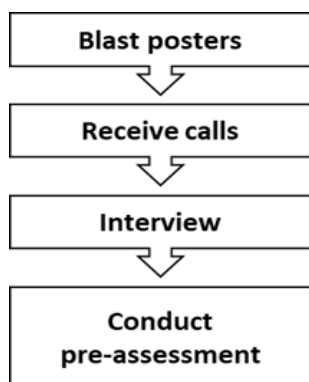


Figure 2. Flow of the Procedures

2.4. Measures

Scoring in each item in the pre-assessment is according to a scale. The scoring measures are used in this study to identify an appropriate criterion measure to assess sensory perception. The scale of scores is arranged by level of problem [51]. The lowest scores indicate that the participant shows serious problem with the stated items in the pre-assessment and conversely. The following Table 1 gives description in detail about the scores.

Table 1. Scale; Level of Problem

Scores	1	Serious problem	The child always shows the criteria or refuses to perform the task
	2	Moderate problem	The child often shows the criteria or resists at first, but then performs the task well
	3	Minor problem	The child rarely shows the criteria or able to perform the task with help and guidance
	4	Not at all a problem	The child never shows the criteria or able to perform task the task independently

2.5. Norm-Referenced Standard

This research included items development in the pre-assessment and scoring system development through norm-referenced standard. Basically, the two main approaches to assessment are norm-referenced assessment and criterion-referenced assessment [52]. Norm-referenced assessment appears to be the most common approach to assess a student's performance [53]. An outcome measure from this assessment is a score in the form of grading. Through the obtained range of grades, assessor can determine whether a participant can meet the minimal requirements to participate in THR activities. The minimal requirement is indicated by the minimum passing scores from the pre-assessment that are

graded through norm-referenced standard.

3. Results

In this THR pre-assessment of sensory perception, the theoretical approaches of the learning pyramid are implemented. It is also has been proposed according to the reliable sensory assessment tools. As a result, seven (7) items are formed in tactile and vestibular sensory systems, while six (6) items are designed in proprioception and auditory sensory systems. All of items are built along with the justification related to THR activities. So that the parents or proxy could relate the relevance and importance of the pre-assessment for THR activities.

3.1. Tactile

The tactile system or sense of touch refers to the information received through the skin receptors. Touch is considered one of the most basic senses [54]. The evaluation of the sense of touch could include the participant's response to the stimuli. Children with autism may respond with general discomfort or distress to a certain stimulus. The components of the tactile sensory system are linked to THR activities such as touching the horse's fur and feeling discomfort in certain attire. The tactile system is crucial for a child's ability to learn about the world around them and to form an understanding of who they are in connection to others. Low sensory sensitivity in a child result in poor coordination, and the child's abilities may be affected by tactile sensitivities [55]. Lack of good touch might cause a child to exhibit tactile defensiveness or tactile seeking behavior [56]. All items regarding tactile sensory systems in the pre-assessment are outlined in Table 2.

3.2. Vestibular

The vestibular system plays an important role in body regulation [57]. This sensory system supports numerous other bodily and mental functions [58]. The vestibular sense is known as the most basic sense. This system provides the brain with information about the body's position in space, and is critical for maintaining balance during both static and dynamic activities [59]. In order to provide participants with the most appropriate care and activities during the THR session, it is important to assess children's responses of acceptance or rejection when presented with various vestibular sensory input. In the pre-assessment for vestibular sense, the items include assessment on balancing activities such as riding a bike, climbing and running. In Table 3, the items on pre-assessment regarding vestibular sense are justified.

Table 2. Tactile

Tactile	
Items	Justification
The child is reluctant to touch fur and touch the horse.	Reluctance to touch the horse may lead to negative emotional response.
The child refuses to wear a riding helmet.	Refusal to wear a riding helmet jeopardizes the rider’s safety and could disrupt the THR session.
The child dislikes socks and shoes or avoids walking barefoot.	Refusal to perform simple tasks can lead to negative reactions and is not yet appropriate for the THR session.
The child avoids or overreacting to wet or messy textures.	Children with tactile sensitivity may encounter difficulties during THR activities.
The child is hypersensitive to temperatures or has decreased awareness of extreme temperatures.	Children participating in a THR session must be able to adjust to their surroundings with ease, as temperature has an impact on emotional reaction.
The child frequently drops objects out of their hands.	This behavior can lead to frustration and lack of engagement during the THR session.
The child shows irritation over particular types of clothing such as jerseys or jeans.	Appropriate attire is required for participation in THR activities.

Table 3. Vestibular.

Vestibular	
Items	Justification
The child gets easily upset while doing balancing tasks on a balance beam or board.	A child who has problems with balance may react negatively to sitting on a horse.
The child is afraid of heights; hesitates to go up or down when climbing.	The child may scream when sitting on a horse as loud noises may disturb the horse.
The child unexpectedly loses balance when walking on uneven surfaces.	The child tends to react poorly or cry when sitting on a horse because of a fear of heights if he loses his balance.
The child has less willpower when riding a bike.	
The child does not like activities that require feet to leave the ground, such as swinging, sliding, bicycling, jumping, or climbing.	THR activities require the child to sit on a horse that is at a high position from the ground.
The child has difficulty sitting still or cannot maintain attention without moving.	The child must remain calm on the horse as he/she may interfere with the horse’s movement and become engaged in THR activities.
The child seems unaware of danger or jumps, runs, or climbs impulsively.	The child may have a tendency to jump off the horse.

3.3. Proprioception

The body uses proprioceptive input to understand where different body parts are located, how they move, and how much strength is needed from muscles. The information provided by this system is used for postural control and motor actions [60]. In addition, it also perceives when something unexpected happens. Proprioception, also known as the sixth sense, is able to know what position it is in. This system helps determine which limbs are in position and how strongly the body is being pulled, pushed, or pressed [61]. The person having issues with this proprioceptive sensory may struggle to behave in accordance with the demands of the environment, which contributes to more functional difficulties. In the pre-assessment, the items listed for proprioception are all related to the body awareness of the participants’ physical

movement. It includes kicking, stomping, and sitting. The evaluation of the proprioception sense on the participants is crucial as horses are very alert to human actions and surroundings [62]. Table 4 justifies the items on proprioception sense listed in the pre-assessment.

3.4. Auditory

The auditory sensory system refers to the ability to receive, process, and respond appropriately to sounds [63]. Auditory defensiveness may cause discomfort or painful responses to certain forms of noise [64]. Some individuals with auditory defensiveness have high noise thresholds and may hear sounds that others cannot [65]. The pre-assessment is proposed as assessor needs to understand the participant’s auditory reaction. The purpose is to determine if the child shows any type of response when presented

with an auditory stimulus. Items listed in the pre-assessment for auditory sense include children's responses to crying, making noise, and loud sounds. In Table 5, it consists of the items for auditory sensory in the pre-assessment.

3.5. Grading Scores

All values are reported in range of the grade, since the mean and standard deviation of the mean represent the value obtained for the norm-referenced standard. The results of this research are summarized in the following

tables. Table 6 summarizes the value of mean and standard deviation attained from the total score of ($n = 33$) participants. The passing grade which is derived from the obtained mean value and standard deviation value (Tactile: $M = 26.4$, $SD = 1.3$; Vestibular: $M = 26.6$, $SD = 1.2$; Proprioception: $M = 22.4$, $SD = 1.3$; Auditory: $M = 22.6$, $SD = 1.4$). Based on the results, it can be proposed that tactile and vestibular perception require minimum passing scores of 23 out of 27, while proprioception and auditory perception require minimum passing scores of 19 out of 24. An overall summary of the results of grading score for each sensory system is given in Table 7.

Table 4. Proprioception

Proprioception	
Items	Justification
The child frequently attempts to climb, fall, tumble or jump.	Any sudden attempt or movement by the child may cause a frightened horse.
The child frequently kicks while sitting or stamps his or her feet while walking.	The child's active feet can aid the horse increase its gait.
The child often plays too roughly with peers, siblings, or pets.	During the THR session, there is a risk of the child misbehaving on the horse.
The child frequently bumps into objects or other people.	The child's unexpected action may disrupt the THR activities.
The child uses too much force when carrying or opening things, resulting in dropping, spills, or breaks something.	This child may lead to negative emotional reactions during the THR session.
The child has difficulty climbing stairs, riding a bike, or standing on one foot.	If he/she has difficulty with these activities, it shows a lack of body coordination that can lead to safety deficiencies.

Table 5. Auditory

Auditory	
Items	Justification
The child enjoys making noise just to make noise.	Sudden loud noises or screams from the child may startle the horse, as its natural instinct is to fight or flight.
The child overreacts to loud or unexpected noises (covering ears, crying, running away).	THR sessions could be harmful and are not yet appropriate for the child, as this criterion may enhance negative emotional reactions.
The child is upset or distracted by sounds that most of us are not aware of.	They may be very sensitive and disturbed while on the horse and unable to engage in activities.
The child often gets upset with others because they are too loud.	Mild agitation during simple tasks can lead to negative emotional reactions and is not appropriate for a THR session.
The child prefers to keep television, radio, or music very loud.	A child with auditory hypersensitivity may not give a good feedback or engage during THR activities.
The child does not like noisy places like shopping malls, movie theaters, or fairs.	

Table 6. Mean and SD value for each sensory perception

Sensory elements	Mean	Standard Deviation
Tactile	26.4	1.3
Vestibular	26.6	1.2
Proprioception	22.4	1.3
Auditory	22.6	1.4

*Value of mean and SD based on 33 subjects

Table 7. Criterion-referenced standard for each sensory perception

Grading	Tactile	Vestibular	Proprioception	Auditory
Serious problem	≤ 23	≤ 23	≤ 19	≤ 19
Moderate problem	24 – 25	24 – 25	20 – 21	20 – 21
Minor problem	26 – 27	26 – 27	22 – 23	22 – 23
Not at all a problem	28	28	24	24

*Grading value for passing marks based on 33 subjects.

4. Discussion

Therapeutic horseback riding is found to be beneficial for children with autism spectrum disorders, primarily because of the positive engagement and social interaction between the horse and the child [66]. In addition, therapeutic horseback riding can have positive effects on social, emotional, and physical domains [67]. The benefits of these THR activities for children with autism are evident. Therefore, before including ASD children in THR activities, all aspects of safety, therapeutic, and learning sessions must be evaluated. It is to get the most reliable information possible about each of their senses and how it works. All concerns were objectified through the pre-assessment. This was done with the aim of reducing the risk of injury and improving the quality of THR activities. In this way, these therapeutic activities can provide comprehensive benefits to the child.

Most therapy requires adequate treatment tools, goals and frequency to maximize the positive outcome of the treatment. In any therapeutic or learning session, a standard operating procedure or lesson plan is required. Therefore, an adaptation should be made to practice therapeutic horseback riding in children with autism. Hence, this study provides a convenient way to assess the sensory capacities in each individual before participating in THR activities. The method presented in this paper is general enough to be applied to children with ASD who are interested in therapeutic activities with horses. Although the sensory assessment was originally developed to evaluate an individual’s sensory abilities for medical examination, this anticipated THR pre-assessment can be usefully applied in the fieldwork of equine-related activities. There have been a number of studies that have investigated the effectiveness of THR activities on the sensory perception of an individual. Sensory is closely related to the cognition, which includes the learning systems. THR helps improve the rider’s sensory input by allowing rhythmic and repetitive movement of the horse [68]. As discussed earlier, one study explained that good functioning of sensory systems enables a person to connect with his or her environment and act accordingly [69]. A good sensory level of the participant can help the participant engage with the horse and maximize the benefits of this therapeutic activity. Thus, in order to help children with the different sensory capacities to be working with horses, it is truly recommended to evaluate the sensory perception of the rider. The

improvement of the sensory perception would help improve the total well-being of the individuals.

Successful interactions with horses may encourage important sensory stimuli that are good for psychological and social functioning [70]. On the other hand, the coach or instructor has the responsibility of managing the rider’s performance. They also play an important role in developing a good therapeutic program. In order to make the most of benefits of THR activities for the rider, an appropriate treatment plan should be considered. Accordingly, it is first essential to be aware of the sensory range of an individual. THR coaches or instructors play an important role in helping children with autism improve their performance and gain full benefits from THR activities.

The objectified items in the pre-assessment can be evaluated by scoring and grading systems. This THR pre-assessment differs from the medical assessment, which is very detailed in content and has a specific measure. As was pointed out in the introduction to this paper, planning the goals for THR activities after sensory evaluation from this pre-assessment could be alike to administering medication, with the dose being adjusted to each individual. For this reason, this has significant potential for many future applications of this pre-assessment for THR activities. The sensory perceptions included as items in the pre-assessment are the most basic sensory systems essential for THR activities. This ensures that the child can safely interact with and ride the horse during therapy session. According to learning pyramid, all learning is dependent on the prior development of the necessary sensorimotor skills [71]. It is stated that the basic sensations in the pyramid of learning include tactile, vestibular and proprioception. Based on the neurophysiological studies of auditory perception, individuals with ASD have difficulties with sustained auditory attention [72]. Since the safety of the horse and child is paramount, it is important to assess the child’s sense of touch, hearing, balance, and proprioception. Items in the pre-assessment involve these four (4) sensory perceptions.

From the results obtained from the criterion-referenced standard, the scale of grade for each sensory perception was attained. The findings of this study suggest the minimum passing scores for tactile and vestibular perception is 23, while minimum passing scores for proprioception and auditory is 19. As previously stated, the scoring measures used are in scale; level of problem. Taken together, these

results suggest that the participants that got the highest total scores of 28 for tactile and vestibular, and total scores of 24 for proprioception and auditory are categorized as 'not at all a problem'. The participants could also be classified as 'moderate problem or minor problem' according to their achieved total scores. The data reported here appear to support the assumption that the minimum passing scores determined the participation of the ASD children in THR activities.

In addition, three local coaches or instructors who deal with horses and riders on a regular basis provided additional input to the work on the development of the pre-assessment items. Their general opinion of this pre-assessment is that they find this pre-assessment with a scoring system useful and appropriate for use in therapeutic horseback riding practice. Furthermore, it is also important to assess the horse's behavior, personality, and physical condition before sessions with a child begin. This will ensure that the horse is well-suited for the child's needs and has no issues that could affect the child's safety during therapy sessions.

5. Conclusions

As shown in the findings obtained, the pre-assessment for therapeutic horseback riding activities has a solid objectifying content in order to help instructors or coaches with prior assessment for children with autism to participate in THR activities. This proposed pre-assessment can be considered to be a significant step forward for the safety concerns before ASD children involve in THR activities. This study is a first step towards a more profound understanding of nature of the horse as treatment tools and difficulties associated with autism. The pre-assessment should be a tool that can be used in the field that works on therapeutic horseback riding. This THR pre-assessment has been proposed as it should be easy to use and it should be able to generate as much information as possible about the person's sensoriality. Thus, the THR activities could be designed in an appropriate and specific way according to the individual sensory characteristics. The pre-assessment is a critical component in the planning and implementation of horse therapy sessions, as it enables the instructors to tailor their approach to meet the specific needs and abilities of each child. This study acknowledges that the pre-assessment gives comprehensive benefits to the child. Therefore, this THR pre-assessment could be integrated with recognition that those items in the assessment can be developed with further refinement. Additionally, it is recommended the pre-assessment to be empirically validated before coaches or instructors may use this THR pre-assessment. Taking into account the fact that this pre-assessment with limited reliability, and involves a certain degree of subjectivity on the part of professional who applies it. Nevertheless, this pre-assessment will be a great help to this field of work.

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