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Changing dimensions in human–animal relationships: Animal Assisted Therapy for children with Cerebral Palsy

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Abstract

Animal Assisted Therapy (AAT) or Pet Therapy is an emerging trend in the management and rehabilitation of many conditions. It has become an area of dedicated research recently, even though tradition has always affirmed the significance of animals in promoting the health and well-being of people. In AAT, animals are involved in the therapy as a Co-Therapist. Main goal, the health professionals are not really convinced about the usefulness of this kind of therapy and the evidenced based practice in this area is extremely minimal. Hence we felt it would be beneficial to discuss various researches conducted on Animal Assisted Therapy in children with cerebral palsy (CP) and the issues and challenges associated with it. We focused on original research conducted among children with cerebral palsy. Horses (Hippo Therapy or Equine Assisted Therapy) are the most widely used animals among children with CP. Most of the studies were aimed to assess the effect of AAT in neuro rehabilitation of children with CP. Results indicated improvement in motor areas such as Gross Motor Functioning, re-establishing muscle symmetry, improving trunk stability, postural control, balance, gait, range of motion, functional skills, ADL, strength, co-ordination, and muscle tone. It also revealed significant improvement in psychological variables such as cognition, attention, concentration, memory, self-esteem, emotional well-being and social interaction, but we noticed a scarcity of literature in the paediatric population and most of the articles are anecdotal in nature. Nevertheless, in the United States and Northern Europe, this kind of therapy has begun to be implemented in a regulated and systematic way to deliver concrete results.

Keywords : Animal Assisted Therapy, Equine Assisted Therapy, Therapeutic Horseback riding, Hippo Therapy, Pet Therapy, Cerebral Palsy

Introduction

Human beings and animals have always shared a powerful bond and companionship since the dawn of civilization and animals are a source of solace and relief for those who experience physical, emotional and psychological problems. Animals can play a vital and multifaceted role in each and every aspect of human life. Cerebral palsy is a persistent, but not necessarily an unchanging, disorder of movement and posture due to non-progressive disorder of the immature brain (Brett, 1997). It is one of the common forms of disability and a chronic condition which severely affect all health dimensions of children, and requires lifelong occupational or other physical therapies. Children with cerebral palsy have very

limited ability to participate in the activities at home, school and during play. Animal Assisted Therapy is the use of trained animals as a therapeutic tool to assist humans in restoring strength, balance, flexibility, and improving cognitive and emotional abilities and whose use reportedly dates back to the 1940s, when an army corporal brought his Yorkshire terrier to a hospital to cheer wounded soldiers. There is a noted increase in the body of research literature over the past couple of years in its use among children with CP;but even then, existing literature is quite restricted.

Animal Assisted Therapy

Nimer & Lundahl (2007) found that animals have a natural affinity for creating bonds with people, which makes the Animal Assisted interventions possible and beneficial. This natural tendency fosters quick rapport and empathy between animals and children (Chandler, 2005).

Delta society (2009) classifies Animal Assisted interventions into two types, Animal Assisted Activities (AAA) and Animal Assisted Therapy (AAT). AAA involves less formal human animal interaction and is used for social visits of animal to hospitals or other community settings. AAT is goal directed where the animal should meet specific criteria. AAT is defined as a goal oriented intervention in which the animal is a part of the treatment process delivered by a health /human services professional (Anderson, 2004). Nimmer and Lundahl (2007) defined AAT as the deliberate inclusion of an animal in a treatment plan where the introduction of animal is designed to accomplish predetermined outcomes believed to be difficult to achieve otherwise, or outcomes best addressed through exposure to animals. Research and observations suggested that the involvement of animals can be useful for educational and motivational effectiveness for participants in the therapy. When an animal or a pet is involved in therapy, the therapist may be viewed as being less threatening, which enhances the rapport between patient and therapist. Varieties of animals are used in different medical conditions, and include domesticated pets, farm animals and marine mammals (such as dolphins). But research literature states concerns about the poor quality of medical evidence underpinning AAT.

The most widely used animals in cerebral palsy are horses. Hence this article details more regarding Equine Assisted Therapy, and gives a brief description regarding Canine and Dolphin Assisted interventions.

Dolphin Assisted Therapy (DAT)

Dolphins are considered closest to human beings because of their ability to keep contact with humans for very long periods, as well as their intelligence and sociability. Dolphins can be used as motivators for improving attention span, and it is hypothesized that communication with dolphins has a positive impact on brain waves. Moreover, high frequency sound emissions by dolphins are considered to have a positive impact on neuro physiologic hormones (Nathanson, DeCastro, & Friend, 1997). DAT is one of the popular forms of animal assisted therapy which can be used in children and adults with cerebral palsy. Dolphin assisted therapy can improve movement, motor control, attention span, speech, language skills and behavioural skills. But there is a dearth of scientific evidence regarding its potential and long term benefits, in literature.

Canine/Dog Assisted Therapy

Dogs have been a part of human life since the beginning of civilization and became the first domesticated animal. Forbes & Marxen (2015) found that occupational therapy with a therapy dog, increased enjoyment and participation in the therapy process of the child with CP. Elmaci & Cevizci (2015) reported that children with cerebral palsy improved in their ability to use their bodies

according to their capabilities. The curative effects of Dog Assisted Therapy comprise psychological, emotional, play and physical stimulation. The Researcher has used a therapy dog for improving the use of the right side of the body,in a child with right hemiparesis.The child's muscle tone was increased, as he has difficulty using the right side, his awareness of the right side was low,and he used his left side to accomplish all activities. The goal of the child was to give yogurt to his dog. It was reported that the cold yogurt, the warm tongue of the dog and the vibration triggered by licking, decreased muscle tone and increased the awareness of its extremity. But the result found was temporary, and he also concluded that Dog Assisted Therapy also improved balance in children with CP. There is extreme scarcity of scientific evidence in literature and the above mentioned studies are purely anecdotal.

Equine Assisted Therapy

Some records say that Greeks used horses to improve movement since 460 BC. Horse assisted therapy is being widely used in a variety of medical and psychiatric conditions. Previous studies have widely used Equine Assisted Therapy in children with cerebral palsy and have documented its effectiveness.

Types of Equine Assisted Therapy

Two types are widely used, Hippo Therapy and Therapeutic Horseback Riding (THR). In Hippo therapy, a physical or occupational therapist controls the horse to influence the child's posture, balance, co-ordination, strength and sensory motor systems, while the child interacts with the horse and responds to the movement of the horse.

THR is led by a trained riding instructor with the child actively controlling the horse as a form of exercise or to improve co-ordination, balance, and posture and to encourage development of sensory and perceptual motor skills. But the therapeutic goals are the same- the warmth and shape of the horse and the rhythmic three dimensional movement of THR are believed to improve the flexibility, posture, balance and mobility of the rider.

Goals/ Benefits of Equine Assisted Therapy

1. Improves gross motor development, specifically walking, jumping, and running.
2. Benefits physical characteristics, strength, muscle symmetry, balance, posture, arm and leg coordination, trunk stabilization, flexibility, grasp/ release patterns.
3. Develops social and communication skills.
4. Mobilizes the pelvis, lumbar spine, and hip joints.
5. Normalizes muscle tone.
6. Develops equilibrium reactions of the trunk.
7. Facilitates relationship building.
8. Provides an experience of physical affection.
9. Enhances self-esteem.

Contra indications for Equine Assisted Therapy

1. Children under 2 years of age
2. Seizure disorder
3. Scoliosis
4. Dislocated hip
5. Allergy

Mechanism of Hippo Therapy

HippoTherapy can be effective when dynamic three dimensional movement of the horse is transferred to a patient, which produces a combination of sensory, motor and neurological input and can improve muscle tone, range of motion, strength, coordination, posture, balance, gait, gross motor skills, and walking abilities. It has profound cognitive, social, and emotional behavioural benefits also. Hippo Therapy

improves the functioning of neural muscles, and while riding, due to movement of the horses, riders experience 500-1000 bodily movements in 10 minutes. Movement generated by horses walking, allows riders to experience 3 dimensional motions, forward/backward, left/right, upward/downward. It was reported that the movement of horses, transmitted to the riders, is similar to the pattern of movement which occurs in the pelvis of walking humans, and generates the same feelings of motion effects, as though the riders were walking themselves. The rhythmic and repeated movement of horses, through horseback riding, provides the riders with sensory input, which stimulates the superior motor nerve along upward neurotabes (Debuse, Chandler, & Gibb, 2005 & Herrero, Asensio, Garcia, Marco, Olivan, & Ibarz, 2010) and activates the neural circuit of voluntary movement. Children with CP use extensor muscles excessively in order to maintain their sitting posture, mobilize muscles abnormally, and use antagonistic muscles excessively. (Brogren, Hadders, & Forseberrg, 1998; Liao, Yang, Hsu, Chan, & Wei, 2003) . The proper posture during horseback riding is to maintain 90 hip joint and 90 knee joint, and such posture induces a decrease in the muscle tone and spasticity of the riders. The posture of the child during horseback riding naturally alleviates tension and enables functional movement. While doing therapeutic riding, children with CP recover an appropriate posture, and maintaining an appropriate posture plays an important role in reducing spasticity. (Meregillano, 2004). Horse riding requires contraction and relaxation of all muscles inside the thigh. In the case of riding on horses without stirrups, gravity helps to relax calf muscles. In the case of stirrups, gravity helps to relax heel tendons. Such a balancing exercise of muscles reduces one leg movement, and the balanced use of two legs prevents the riding posture from leaning in one direction. Achieving correct posture and remembering correct bodily movement is considered to be an effect of horseback riding. Even when a horse turns in one direction, the rider's body automatically compensates by leaning in the opposite direction. So the child automatically learns to accommodate to the horse's particular gait pattern. (Jung, Jung, & Cho, 2011).

While horse riding, as each forelimb and hind limb of the horse hit the ground, there is a shifting of the riders' trunk in between impacts. The constant motion of the trunk would seemingly affect the riders vestibular, proprioceptive, and neuromuscular systems stimulating equilibrium responses, and allowing enhancement of preparatory and anticipatory trunk muscle activity for proximal stability

Criteria for animals to be used in AAT

Animals should have the right temperament, be friendly, affectionate, and sociable with all ages and ethnicities, as well as any gender. (Chandler, 2005).If dogs, they should be able to tolerate high levels of noise and activity, be relatively calm, obedient, easy to control, and should be comfortable travelling in a car and visiting unfamiliar places, and also tolerant under stress. Humans' basic psychological needs of being loved, respected, cared for, useful, needed, accepted and trusted, can be fulfilled by animals. They play the roles of companion, friend, servant, dependent, admirer, confidante, scape goat, mirror, trustee and defender (Urichuk & Anderson, 2003).

Potential Barriers of Animal Assisted Therapy

1. Lack of time
2. Financial constraints
3. Transportation issues
4. Need of properly trained animals
5. Lack of Familiarity with AAT and its wide scope of practice
6. Cultural differences
7. Sanitation concerns

Animals can be carriers of zoonosis, diseases and infections and transmit them to humans. Research conducted concluded that the rate of infections from animals to humans is minimal, if adequate safety measures are taken, e.g.using barrier methods, hand washing, meticulous grooming and health care of canines, therapy dogs trained not to lick or scratch to avoid infecting, and proper vaccinations, will prevent various zoonotic diseases.

8. Allergic issues

Positions used in Equine Assisted Therapy

In Hippo Therapy the horse is used as a treatment modality, similar to the therapeutic balls and bolsters typically used in paediatric physical therapy clinics. The therapist places the child in various positions on the horse -supine, prone, prone backwards, sitting backwards, or sitting sideways, to facilitate desired postural reactions and motor responses.

The prone position is being prone over the horse's barrel, prone propped on both elbows with weight bearing equally on shoulder joints and across the shoulder girdle.The prone propped position is a functional skill and there are very few published studies measuring its effect on improving gross motor function in children with hypotonic CP. Prone and sitting positions on a horse's back, can activate axial extension of the back and facilitate head control to improve gross motor function in children with spastic CP.Yet the effects of the two positions utilized in hypotonic CP are still unclear due to limited evidence of its effectiveness. Hsieh, Zhan, Wu, Yang, Lee, & Luo (2008) studies conducted to compare the effects of different positions used in Hippo therapy are limited. Hsieh et al (2008) in his study reported that the prone propped position showed marked improvement, more than the sitting backward position.

Frequency and duration of Hippo Therapy sessions

The number of Hippo Therapy sessions varied widely from session to session, throughout a year. But in the majority of the studies retrieved, sessions ranged from 8 weeks to 12 weeks, of 15 minutes to one hour duration, once or twice a week. A systematic review and meta-analysis of RCT and observational studies on Therapeutic Horse Back riding and Hippo Therapy by Tseng, Cheng, & Tam (2013), points out the lack of difference in the effect of long term Hippo Therapy with a total riding time of 8 to 22 hours, compared to short term Hippo Therapy with a total riding time of 8-10 minutes. McGee & Reese (2009) reported that there are no significant differences immediately after one session of therapy on spatio temporal parameters of gait. There is a dearth of scientific literature to be able to conclude the desirable frequency and duration of a session.

Effectiveness of Equine Assisted Therapy on various parameters

Health professionals are not really convinced about the usefulness of this kind of therapy and the evidenced based practice in this area is extremely minimal. Hence we felt it would be beneficial to discuss various research conducted on Animal Assisted Therapy in children with cerebral palsy (CP) and the issues and challenges associated with it.

Hippo Therapy on modulation of back geometry

El-Meniawy & Thabet,(2012) reported that Hippo Therapy employs locomotion impulses that are eliminated from the back of a horse while the horse is walking.These impulses stimulate the rider's postural reflex mechanism. It affects multiple systems, such as sensory, musculoskeletal, limbic, vestibular, and ocular systems simultaneously,leading to different therapeutic

effects. He has investigated the effect of Hippo therapy training on modulation of back geometry in children with spastic diplegic cerebral palsy. These children suffer from abnormal back geometry, poor postural reflexes, and poor alignment of the trunk, so the quality of sitting and standing postures are affected and reflected in their lives and Activities of Daily Living. Hippo Therapy showed a significant reduction in measured variables, lateral deviation, trunk imbalance, pelvic tilt, and surface rotation of vertebra.

Effect of AAT on Gross Motor Function

Streba, Rogers, France, & Vokes (2002) reported that recreational horseback riding improves the gross motor function in children with spastic diplegia, spastic quadriplegia, and spastic hemiplegia types of CP. One hour of therapy per week for 18 weeks showed improvements in gross motor functions of walking, running and jumping which increased 8.7% after 12 weeks, and 8.55% after 13 weeks. This improvement in gross motor function is also supported by study results of McGibbon (2009).

This result is replicated in the study conducted by Park, Rha, Shin, Kim, & Jung (2014),where they have used 45 minutes of Hippo Therapy, twice a week for 8 weeks for children with spastic cerebral palsy.The results of the study demonstrated the beneficial effect of Hippo Therapy on gross motor function and functional performance in children with CP. Hsieh et al (2008) investigated the therapeutic effects of Hippo Therapy using specific positions and its longitudinal improvement in a child with hypotonic quadriplegic CP. She received 15 minutes intervention twice a week for one year where two treatment positions are used, sitting backward for the first 3 months and then prone propped positons for the next 9 months. The improvement was limited after initial 3 month Hippo Therapy with sitting backward, and marked improvement was noted after replacing the sitting backward programme with the prone propped position. The study concluded that HippoTherapy enhances gross motor performance and functional ability in hypotonic CP with appropriate treatment positions. Davis, Davies, Wolfe, Raadsveld, Heine, & Thomason (2009) reported contradictory results where he documented that there is no significant difference in gross motor function after the therapy.

Effect of HippoTherapy on postural control, balance and ADL

A meta-analysis by Zadnikar & Kastrin (2011) on the effects of Hippo Therapy and Therapeutic Horseback Riding on postural control and balance of children with cerebral palsy reviewed and analysed eight different studies. Result showed statistically significant improvement in postural control and balance. But the generalization is restricted due to small sample size. The studies also had some limitations.Children differed in type and severity of CP, such as mild or moderate diplegia, tetraplegia and hemiplegia, while the comparison group was composed of children with CP and non-disabled, activities were different in different studies, and used different methods, instruments and duration.

Bertoti (1988) studied the effect of Hippo Therapy on postural changes in eleven, two to nine year old children with spastic diplegia and quadriplegia. One hour, twice a week for 10 weeks intervention was given, and the findings showed significant improvement in posture. Silkwood Sherer, Killian, Long, & Martin (2012) documented consistent findings where Hippo Therapy showed improvement in balance and increased performance of Activities of Daily Living.

Horseback riding effects on muscle tone and range of motion

Baik, Byeun, and Baek (2014) reported

that participation in Therapeutic Horseback riding improves knee muscle tone of children with spastic cerebral palsy. Participation also improved hip joint motion range for the knees of children with CP. Lee, Kim, & Lee (2011) applied 8 weeks of therapeutic horse back riding for children with spastic diplegia and concluded that spasticity of elbow joint bending and knee joint bending decreased significantly.

Kulkarni, McGuigan, Narula, & Sepalak (2001) also reported consistent findings. Horseback riding significantly improved the right side hip joint and the articular range of motion of the knee and ankle, and the pelvic movement during walking was close to normal. Shurtleff et al (2009) reported similar findings that horseback riding increased the articular range of motion in children with spastic cerebral palsy.

Hippo Therapy effects on gait parameters

Kwon, Chan, Lee, Ha, Lee, & Kim (2011) evaluated the effects of Hippo Therapy on tempero spatial parameters, and pelvis and hip kinematics of gait in children with bilateral spastic cerebral palsy. Hippo Therapy was given for 30 minutes, twice weekly for 8 consecutive weeks. The study documented that Hippo Therapy significantly improved walking speed, stride length, and pelvic kinematics, (average pelvic anterior tilt at initial contact, pelvic anterior tilt at terminal stance). McGee & Reese (2009) reported a contradictory study where they studied the immediate effect of Hippo Therapy on spatio temporal parameters of gait, in spastic quadriplegia and hemiplegia, and documented that there is no significant difference immediately after one session of therapy, on spatio temporal parameters of gait.

Hippo Therapy effects on muscle symmetry, trunk/head stability and functional reach

Benda, McGibbon, & Grant (2003); McGibbon, Benda, Duncan, & SilkwoodSherer (2009) reported improvement in muscle symmetry with Hippo-Therapy. Shurtleff, Standeven, & Engsberg (2009) reported results of a study which investigated the effect of HippoTherapy on trunk/head stability, and upper extremity reaching/targeting in children with spastic diplegic cerebral palsy, after 12 weeks of intervention. Results revealed significant improvement in trunk/head stability and upper extremity reaching/targeting. These skills formed a foundation for many functional skills that also enhanced occupational performance and participation

HippoTherapy simulators in children with CP

Hippo Therapy simulators are available for purchase,imitate the movement of a horse,and increase a patient's accessibility.However there isa scarcity of research evidence in this area. Only three papers have been identified, after a comprehensive research review (Herrero, Asensio, Garcia , Marco, Olivan, & Ibarz, 2010).

Herrero, Trullen, Asensio, Garcia, Casas, Monserrt, & Anand (2012) investigated the therapeutic effects of a Hippo Therapy simulator in children with cerebral palsy. Sitting balance improved significantly after the intervention, while the effect was seen more in the severely disabled. However, the improvements were not maintained over the follow up period, but this did not lead to a change in the overall function of these children

Quint & Toomey (1998) reported that treatment on a Hippo Therapy simulator can lead to improvement in static posture; however, they also noted similar improvements when patients used a static saddle. Kuczynski & Slonka (1999) demonstrated that there is an increase in the sagittal plane stability following 3 months of treatment using a Hippo Therapy simulator. There is a lack of research to prove the clinical effects of Hippo Therapy simulators and rigorous studies with large samples are needed to prove its benefits.

AAT effects on psychological variables

Lubbe & Scholtz (2013) have done a case study using a therapy dog with a child, and findings suggested that AAT facilitated relationship building, enabled communication, provided an experience of physical affection, improved socialization skills, and enhanced self-esteem. Research evidence shows that the presence of an animal tends to reduce stress (Jalango, Astorino, & Bomboy, 2004). Physiological measures such as reduction in heart rate, lowering of BP and other signs of anxiety, show that it moderates stress (Katcher, Friedmann, Beck, & Lynch, 1983). In one study of peer interaction, a child without disabilities was 10 times more likely to interact with a peer who had disabilities, if the child wasaccompanied by a dog (Katcher, 1983). It plays a social lubricant function as described by Boris Levinson (1971), a child psychotherapist and the father of pet therapy. Studies have observed that horseback riding: motivates the children as it is interesting to them, is expected to provide a synergistic effect to functional improvement of the children, reduces resistance to treatment, and encourages enthusiastic participation.

Conclusion

Original research conducted among children with cerebral palsy indicated improvement in motor areas such as Gross Motor Functioning, re-establishing muscle symmetry, improving trunk stability, postural control, balance, gait, range of motion, functional skills, ADL, strength, co-ordination, and muscle tone. It also revealed significant improvements in psychological variables such as cognition, attention, concentration, memory, self-esteem, emotional well-being and social interaction, but we observed a scarcity of literature in the paediatric population and most of the articles are anecdotal in nature. Nevertheless, in the United States and Northern Europe, this kind of therapy has begun to be implemented in a regulated and systematic way to deliver concrete results. However, Animal Assisted Therapy demands empirical scientific evidence from studies conducted more systematically in its methods, duration and other criteria.

References

Anderson, D. C. (2004). The human companion animal bond. *The reference Librarian, 41,* 7-23.

Benda, W., McGibbon, N., &Grant, K. (2003). Improvements in muscle symmetry in children with cerebral palsy after equine assisted therapy. *J Alterncomplement med, 996,* 817-825.

Baik, K., Byeun, J. K., & Baek, J. K. (2014). The effects of horseback riding participation on the muscle tone and range of motion for children with spastic cerebral palsy, *Journal of exercise rehabilitation, 10*(5), 265-270.

Bertoti, D. B. (1988). Effect of therapeutic horseback riding on posture in children with cerebral palsy. *Phys Ther, 68,*1505-1512.

Brett, M. E. (1997). *Paediatric Neurology,* Churchill livingstone, 3rdedn, 290.

Brogren, E., Hadders, M., & Forseberrg, H. (1998). Postural control in sitting children with cerebral palsy. *NeurosciBiobeha Rev, 22,* 591-596.

Brodie, S. J., & Biley, F. C. (1999). An exploration of the potential benefits of pet facilitated therapy. *Journal of clinical nursing, 8,* 329-337.

Chandler, C. K. (2005). Animal Assisted therapy in counselling. New York,NY: Routledge/Falmer.

Davis, E., Davies, B., Wolfe, R., Raadsveld, R., Heine, B., Thomason, P., et al. (2009). A randomized controlled trial of the impact of therapeutic horse riding on the quality of life, health and function of children with cerebral palsy. *Developmental Medicine and Child Neurology, 51,* 111-119.

Debuse, D., Chandler, C., & Gibb, C. (2005). An exploration of German and British physiotherapists views on the effects of hippo therapy and their measurement, *Physiother Theory pract, 21,* 219-242.

Delta Society. (2009).What is animal assisted activities/Therapy? Retrieved from www. Delta society.org/Animal assisted activities therapy.

Elmaci, T. D., & Cevizci, S. (2015). Dog Assisted Therapies and Activities in Rehabilitation of children with Cerebral Palsy and physical and mental disabilities. *Int.J. Enviorn. Res. Public Health, 12*(5), 5046-5060. doi:10.3390/ijerph120505046

Forbes, E. H., & Marxen, K. (2015). Animal Asssisted Therapy: A Dog's influence on occupational therapyoutcomes of a child with cerebral palsy. Available online at http://soundideas.pugetsound.edu/ms_occ_therrapy/97/

Herrero, P., Asensio, Á., García, E., Marco, Á., Oliván, B., Ibarz, A., et al (2010). Study of the therapeutic effects of an advanced hippotherapy simulator in children with cerebral palsy: a randomised controlled trial. BMC *Musculoskeletal Disorders, 11*(1). doi:10.1186/1471-2474-11-71

Herrero, P., Trullen, E. M., Asensio, A., Garcia, E., Casas, R.., Monserrt, E., & Anand, P. (2012). Study of the therapeutic effects of a hippotherapy simulator in children with cerebral palsy: a stratified single blind randomized controlled trial. *Clinicalrehabilitation, 26*(12), 1105-1113.doi:10.1177?0269215512444633.

Hsieh, L. Y., Zhan, Y. S., Wu, K. S., Yang, C. C., Lee, C. Y., & Luo, J. H. (2008) Hippo therapy on gross motor function in a child hypotonic quadriplegic cerebral palsy: A one year follow up. *TwJ Phys Med Rehabil, 36*(3), 177-185.

Jalongo, M., Astorino, T., & Bomboy, N. (2004). Canine visitors: The influence of therapy dogs on young children's learning and well-being in classrooms and hospitals. *Early Childhood Education Journal,* 9-17.

Jung, S., Jung, T., & Cho H. (2011).The effects of horseback riding on equilibrium and spinal posture of children with cerebral palsy. *J Adapted Phys ed and exercise, 19,* 79-90.

Katcher, A. H., Friedmann, E., Beck, A. M., & Lynch, J. J. (1983). Looking, talking and blood pressure: The physiological consequences of interaction with the living environment. In: A. H. Katcher, & A. M. Beck (Eds.), *New Perspectives on Our Lives with Companion Animals, Philadelphia,* PA: University of Pennsylvania Press, 351-359.

Kwon, J., Chang, H. J., Lee, J. Y., Ha, Y., Lee, P. K., & Kim, Y. (2011). Effects of Hippotherapy on Gait Parameters in Children With Bilateral Spastic Cerebral Palsy. *Archives of Physical Medicine and Rehabilitation, 92*(5), 774-779. doi:10.1016/j.apmr.2010.11.031

Kulkarni, L. S., McGuigan, A., Narula, N., & Sepalak, K. (2001). Kinematic gait analysis of an individual with cerebral palsy before and after hippotherapy. *Phys ther, 81,* 40.

Kuczyński, M., & Słonka, K. (1999). Influence of artificial saddle riding on postural stability in children with cerebral palsy. *Gait & Posture, 10*(2), 154-160. doi:10.1016/s0966-6362(99)00028-4

Lee, J., Kim, J., & Lee, S. (2011). The effects of hippo therapy on spasticity and muscular activity of children with cerebral palsy. *J Korean Sococuup Ther, 19,* 117-124.

Levinson, B. (1971). Household pets in training schools serving delinquent children. *Psychological Reports, 28,* 475-48.

Liano, S. F., Yang, T. F., Hsu, T. C., Chan, R. C., & Wei, T. S. (2003). Differences in seated postural control in children with spastic cerebral palsy and children who are typically developing, *Am J Phys med Rehabilil, 82*, 622-626.

Lubbe, C., & Scholtz , S. (2013). The application of animal assisted therapy in the south African context: a case study. *South African journal of psychology, 43*(1), 116-129. doi :10.1177/0081246312474405.

Mcgee, M. C., & Reese, N. B. (2009). Immediate effects of hippo therapy session on gait parameters in children with spastic cerebral palsy. *Pediatr Phys Ther, 21,* 212-218.

McGibbon, N. H., Benda, W., Duncan, B. R., & Silkwood-Sherer, D. (2009). Immediate and Long-Term Effects of Hippotherapy on Symmetry of Adductor Muscle Activity and Functional Ability in Children With Spastic Cerebral Palsy. *Archives of Physical Medicine and Rehabilitation, 90*(6), 966-974. doi:10.1016/j.apmr.2009.01.011

El-Meniawy, G. H., & Thabet, N. S. (2012). Modulation of back geometry in children with spastic diplegic cerebral palsy via hippotherapy training. E*gyptian Journal of Medical Human Genetics, 13*(1), 63-71. doi:10.1016/j.ejmhg.2011.10.004

Meregillano, G. (2004). Hippotherpy. *Phys Med Rehabil Clin Am, 15,* 15(4):843-54, vii.

Nathanson, D. E., DeCastro, D., & Friend, H., (1997). Effectiveness of Short – Term Dolphin Assisted Therapy for Children with Severe Disabilities. *Antrozoos, 10 (2/3),* 90–100.

Nimer, J., & Lundahl, B. (2007). Animal-Assisted Therapy: A Meta-Analysis. *Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals, 20*(3), 225-238. doi:10.2752/089279307x224773

Park, E. S., Rha, D.W., Shin, J. S., Kim, S., & Jung, S. (2014). Effects of hippotherapy on gross motor function and functional performance of children with cerebral palsy. *Yonsei Med J, 55*(6), 1736-1742.

Quint, C., & Toomey, M. (1998). Powered saddle and pelvic mobility: an investigation into the effects on pelvic mobility of children with cerebral palsy of a powered saddle which imitates the movements of a walking horse, *Physiotherapy, 84,* 376-384.

Shurtleff, L. T., Standeven, W. J., & Engsberg, R. J. (2009). Changes in dynamic trunk /head stability and functional reach after hippotherapy. *Arch Phys med Rehabil, 90,* 1185-1195.

Silkwood Sherer, D. J., Killian, C. B., Long, T. M., Martin, K. S. (2012). Hippotherapy an intervention to habilitate balance deficits in children with movement disorders: a clinical trial, *Phys Therapy, 92,* 707-717.

Sterba, J. A., Rogers, B. T., France, A. P., & Vokes, D. A. (2002). Horseback riding in children with cerebral palsy: Effect on gross motor function. *Developmental Medicine and child neurology, 44,* 301-308.

Tseng, S. H., Cheng, H. C., Tam, K. W. (2013). Systematic review and meta-analysis of the effect of equine assisted activities and therapies on gross motor outcome in children with cerebral palsy. *Disabil Rehabil, 35,* 89-99.

Wang, G., Ma, R., Qiao, G.,Wada, K., Aizawa, Y., & Satoh ,T.(2014). The effect of riding as an alternative treatment for children with Cerebral Palsy: a systematic review and meta-analysis. *Integr medInt, 1,* 211-22. doi 10.1159/000368408.

Urichuk, L. J., & Anderson, D. (2003). Improving mental health through animal assisted therapy. Edmonton, Alberta, Canada: The chimo project.

Zadnikar, M., & Kastrin, A. (2011). Effects of hippotherapy and therapeutic horseback riding on postural control or balance in children with cerebral palsy: a meta-analysis. *Developmental Medicine & Child Neurology, 53*(8), 684-691. doi:10.1111/j.1469-8749.2011.03951.x