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#### **ORIGINAL ARTICLE**

# EFFECTS OF LAND BASED EXERCISE PROTOCOL IN THE MANAGEMENT OF HINDLIMB OA IN WHITE GAINT RABBIT

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#### ABSTRACT

**Back ground of the study:** Osteoarthritis (OA) is one of the most commonly occurring forms of arthritis in the world today. Hind limb weakness is caused by a disorder such as a break, strain, degenerative damage or other physical process, this can result in temporary or permanent inability to use the back legs. Physical therapy techniques to increase function and mobility of joints from, injury, surgery, degenerative diseases, age related diseases and obesity. **Methods:** This is an experimental study conducted at M. K. Vet. Clinic, Villupuram for a duration of 3 sessions per week for about 4 weeks (1 month) for a sample size of 15 subjects. Random sampling method used to allocate the samples in two groups. White Giant Rabbits with Age group between 3-4years and CANCRS (composite pain score of 2-4) were included for this study. age group between 4-6 years. White Giant Rabbit-breeds irrespective of gender with duly vaccinated. Rabbits' intervention included land-based exercises. Outcome measures of the study was cancrs. **Result:** On comparing the mean values of Group A & Group B on Multidimensional Composite Pain Scale score, it shows a significant decrease in the post test mean values in both groups, but Group A shows mean difference of 5.90 which has the more effective than Group B with mean difference of 3.90 at P  $\leq$  0.05. **Conclusion:** The study concluded that land-based exercise protocol is more effective on management of hind limb OA in White Giant Rabbits.

**Key Words** CANCRS (Composite pain scale for Assessing and quantifying Pain in Rabbit's); White Giant Rabbit; Hindlimb Osteoarthritis; Land-Based Exercises

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#### INTRODUCTION

White Giant Rabbit originated in the erstwhile Soviet Union. It is almost similar in appearance to New Zealand White. Color of the fur is white while that of the eyes and skin is red. The length of hind limbs as well as body size is larger than that of New Zealand White. It is native to erstwhile Soviet Union. It has white fur while red fur is present at the skin and eyes. It has long hind limbs. It has 3-4kg of an average weight <sup>1-3</sup>.

Rabbit can feed on all types of grains such as sorghum, bajra and other legumes and green fodder such as carrot and cabbage leaves, Lucerne etc. Fresh and clean water should be available all the time to the rabbits. The teeth of rabbit grow continuously therefore it requires both type of feeds i.e., concentrate and green fodder. 1kg rabbit requires 40gm of concentrated feed and 40gm of green fodder per day <sup>4</sup>.

Rabbits take their feed only at day time. The concentrate feed should be given in the form of pellets by making small balls of it <sup>5, 6</sup>.

The feed should be given according to the size and weight of the rabbit as given below:

• Adult male rabbit having weight of approximately 4-5kg should be given 100gm of concentrate feed and 250gm of green fodder per day.

• Adult female rabbit having weight of approximately 4-5kg should be given 100gm of concentrate feed and 300gm of green fodder per day.

**Veterinary rehabilitation:** Veterinary rehabilitation uses many of the same modalities and techniques for animals as physical therapy does for humans; the two are similar in almost all ways. The veterinary rehabilitation offers a good portion by working on building strength, flexibility, proprioception, range of motion and in pain management. The idea of applying rehabilitation techniques and principles to animals, although not new, has grown appreciably since the mid-1990s.

Although many of the treatment protocols for humans were developed and continue to be developed using animal models, a growing number of research studies are being conducted in universities and private practices that look specifically at the benefits of different methods of rehabilitation in animals, especially dogs. Higher owner expectations combined with increased sophistication and technical abilities of veterinary clinicians have resulted in greater interest in physical therapy and rehabilitation <sup>7-9</sup>.

Osteoarthritis: Osteoarthritis is one of the most prevalent chronic muscular disorders in Canada. It affects approximately 10% of the adult Canadian population. It causes pain and disability and is associated with a substantial economic burden and serious socioeconomic consequences. The etiology of OA is thought to be multi-factorial and pathological changes may take place in different tissues of joints. OA studies have mainly focused on the changes occurring following intra-articular derangement such as ligament transection (or) meniscectomy. Little is known on how changes in periarticular structures, such as skeletal muscles, may affect the fully intact joint <sup>10,11</sup>.

Muscles and joints are functionally interdependent, as muscles move the joints, contribute to joint stability, and provide shock absorption. Muscles are also the biggest contributors to the mechanical loading of joints which is thought to provide crucial mechanical stimuli for joint integrity and cartilage nutrition<sup>12</sup>.

Muscles are also implicated in providing proprioceptive information to joints. The motor and sensory functions of muscles are integrated to generate a neuromuscular protective mechanism that allows safe, smooth, functional movements

Muscle weakness was found to be a better predictor of joint disability and OA, than radiographic assessment. These findings suggest that impaired sensorimotor function plays a significant role in the development and progression of OA, However, the possible role of muscle weakness in the development and progression of joint degeneration leading to OA remains unclear. Herzog and Longino, developed a quadriceps weakness model in the New Zealand White (NZW) rabbit and found evidence of articular cartilage, reddening which was interpreted as an early sign of cartilage deterioration. However, no histological assessment of the joint surfaces or molecular biology approaches of the cartilage were performed to strengthen the "clinical" observation. Therefore, the purpose of this study was to investigate the histopathological changes in the rabbit knee following a period of systematic knee extensor weakness. We hypothesized that muscle weakness is associated with degenerative changes in the knee cartilage, thereby providing evidence that muscle weakness might be an independent risk factor for joint degeneration leading to OA. The rabbit experiences radiographic signs of naturally-occurring osteoarthritis. There was a significant influence of age on the development of the disease. Rabbits begin to have radiographic signs of the disease as early as 1 year of age with older rabbits experiencing

over 70% occurrence. The most commonly effected joints were the knee and the hip.

**Aim of the study:** The aim of the study is to find the effectiveness of land-based exercise protocol in the management of hind limb OA in white giant rabbit.

**Background And Need of Study:** The need of the study is to find the effect of land-based exercise protocol in the management of hind limb OA in white giant rabbit, by applying various land-based exercises and to create bridging the gap between physical therapy and veterinary medicine. Also, to access the efficacy of rehabilitation program on improving behavior and welfare of pet rabbits. In this study, a rehabilitation protocol including training to improve the mobility of bunnies.

#### METHODOLOGY

This is an experimental study conducted at M. K. Vet. Clinic, Villupuram for a duration of 3 sessions per week for about 4 weeks (1 month) for a sample size of 15 subjects. STUDY TYPE: Pre and Post type. Random sampling method used to allocate the samples in two groups. White Gaint Rabbits with Age group between 3-4years and CANCRS (composite pain score of 2-4) were included for this study. White Gaint Rabbit-breeds irrespective of gender with Duly vaccinated were included in this study. Below 3 years of age, White Gaint rabbit with skin pathology, neurological disorders, Open wounds, Behavioral complaints, Uncooperative rabbits, Pregnant white Gaint Rabbit were excluded from this study.

**Outcome measures:** White Gaint Rabbits with hind limb pain were the outcome of the study and it was measured using Composite Pain Score (CANCRS).

**CANCRS**: A multidimensional composite pain scale (CANCRS) was developed for rabbits based on pain scales developed for other species of mammals bearing in mind that dealing with rabbits allows the clinician to monitor parameters that are less stressful, the Scores were equally distributed in four pain classes<sup>14,22</sup>.

For **CANCRS**, pain scale range from (0 to 24), From 0 to 5 were classified as NP, From 6 to 11 were classified as D, From 12 to 17 were classified as MP and From 18 to 24 were classified as SP.

#### Intervention:

**Isometric Strengthening of Hind Limb:** Exercise training induces muscular adaptations that are highly specific to the type of exercise. For a systematic study of the differentiated exercise adaptations on a molecular level rabbit models have been used successfully. The aim of the current study was to develop a suitable rabbit model of isometric strength exercise training characterized by specific adaptations known from strength training. Strength training was performed for 5 times/week for 3 minutes and 3 series.

During the first week, the rabbits ran for 1–3 min at 6 m/min, and by the third week, the rabbits were reaching a speed of 20 m/min during 2 min of continuous running. When the rabbits were moved on to the experimental phase of the intervention protocol, the continuous exercise group ran at a speed of 15–20 m/min for 3 min, 5 min, or until fatigue. On the other hand, the intermittent exercise group reached speeds between 40 and 50 m/min for 30 s followed by an equal period of time for rest, or maximum speeds up to 70 m/min for 15 s with double the time of rest. A 2° inclination was used throughout the experiment

**Importance of Proprioceptive & Balance Exercises:** It is extremely important for our four-legged companions to be able to perform these activities with good balance and proprioceptive coordination. If they can do so, it indicates that they are generally able to orient themselves well to complete a range of activities; from daily activities such as walking and trotting, to more complex movements like jumping, landing and turning.

In a healthy individual, the conscious and subconscious minds are both engaged to maintain the stability of their center of gravity as well as the flight or fight reflexes. There is continuous input of sensory feedback (proprioceptive information). This allows the body to protect the muscles and joints through unconscious stabilization and proper positioning, which prevents overstretching or tearing of tendons and ligaments.

Data Analysis: The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24, with a significance level of p value less than 0.05 and a 95% confidence interval set for all analysis. The Shapiro Wilk test was used to determine the normality of the data. In this study, shapiro wilk test showed that the data was normally distributed on the dependent values of Multidimensional Composite Pain Scale (significance 0.211) at P > 0.05. Hence parametric test was adopted. Paired t-test was adopted to find the statistical difference within the groups & Independent t-test (Student t-Test) was adopted to find statistical difference between the groups.

	GROUP - A		GROUP - B				
TEST	MEAN	S.D	MEAN	S.D	t - TEST	df	Significance
PRE TEST	14.30	1.76	14.60	1.71	386	18	.704*
POST TEST	8.40	1.89	10.50	1.71	-2.59	18	.018**

#### (\*- P > 0.05), (\*\*- P ≤ 0.05)

**Table-1** Comparison of multidimensional composite pain scale score Between group A and group B in pre and post test

The above table reveals the Mean, Standard Deviation (S.D), t-test, degree of freedom (df) and p-value between (Group A) & (Group B) in pre test and post test weeks.

This table shows that there is no significant difference in pre test values between Group A & Group B (\*P > 0.05).



**Graph 1** Comparison of multidimensional composite pain scale score Between Group A and GroupB in pre and post test

	PRE TEST		POST TEST			
GROUP	MEAN	S.D	MEAN	S.D	t - TEST	SIGNIFICANCE
GROUP- A	14.30	1.76	8.40	1.89	59.00	.000***
GROUP- B	14.60	1.71	10.50	1.71	41.00	.000***

(\*\*\*- P ≤ 0.001)

**Table- 2** comparison of multidimensional composite pain scale score Within Group – A and Group - B between pre test and post test

This table shows that statistically highly significant difference in post test values between Group A & Group B (\*\*\*-  $P \le 0.05$ ).

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A &

Group – B. There is a statistically highly significant difference between the pre test and



**Graph 2** Comparison of multidimensional composite pain scale score Within Group A and Group B between pre test and post test

#### RESULTS

On comparing the mean values of Group A & Group B on Multidimensional Composite Pain Scale score, it shows a significant decrease in the post test mean values in both groups, but Group A shows mean difference of 5.90 which has the more effective than Group B with mean difference of 3.90 at P  $\leq$  0.05. On comparing pre test and post test between Group A & Group B on Multidimensional Composite Pain Scale test score shows highly significant difference in mean values at P  $\leq$  0.05.

#### DISCUSSION

The presence study was conduct with purpose evaluate the effects of land-based exercise protocol in the management of hind limb OA in white Gaint Rabbit. Osteoarthritis is one of the most prevalent chronic muscular disorders.

The etiology of OA is thought to be multifactorial and pathological changes may take place in different tissues of joints. OA studies have mainly focused on the changes occurring following intra-articular derangement such as ligament transaction or meniscectomy <sup>13-15</sup>.

post test values within Group A and Group B

This study is based on the effects of land based exercise show the benefits of management of Hind limb OA in white Gaint Rabbit . Wang, Y ; Wishloff , U ; Kemi ,O.J. Animal models in the study of exercise induced cardiac hypertrophy  $^{16}$ .

Arias-Mutis,O..J.;Genoves p.; Calvo , c.j.; Diaz An experimental Model of diet Induced Metabolic Syndrome In Rabbit <sup>17</sup>.

**Ethical clearance:** Ethical clearance was obtained from the ethical Institutional Review Board of Faculty of Pharmacy, Dr. MGR. Educational and Research Institute, Chennai with reference No-2053/PO/ReBi/S/19/CPCSEA approval letter dated 01/02/2019.

**Conflicts of Interest:** There is no conflict of interest to conduct and publish this study.

**Fund for the study:** This is self-funded study, no fund received from any organization.

#### CONCLUSION

The study concluded that land-based exercise protocol is more effective on management of hind limb OA in White Giant Rabbits. There is a great variety of exercise training protocols in rabbits which can be used to model the cardiovascular adaptations to training in humans. These experimental models of exercise training in rabbits have allowed for the investigation of the physiological effect of training, and in different pathologies with cardiovascular involvement, and their possible underlying mechanisms.

However, from the analysis of the protocols, we have observed that there is a great heterogeneity in the literature and a lack of consensus regarding a process of design and validation of the training protocols that allows us to define or to standardize a protocol of exercise in rabbits. In this sense, this makes the determination, validity, and reproducibility of the evaluation of the aerobic fitness in rabbits and its associated changes very challenging. With the great potential of the rabbit as an experimental model that mimics human physiology.

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