REZUMATUL TEZEI DE DOCTORAT

Animal therapy in children with autism

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INTRODUCERE

The literature is replete with reports of successes with Animal Assisted Therapy (AAT), and the number of professionals, programs, and organizations that have embraced TAA continues to grow. The overall intention of this project was to observe/analyze whether, based on the available research, the concept and strategies of AAT represent an effective method of treatment for children with autism.

This project is based on interdisciplinary research and specific research, which considers how therapy animals could be used as part of the process of improving people with autism, especially in the educational environment, and to help generate a level of social functioning through which people with autism participate more in life.

Current empirical and research studies, which follow this line of study, provide preliminary statistical evidence in two general categories:

a) research suggestive of therapy animals (MARTIN and FARNUM, 2002) and

b) encouraging improved (pragmatic) communication skills, from research suggesting that therapy dogs can generally have a unique role. as a transitory object, similar to that of the safety blanket worn by a child (FINE, 2006; WINNICOTT, 1986). The goal of the therapy dog is to provide a way to improve emotional regulation and release from a tense state (gaining emotional comfort/safety). In this case, the child projects his familiar attributes of predictability and safety onto the animal and thus has the potential to help the child as a supportive agent to enter new situations or environments successfully, despite social obstacles (WINNICOTT, 1986).

The most common deficiencies faced by the autistic community occur within communication and social development (HEWARD, 2006). The integration of the person into the community and the formation of bonds and social relationships are usually very difficult for people with autism and often leave the individual feeling of isolation (FINE, 2006). Reliable interventions and therapies to facilitate improvement for this population in emotion regulation and community integration are in demand, and the structured use of a therapy animal can be beneficial, as a tool that encourages the management of one's own emotions, as well as the development of prosocial behavior.

Prioritizing data-driven efforts, effectively and ethically expanding the current in the literature, as well as establishing a scientific basis for the informed clinical response to the use of therapy animals in the autistic community, is an important and timely task in time (PAVLIDES, 2008).

Most children with autism spectrum disorders (ASD) have difficulty processing everyday sensory information, which is also diagnostic criteria for autism (DSM-5, 2013). These disorders are of the "restriction, repetition" type, and represent behavioral patterns. Those who suffer from autism show attitudes of hypo or hypersensitivity in activities such as body movements, visual, auditory, gustatory, olfactory and tactile. It

manifests itself by seeking/inducing or escaping any sensory stimulation in a certain environment (ASHBURNER et al., 2008). Sensory processing involves the adaptation of the senses, which allows individuals to respond sensorily to stimulation in an intentional way. Adaptive response is one of the requirements/skills necessary in the learning process and social interaction of daily life, for children with ASD (TOMCHEK et al., 2015).

STRUCTURE OF THE DOCTORAL THESIS

The doctoral thesis "Animal-assisted therapy in children with autism" totals 150 pages and contains 13 chapters, 28 tables, 31 figures and 144 bibliographic resources, being structured in two parts:

- Current state of knowledge – 32 pages
- Personal contribution – 98 pages

The first part (The Current State of Knowledge) presents general aspects regarding:

1. Human-animal relationships: from everyday life to animal-assisted therapies

2. Introduction to Animal-Assisted Therapy/Animal-Assisted Activities (TAA/AAA)

3. Impact of Animal-Assisted Therapy on Animal Physiological and Behavioral Responses

The second part of the thesis (Personal contribution) is structured in 6 chapters that present the objectives, research methods, results and discussions, conclusions and recommendations, originality and innovative contributions of the research.

4. Objectives

1. The main objective of this study was to evaluate the behavior and stress tolerance in Dogs, Horses, Cats and Rabbits involved as co-therapists in animal-assisted therapies in children with autism spectrum disorder (ASD). The study used an observational research design, exploring the frequency of behaviors and hematological changes induced by these activities.

2. The second objective of this study was to evaluate the impact of an existing TAA program on social communication skills, executive functions and motor skills in children diagnosed with autism spectrum disorder (ASD). Unlike previous studies that primarily explored changes over time, this study was designed to assess what level of interaction children with autism spectrum disorders have with equines, dogs, and rabbits, if any, and was associated with observed differences in behavior and abilities during that interaction. The

study used an observational research design, exploring the frequency of behaviors when animals are present or absent from an early intervention group program.

5. Study 1.1. Evaluation of stress in riding horses during horse-assisted therapy activities in children with autism spectrum disorders

5.1.1.1. Introduction

The aim of this study was to evaluate the stressful effect of equine-assisted therapy activities on horses in children with autism spectrum disorders.

5.1.1.2. Materials and methods

In our experiment we used 10 horse handlers (8 females and 2 males), of the English thoroughbred breed. The 10 horses, divided into 2 groups, were aged between 4-8 years. The animals had the same maintenance and living conditions. Blood samples were taken from the jugular vein, in 5 ml heparinized tubes. The above-mentioned parameters were determined using a ProCyte Dx Hematology Analyzer. The data obtained were statistically analyzed, calculating the Mean and Standard Deviation (SD), using the Microsoft Excel application.

5.1.1.3. Results and discussions

In the case of batch 1, the level of red blood cells was 1.9% higher at the second collection. In the case of batch 2, the level of red blood cells was higher by 0.1% at the second collection. In the case of batch 2, the level of leukocytes in the blood was 2.4% higher at the second collection. The share of neutrophils in the leukocyte formula, in the case of batch 2, was higher by 0.35% at the second collection. The share of lymphocytes in the leukocyte formula, in the case of batch 1, was lower by 9.09% at the second collection. The share of lymphocytes in the leukocyte formula, in the case of batch 2, was lower by 4.12% at the second collection.

The results highlight the fact that the activities specific to equine-assisted therapy do not have a stressful effect on the horses used. These activities were obviously less stressful than the usual recreational riding activities in a manor, which is induced by the activities specific to equine-assisted therapy, activities that subject the animal to a less intense physical effort than those following the daily activity in the manor.

5.1.1.4. Conclusions

The results encourage the further application of these therapeutic methods, which do not have a negative effect on the welfare of the animals used.

Research confirms that assessing the number of leukocytes, neutrophils and leukocytes in the leukocyte formula is an effective way to assess stress in horses, being easy to apply and providing relevant results.

6. Study 1.2. Assessment of the stress level of therapy dogs during animal-assisted activity in children with autism spectrum disorders

6.1.2.1. Introduction

The purpose of the present study was to investigate whether the inclusion of dogs in a therapy program in the daily activities of children with autism spectrum disorder (ASD) has a positive or negative impact on the health and well-being of dogs.

6.1.2.2. Materials and methods

We initiated this approach by evaluating the hematological changes induced by these activities in the dogs' bodies. In our experiment we used 10 dogs (7 females and 3 males) of different breeds that ranged in age from 3-7 years. The dogs used in the experiment formed a uniform sample in terms of maintenance status. Hematological parameters were determined using a ProCyte Dx Hematology Analyzer. The data obtained were statistically analyzed, calculating the Mean and Standard Deviation (SD), using the Microsoft Excel application. At the same time, the statistical significance of the differences between the batches was calculated using the t-test (Student), using the Microsoft Excel application.

6.1.2.3. Results and discussions

We found that the specific activities of canid-assisted therapy, in the case of children with autism spectrum disorders, determined a significant increase in hematocrit, hemoglobin and the number of red blood cells in the blood of dogs used in therapy, indicating a polycythemic toning effect, following eustress. On the other hand, the share of lymphocytes in the blood of the dogs used in therapy decreased, resulting in a confirmation of the eustress condition induced by the activity in which the therapy dogs were engaged. The eustress generated by canid-assisted therapy activities had a positive effect on the general condition, specific behaviors and hematological profile, in the dogs used in the experiment.

6.1.2.4. Conclusions

Our results emphasize that activities specific to canine assisted therapy have

an eusstress effect on participating dogs. It was clear that these stress-inducing activities have a toning effect that improves behavioral and hematological parameters in the animals involved in the experiment.

7. Study 1.3. Assessing the stress levels of cats used in animal-assisted therapies in children with autism spectrum disorders

7.1.3.1. Introduction

Despite the fact that animal welfare has recently come to the fore, most studies that indicate the stress that animals experience when used for TAA relate to dogs**.**Our research aimed to assess the stressful effect that cat-assisted therapy activities have on cats in children with autism spectrum disorders.

7.1.3.2. Materials and methods

In our experiment we used 15 clinically healthy cats (10 females and 5 neutered males) of the European breed. The 15 cats were aged between 5-7 years.

The cats used in the experiment were divided into two experimental batches:

-Lot 1 (control), consisting of 5 cats (4 females and one male);

-Batch 2 (experimental), consisting of 5 cats (2 females and 3 males);

-Batch 3 (experimental), consisting of 5 cats (4 females and one male).

The cats in batches 1 and 2 were part of a group of animals, specially prepared for use in the treatment of children with autism spectrum disorders, as an annex therapeutic option, through animal-assisted therapy.

The cats used in the experiment formed a uniform group, both in terms of maintenance and health.

Blood samples were taken from the external saphenous vein. Heparinized tubes of 5 ml were used. The blood samples were used for the purpose of evaluating hematological parameters, such as: hemoglobin, hematocrit, number of red blood cells, number of leukocytes, as well as the weight of neutrophils and lymphocytes within the leukocyte formula.

The aforementioned ratings were determined using a ProCyte Dx Hematology Analyzer. The data obtained were statistically analyzed, calculating the Mean and Standard Deviation (SD), using the Microsoft Excel application. At the same time, the statistical significance of the differences between the batches was calculated using the t-test (Student), using the Microsoft Excel application

7.1.3.3. Results and discussions

From the analysis of the ethograms drawn up during our experiment we noticed the following: an 8.33% decrease in food consumption, a fourfold increase in the manifestations of alertness, a twofold increase in vocal manifestations, a 5% decrease in the duration of Self-grooming behavior, a threefold increase in the frequency of urination, a 5% decrease in the duration of playful behavior and a threefold increase in the frequency of aggressive behaviors in the the case of cats in lot 3, compared to those in lot 1;

There were no significant differences between the animals in batches 1 and 2 in terms of the behavioural parameters investigated.

As regards the haematological examination, in the case of the animals in batch 3, the level of red blood cells was higher by 3 %, the level of haemoglobin was higher by 5.05 %, the level of haematocrit was higher by 9.02 %, the level of leukocytes in the blood was higher by 37.14 %, the level of neutrophils was higher by 24.7 % and the lymphocyte level was lower by 8.89% at the second collection, compared to the first determination, the differences being statistically significant ($P<0.05$)

In the case of batch 2, no significant differences were found between the hematological determinations on the first day of the experiment and those on the last day, in the case of the leukocyte parameters evaluated ($P>0.05$)

7.1.3.4. Conclusions

These results indicate an obvious stressful effect, found in the case of cats from group 3, subjected to activities following feline-assisted therapy, applied to children with autism spectrum disorders, but without prior preparation and training. These results can be explained by increased blood levels of glucocorticoid hormones. These hormones induce the centralization of neutrophils, respectively inhibiting their adhesion to the vascular endothelium and delaying diapedesis. This results in an increase in the total number of leukocytes in the blood. Last but not least, the increase in the blood level of glucocorticoid hormones leads to tissue sequestration of lymphocytes and a decrease in their share in the leukocyte formula.

8. Study 1.4. Assessment of stress in rabbits in rabbit-assisted therapy for children with autism

8.1.4.1. Introduction

The main aim of the study was to objectively determine the possible degree of impact of stress on rabbits caused by therapy-specific activities in children with autism

spectrum disorders.

8.1.4.2. Materials and methods

In our experiment we used 16 rabbits of the Netherland Dwarf breed, with body weights of 1.5 ± 0.2 kg. The 16 rabbits were aged between 2-4 years old (10 females and 6 castrated males). The rabbits used in the experiment formed a uniform group, both in terms of maintenance and health. The rabbits were separated into 2 experimental batches: batch 1 (Experimental; n=8) and batch 2 (Control; n=8). During the experimental period, the rabbits were housed in cages (95 × 57 × 46 cm) adapted to the species

The blood samples were used for the purpose of evaluating the following hematological parameters: hemoglobin, hematocrit, number of red blood cells, number of leukocytes, as well as the weight of neutrophils and lymphocytes within the leukocyte formula. An IDEXX ProCyte Dx Hematology Analyzer was used to perform hematological determinations.

The data obtained were statistically analyzed, calculating the Mean and Standard Deviation (SD), using the Microsoft Excel application. At the same time, the statistical significance of the differences between the batches was calculated using the t-test (Student), using the Microsoft Excel application.

8.1.4.3. Results and discussions

As regards the hematological examinations, in the case of rabbits in the experimental batch, the level of the number of red blood cells in the blood was higher by 14.81% at the second collection, compared to the level recorded at the first collection, the hematocrit level was higher by 13.33% at the second collection, compared to that recorded at the first determination, the hemoglobin level was 10.20% higher at the second collection, compared to the one recorded in the first determination, the differences being statistically significant ($P<0.05$).

In the case of the experimental batch, the evolution of the three parameters is in direct reciprocal correlation, indicating a slight polycythemia, a direct consequence of the initial contact between the rabbits used in the experiment and the treated children. Thus, in the first part of the experiment, the initial contact generated a potentially stressful condition on the animals. The sympathocution specific to such a condition initiates an increase in the number of red blood cells, without, however, leading to an exceedance of the normal maximum values.

As the experiment progressed, as a result of the animals getting used to the children under treatment, there was a decrease in the level of stress developed by the animals used in the experiment.

As for the level of leukocyte count was 18.55% higher at the second collection, compared to the one recorded in the first collection, the neutrophil share was higher by 8.69% at the second collection, compared to the one recorded in the first determination

and the lymphocyte share was lower approx. by 21.87% at the second harvest, compared to the one recorded in the first determination, the differences being statistically significant ($P<0.05$)

Our results indicate the establishment of a potentially stressful condition in the first part of the experiment, as a result of the initial contact between the rabbits used in the experiment and the treated children.

This evolution was induced by the amplification of the blood level of glucocorticoid hormones. These hormones induce the centralization of neutrophils, respectively inhibiting their adhesion to the vascular endothelium and delaying diapedesis. The result is an increase in the total number of leukocytes in the blood fluid. Also, the increase in the blood level of glucocorticoid hormones leads to tissue sequestration of lymphocytes and a decrease in their share in the leukocyte formula.

As the experiment progressed, as a result of the animals getting used to the children under treatment, there was a decrease in the level of stress developed by the animals used in the experiment.

8.1.4.4. Conclusions

The results of our experiment indicated an increase in stress-related behaviors in rabbits used in therapy.

The activities specific to rabbit-assisted therapy, in the case of children with autism spectrum disorders, determined a transient polycythemia, which decreased until the end of the experiment, supporting a possible eustress to which the animals were subjected, only in the first part of the experiment.

9. Study 2.1. Evaluation of socio-emotional behaviors in children with autism in canid-assisted therapy

9.2.1.1. Introduction

The purpose of this study was to evaluate the impact of an existing TAA program on social communication skills, executive functions, and motor skills in children diagnosed with ASD.

9.2.1.2. Materials and methods

The study used an observational research design, exploring the frequency of behaviors when dogs are present or absent from an intervention group program. This study involved 16 children, diagnosed with ASD, aged between 7 and 13 years (12 boys and 4 girls) who were recruited from the School Center for Inclusive Education (C.S.E.I.) "LACRIMA" BISTRIȚA.

9.2.1.3. Results and discussions

The results obtained by us concluded that canid-assisted therapy, applied under the conditions of our experiment, led to a significant improvement in all behavioral parameters taken in the study. We observe the positive effect, especially on the parameters related to group game behavior with a weight of 38.7% higher than the control group, eye contact with a weight of (15.68%) higher than the control group and social attention with a weight of 28.57% higher than the control group. We also observe a positive effect on the parameters regarding emotional and physical functionality.

9.2.1.4. Conclusions

Canid-assisted therapy, applied under the conditions of our experiment, led to a significant improvement in all behavioral parameters taken in the study. We note the positive effect, especially on the parameters related to the game (solitary play, in pairs, with adults and in groups), eye contact and social attention. It is also worth noting a positive effect on the parameters of emotional and physical functionality.

10. Study 2.2. Assessment of social-emotional behaviors in children with autism in rabbit-assisted therapy

10.2.2.1. Introduction

The primary purpose of the study was to assess the impact of an existing TAI program on social communication skills, executive functions, and motor skills in children diagnosed with ASD.

10.2.2.2. Materials and methods

The study involved 16 children (10 boys and 4 girls), who were recruited from the School Center for Inclusive Education (C.S.E.I.) "LACRIMA" Bistrița. The ages of the children involved in the study ranged from 7 to 13 years. These children are diagnosed with: psychomotor delay; deficient general and specific motor skills; unfixed laterality; spatio-temporal disorientation; non-development of articulate verbal language; affective instability, autism spectrum disorders (ASD), based on specialized psychiatric and psychological examinations.

The 16 children were separated into two batches:

- Batch 1 (n=8), consisting of children undergoing Rabbit Assisted Therapy (TAI);

- Batch 2 (n=8) consisting of children who were not subjected to Rabbit Assisted Therapy (TAI).

Children from Batch 2 were subjected, for 10 weeks, with a duration of 2 hours with a break of 10 min. (10.00-12.00), with a frequency of 2 sessions per week, to regular treatment sessions (without the use of rabbits), in the presence of a psychotherapist.

The data obtained were statistically analyzed, calculating the Mean and Standard Deviation (SD), using the Microsoft Excel application. At the same time, the statistical significance of the differences between the batches was calculated using the t-test (Student), using the Microsoft Excel application.

10.2.2.3. Results and discussions

TAI in the current therapy of children with ASD left a significant imprint on the parameters highlighted in our study. Our observations on the effect of TAI on hyperactivity indicate a decrease of 31.5%, inappropriate speech a decrease of 21.42%, stereotypes of 66.6%, compliance of 57.80% and an improvement in active attention by 30.30%, hyperactivity (31.5%) and inappropriate speech (21.42%). And the biggest difference was found in the case of the Communication, where the difference was 93.75%.

10.2.2.4. Conclusions

The results of our experiment highlight the fact that the use of rabbits as auxiliaries in the therapy of autism spectrum disorders in children determined a transient polycythemia, which diminished by the end of the experiment, supporting a possible eustress to which the animals were subjected, only in the first part of the experiment. From our research, it follows that the association of TAI with the current therapy of children with ASD left a significant imprint on the parameters highlighted in our study.

11. Study 2.3. The impact of equine-assisted therapy on social-emotional behaviors in children with autism

11.2.3.1. Introduction

The main purpose of the study was to investigate the effect of an existing EAT program on social communication skills ("all forms of social relationships in which individuals and groups voluntarily participate"), executive functions, and motor skills in children diagnosed with ASD. Unlike previous studies that have mainly explored

changes over time, this study was designed to explore what level of interaction with equines, if any, was associated with differences observed in behavior and other abilities during that interaction. To this end, the following hypotheses have been formulated:

1. What psychological and social benefits does horse-assisted therapy bring when used in children and young people with autism?

2. What impact does horse-assisted therapy have on an autistic child?

11.2.3.2. Materials and methods

The research adopted an observational design to analyze how often certain behaviors occur in the presence or absence of horses in a group intervention program. This research included 16 children diagnosed with autism spectrum disorder (ASD), aged between 9 and 14 years (12 boys and 4 girls), who were selected from a School Center for Inclusive Education.

The data obtained were statistically analyzed, calculating the Mean and Standard Deviation (SD), using the Microsoft Excel application. At the same time, the statistical significance of the differences between the batches was calculated using the t-test (Student), using the Microsoft Excel application.

11.2.3.3. Results and discussions

Results on the efficacy of TAE, as a complementary intervention for children with ASD, assessed by the MOPI method. Here significant differences ($P<0.05$) were observed between the two experimental groups. Improvements were observed in terms of attention in activity (21.2%), communication (18.3%) and compliance (9.1%) during activities. The largest difference was observed in physical movements, with a difference of 34.1%.

Regarding the affective state of the children involved in this experiment, we observed a notable distinction between the two groups ($P<0.05$). In batch 1, i.e. those children who benefited from Equine Assisted Therapy (EAT), no less than 58.33% positive reactions were recorded. This represents a considerable increase, 23.33% more than the percentage of positive reactions observed in batch 2, which includes children who did not receive the same therapy.

Results on the effectiveness of TAE, as a complementary intervention for children with ASD, assessed by ethograms, after each intervention session for each participant. Here, significant differences ($P<0.05$) were observed between the two experimental groups. Improvements were observed in affective state (23.33%), visual control (45%), functional skills and response to command (46.66%), social attention (33.5%) and dynamic motor skills (35.55%) during activities. And the biggest difference was observed in vocalizations, with a difference of 53%.

11.2.3.4. Conclusions

The conclusions of this study indicate that TAE can influence the improvement of social aspects in children with ASD. The conclusions showed that a beneficial decrease in inappropriate behavior and an increase in the capacity for empathy was observed, it also showed a significant improvement in general adaptive behaviors, specifically, there were significant improvements in communication and social interaction. Our results strongly support the fact that the auxiliary therapy of autism spectrum disorders with the help of horses is an effective form of intervention, which can bring substantial improvements in therapeutic outcomes.

12. General conclusions and recommendations

Based on the data obtained during this experimental research on the effectiveness of animal-assisted therapy in children with autism spectrum disorders, on the animals that can be used in this type of therapy and on the results obtained regarding the welfare of the animals used in the therapy, several conclusions can be drawn.

1. This experimental study investigated the effectiveness of animal-assisted therapy in reducing difficulties associated with autism spectrum disorder (ASD). The results show that TAE is linked to improved adaptive behavior and more effective coordination, while contributing to a progressive development of the child's abilities to react to the increased complexity of this type of positive behavioral support.

Due to the multisensory nature of different forms of animal-assisted therapy in general, it is difficult to identify which is the defining aspect in promoting positive change.

2. These results support the argument in favour of using an intervention involving animals, which has the potential to be an effective model for the development of social communication skills. It is known that one of the biggest difficulties of people with ASD is the lack of ability to initiate social interactions and respond appropriately. The attitude that is acceptable in a certain situation or towards a certain person may be completely inappropriate under other conditions. In contrast to humans, the reactions of animals are usually more uniform, and the use of a specific instruction for interacting with them tends to generate similar behavior. In the participation of the dogs in this study, the children only needed to learn certain methods to have an impact on the animals, without having to understand the context, its emotional state or other different situations.

3. The results obtained also validate previous conclusions on the effectiveness of animal interventions. In this study, teachers examined children's social communication skills, given that they are highly skilled observers of interactions between children and their peers, as well as with special education teams in the school.

Adjustment skills were also analysed using a commonly used questionnaire that assesses behaviour in a natural environment.

4. The appearance of animals seemed to have a relaxing effect, manifesting itself in the ability to remain quiet, through behaviors designed to reduce stress, a lower pulse rate and greater docility. It is vital to consider this method, through the application of TAA, in treatment plans for these children, especially when the conclusions of the study are confirmed in subsequent studies. However, it is important to note that, like the treatment protocol used in this study, we suggest that TAA be considered as an adjunct therapy within comprehensive intervention programs, which are commonly used in schools for children with autism spectrum disorders. Therefore, the favorable findings that have been uncovered by these evaluations add more validity to the idea that some social communication skills learned and experienced in the presence of animals may extend, to some extent, to more complicated human interactions.

5. The conclusions of this study show that animal-assisted therapy can have a positive impact on the development of social skills in children with autism spectrum disorder. The results highlighted that a beneficial decrease in inappropriate behavior and even an increase in the capacity for empathy was observed. It also showed a significant improvement in general adaptive behaviors, specifically, there were significant improvements in communication and social interaction. Our conclusions strongly support the idea that complementary treatment of autism spectrum disorders with the help of animals is an effective method of intervention, which can bring significant improvements in therapeutic outcomes.

6. In summary, animal-assisted therapy is a valuable therapeutic option for encouraging social interaction in children and adolescents with autism spectrum disorders, provided that it is planned and implemented correctly. TAE research and new findings highlight that using animal-assisted therapy to reduce symptoms of autism spectrum disorder in children does not improve all aspects, but some of them contribute significantly to their overall well-being and mental health. This study demonstrated that animal-assisted therapy is an effective support within the usual treatments, offered by various professionals in special educational institutions for children with autism spectrum disorders. This interactive and enjoyable activity contributed to the development of interaction and expression skills within the school.

7. Finally, the evaluation of this animal-assisted therapy compared to other programs that use simple approaches with predictable results, as well as through various forms of therapy, such as behavioral therapy, play, music, occupational therapy, speech therapy, art therapy, etc., can have complementary results in many cases, beneficial for children with ASD.

8. It is crucial to have information about the stress resilience of animals during animal-assisted therapy sessions, as well as the impact of repeated sessions. This knowledge is essential to understand the animal-assisted approach, prevent animal burnout and protect their mental and physical health.

9. The results showed that the activities specific to horse-assisted therapy, in the case of children with autism spectrum disorders, have a reduced stress effect on the animals used. This impact is below the level of the stressful impact seen during regular activities in a manger, which turn out to be much more tense. It can thus be emphasised that this type of treatment does not increase the level of stress to which the animals used are exposed.

10. At the same time, we observed that the specific activities of dog-assisted therapy, in the case of children with autism spectrum disorders, determined a significant increase in hematocrit, hemoglobin and the number of red blood cells in the blood of dogs used in therapy, indicating a polycythemic toning effect, following eustress. This type of development was not observed in dogs kept in isolation in cages and shelters.

12. The activities specific to rabbit-assisted therapy in children with autism spectrum disorders caused a temporary increase in the number of red blood cells, which was reduced by the end of the experiment, supporting the possibility of a state of stress that the animals were faced with only in the first part of the experiment. The initial and transient stress is also supported by changes in leukocyte parameters, which indicated a slight increase in the number of leukocytes, the presence of an increased number of neutrophils and a decrease in the number of lymphocytes, with effects only in the early stages of the experiment. The use of rabbits as assistants in the therapy of autism spectrum disorders in children had beneficial results on therapeutic efficacy.

13. We also found that the activities specific to feline-assisted therapy, in the case of children with autism spectrum disorders, led to a significant increase in hematocrit, hemoglobin and the number of red blood cells in the blood of cats used for the first time in therapy, indicating a polycythemic toning effect, following eustress. This type of evolution has not been found in cats that have been used in such therapies before. As the experiment was carried out, as a result of the animals getting used to the children under treatment, a decrease in the stress level developed by the animals used in the experiment resulted. The conclusions of our experiment show that the use of animals as assistants in the therapy of autism spectrum disorders in children led to a transient increase in the number of red blood cells, which decreased by the end of the experiment, suggesting a possible positive stress to which the animals were subjected only in the first part of the experiment.

14. We can highlight the fact that this type of therapy does not lead to an increase in the level of stress to which the animals used are subjected. These results encourage the continued application of these therapeutic methods, which have no negative impact on the well-being of the participating animals.

12.1 Recommendations

Future studies should examine how animal-assisted therapy can be improved to meet children's demands, in collaboration with the other therapeutic methods used by multidisciplinary teams. We emphasize that it is crucial to research the factors that predict positive outcomes to identify children who are more receptive to this type of intervention. Future research should also look at whether progress made through the animal training programme correlates with improvements in the assessment of outcomes.

It would be ideal for future research to use an appropriate control group participating in another form of alternative therapy, such as behavioral therapy, play therapy, music therapy, occupational therapy, speech therapy, and art therapy, to compare the effectiveness of TAA instead of using previous and subsequent measurements.

13. Originality and contributions innovative aspects of the thesis

The studies carried out within this doctoral thesis have certain elements of innovation and originality.

13.1. It is the first study in our country that addresses the therapy of autism spectrum disorders in children from a multidisciplinary perspective, with an emphasis on animal-assisted therapy, which promotes positive interaction between humans and animals.

13.2. Another element of originality is given by the design of the research that makes an evaluation of the benefits obtained by children diagnosed with autism spectrum disorders according to the animal used in therapy: dog, cat, horse, rabbit, and according to the personalized application of rehabilitation techniques.

13.3. Also as an innovative element of the thesis, we consider as the evaluation of the effects of animal-assisted therapy on the level of welfare of the animals used, considered working tools.

13.4. Another aspect of originality of the thesis is given by the enrichment of the theoretical framework regarding the explanation of the mechanisms underlying the therapeutic effects of animals on children diagnosed with autism spectrum disorders.

Considering all these aspects, we consider that this work differs from a high degree of originality, and our research is highly topical and scientifically relevant.

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