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THE EFFECTS OF HAMSTRING STRENGTH TRAINING FOR OSTEOARTHRITIS KNEE ON QUALITY OF LIFE, DEPRESSION AND FUNCTIONAL IMPROVEMENT

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ABSTRACT

TITLE: THE EFFECTS OF HAMSTRING STRENGTH TRAINING FOR OSTEOARTHRITIS KNEE ON QUALITY OF LIFE, DEPRESSION AND FUNCTIONAL IMPROVEMENT

AIM OF STUDY: The purpose of the study was to determine the effectiveness of the hamstring strengthening for osteoarthritis knee on quality of life, depression, and functional improvement. The outcome of this study could potentially guide clinical decision making regarding the most effect strength training in osteoarthritis knee. Thus, to improve quality of life, functional activities and reduce depression.

METHODOLOGY: A total number of 50 subjects were selected. The subjects who met the inclusive and exclusive criteria and wished to participate were assigned for the two different intervention groups by consecutive sampling (Convenient sampling) after getting written content. Group A: Experimental group 25 subjects with hamstring strengthening along with quadriceps strengthening and therapeutic ultrasound. Group B: Non-experimental group 25 subjects only with quadriceps strengthening and therapeutic ultrasound.

RESULT: The initial 50 patients who fit in inclusive criteria and these patients were evaluated and were divided into two groups; experimental group, and non-experimental group under single blinded randomization. Experimental group shows significant changes with both dependent and non-dependent variable methods.

CONCLUSION: The Effect of Hamstring strengthening exercises shows significant decrease in pain and increase in functional activity and improvement in psychosocial wellbeing.

INTRODUCTION Osteoarthritis (OA) is a progressive degenerative disease affecting synovial joints, marked by the loss of articular hyaline cartilage, bone proliferation, and joint contour remodeling. The Knee joint, comprising Tibiofemoral and Patellofemoral joints, is susceptible to OA, particularly in India due to cultural practices like sitting cross-legged. Prevalent in individuals over 45, OA causes pain and functional loss, impacting about 15 percent of those with radiographic findings, more common in women.[1]

Classified into Primary (idiopathic) and Secondary OA, clinical criteria include examination, laboratory tests, and radiographic findings[2,3]. Symptoms include gradual knee pain, stiffness, and muscle weakness affecting daily activities. Psychological factors like anxiety and depression are prevalent, impacting the quality of life.[4]Gait and

kinetics alterations, including reduced knee excursion and muscle activity patterns, are observed. Quadriceps and hamstring weakness, crucial for knee stability, lead to impaired function and Varus deformity.[5]

Muscle dysfunction in OA pathogenesis emphasizes the importance of muscle strength, flexibility, and specific exercises. Depression is associated with OA, influencing pain perception. While there's no cure, treatment focuses on symptom management through rehabilitation and physiotherapy, emphasizing regular exercises to counteract muscle atrophy. This holistic approach recognizes the interconnectedness of physical and mental well-being in managing knee OA. The World Health Organization highlights OA as a major public health concern, impacting global quality of life.[6]

The literature review sheds light on various aspects of knee osteoarthritis (OA) and its management strategies. Chamberlain et al conducted a study involving simple exercises with graduated weights for OA patients, revealing that both hospital-based and home-exercising groups experienced decreased pain and improved function. Consistency in daily exercises was key for sustaining these benefits.[7]

Marks presented a case study demonstrating the positive effects of isometric quadriceps strengthening on a 52-year-old with effused OA knee joint. This intervention, conducted three times a week for six weeks, resulted in increased quadriceps torque, improved clinical status, and reduced pain during walking.[8] Deyle et al (2000) evaluated physical therapy's effectiveness, incorporating manual therapy and supervised exercises. The treatment group exhibited significant improvements in walking distance and WOMAC scores, emphasizing the potential of this combined approach in delaying or preventing surgical intervention.[9]

Huang et al (2003) explored the therapeutic effects of different muscle-strengthening exercises on OA patients, suggesting isotonic exercises for initial strengthening.[10] The role of quadriceps and hamstring muscles in knee OA was emphasized by various studies (Kim L. Bennell et al, Ayodele Teslim et al), recognizing their impact on joint stability and disease progression.[11,12]

Psychological factors, particularly depression, were investigated by Gignac et al and Summers et al, revealing their strong association with functional impairment and pain in knee OA patients.[6,13] Other studies (Rogind et al, Sharma et al, Draper et al) delved into the benefits of general physical training, quadriceps muscle strengthening, and therapeutic ultrasound, providing additional dimensions to the management of knee OA.[14,15,16]

Overall, the literature review highlights the multifaceted nature of knee OA, encompassing exercises, psychological considerations, and therapeutic interventions. The importance of maintaining muscle strength, joint stability, and addressing psychological factors emerges as crucial in the holistic care of individuals with knee OA. The studies collectively underscore the need for comprehensive and tailored approaches in managing this prevalent and impactful condition.

The study aims to assess the effectiveness of hamstring strengthening in individuals with osteoarthritis (OA) knee, focusing on quality of life, depression, and functional improvement. The primary objective is to compare hamstring strengthening with a group undergoing quadriceps strengthening only. The research hypothesis suggests a significant positive impact in the experimental group, while the null hypothesis posits no significant effect. This investigation seeks to provide evidence-based insights for clinical decision-making in OA knee management, contributing to improved quality of life and functional outcomes.

The study adopted a comparative design and was conducted at Vishnu Shree Multispecialty Hospital, Tirupati, under orthopedician supervision. Inclusive criteria involved primary osteoarthritis patients aged 45-60 with Kellgren and Lawrence staging I and II. Exclusion criteria included secondary osteoarthritis, prior lower limb orthopedic surgery, peripheral vascular diseases, cardiovascular abnormalities, scoliosis, back pain/sciatica, obesity, and thyroid/metabolic disorders. A total of 50 subjects underwent convenient sampling, divided into Group A (hamstring and quadriceps strengthening with ultrasound) and Group B (quadriceps strengthening with ultrasound). Outcome measures included VAS, WOMAC, and BDI scales. Materials used comprised therapeutic ultrasound, TheraBand, weights, pillow, couch, and chair. The study duration was 12 weeks, with treatment sessions

5 times a week. Data collection involved pre-test and post-test assessments, utilizing self-assessment questionnaires and multiple-choice scales, VAS, WOMAC Score, BDI Scale. The study focused on strengthening hamstrings and quadriceps in knee osteoarthritis patients, incorporating therapeutic ultrasound for the posterior knee capsule. The protocol included hamstring and quadriceps exercises, such as hamstring sets, knee bends, and quad clenches, done in sets with 10 repetitions and 5 to 10-second holds. Subjects were advised to perform 2 to 3 sets daily, followed by therapeutic ultrasound with 1 MHz frequency and 0.8 watts per cm square power. This comprehensive approach aimed to enhance muscle strength and alleviate symptoms.

STATISTICAL ANALYSIS VAS-PAIN

Group-A Experimental Group			
S.no.	**Subject**	**Pre-test**	**Post test**
1	**1**	**8**	**5**
2	**2**	**4**	**1**
3	**3**	**7**	**3**
4	**4**	**5**	**2**
5	**5**	**6**	**2**
6	**6**	**8**	**3**
7	**7**	**6**	**1**
8	**8**	**9**	**4**
9	**9**	**7**	**4**
10	**10**	**4**	**2**
11	**11**	**7**	**5**
12	**12**	**9**	**6**
13	**13**	**5**	**3**
14	**14**	**6**	**5**
15	**15**	**7**	**2**
16	**16**	**9**	**3**
17	**17**	**8**	**2**
18	**18**	**7**	**1**
19	**19**	**6**	**4**
20	**20**	**5**	**3**
21	**21**	**8**	**6**
22	**22**	**7**	**2**
23	**23**	**4**	**1**

24	**24**	**3**	**1**
25	**25**	**9**	**7**

t-Test: Paired Two Sample for Means		
	Pre-test	**Post-test**
Mean	6.56	3.12
Variance	3.09	3.11
Observations	25	25
Pearson Correlation	**0.6225839**	
Hypothesized Mean Difference	0	
Df	24	
t Stat	**11.243992**	
P(T<=t) one-tail	0.0000	
t Critical one-tail	1.7108821	
P(T<=t) two-tail	0.0000	
t Critical two-tail	**2.0638985**	

Interpretation: There is a significance difference between two variables. Also, Positive relation between variables

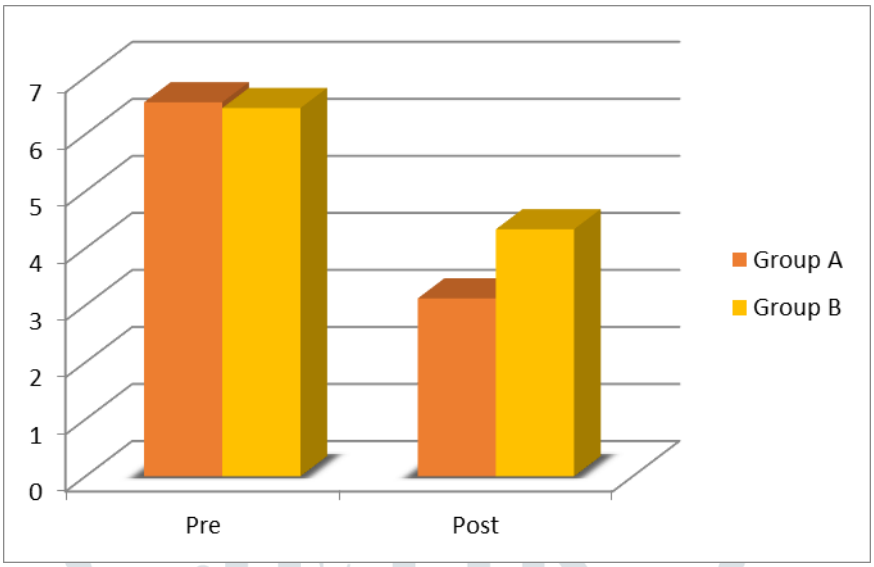
Group-B Non-Experimental Group			
S.NO	**Subjects**	**Pre-test**	**Post-test**
1	**1**	**7**	**6**
2	**2**	**9**	**7**
3	**3**	**8**	**8**
4	**4**	**4**	**3**
5	**5**	**6**	**3**
6	**6**	**5**	**4**
7	**7**	**7**	**5**
8	**8**	**6**	**5**
9	**9**	**4**	**4**
10	**10**	**9**	**8**
11	**11**	**7**	**3**

12	**12**	**8**	**5**
13	**13**	**6**	**4**
14	**14**	**3**	**2**
15	**15**	**5**	**3**
16	**16**	**7**	**4**
17	**17**	**5**	**2**
18	**18**	**8**	**7**
19	**19**	**9**	**6**
20	**20**	**7**	**3**
21	**21**	**5**	**2**
22	**22**	**4**	**1**
23	**23**	**7**	**6**
24	**24**	**9**	**3**
25	**25**		

t-Test: Paired Two Sample for Means		
	Pre-test	**Post-test**
Mean	6.4583333	4.333333
Variance	3.2155797	3.884058
Observations	24	24
Pearson Correlation	**0.7176562**	
Hypothesized Mean Difference	0	
Df	23	
t Stat	**7.3117116**	
P(T<=t) one-tail	0.0000	
t Critical one-tail	1.7138715	
P(T<=t) two-tail	0.0000	
t Critical two-tail	**2.0686576**	

Interpretation: There is a significance difference between two variables. Also, Positive relation between variables

	Pre	*Post*
Group A	6.56	3.12
Group B	6.4583333	4.333333



The Western Ontario and MC Master University Osteoarthritis Index (WOMAC)

Group-A Experimental Group			
S.NO	**Subjects**	**Pre-test**	**Post-test**
1	**1**	**0.27**	**0.6**
2	**2**	**0.5**	**0.7**
3	**3**	**0.3**	**0.83**
4	**4**	**0.56**	**0.73**
5	**5**	**0.31**	**0.52**
6	**6**	**0.4**	**0.89**
7	**7**	**0.6**	**0.9**
8	**8**	**0.24**	**0.59**
9	**9**	**0.37**	**0.92**
10	**10**	**0.18**	**0.53**
11	**11**	**0.2**	**0.5**
12	**12**	**0.33**	**0.8**
13	**13**	**0.72**	**0.9**
14	**14**	**0.63**	**0.82**

15	**15**	**0.2**	**0.61**
16	**16**	**0.43**	**0.7**
17	**17**	**0.3**	**0.8**
18	**18**	**0.4**	**0.76**
19	**19**	**0.3**	**0.6**
20	**20**	**0.5**	**0.83**
21	**21**	**0.6**	**0.9**
22	**22**	**0.36**	**0.7**
23	**23**	**0.19**	**0.62**
24	**24**	**0.2**	**0.5**
25	**25**	**0.36**	**0.73**

t-Test: Paired Two Sample for Means		
	Pre-test	**Post-test**
Mean	0.378	0.7192
Variance	0.023825	0.0190327
Observations	25	25
Pearson Correlation	**0.726246**	
Hypothesized Mean Difference	0	
Df	24	
t Stat	**-15.6207**	
P(T<=t) one-tail	0.0000	
t Critical one-tail	1.710882	
P(T<=t) two-tail	0.0000	
t Critical two-tail	**2.063899**	

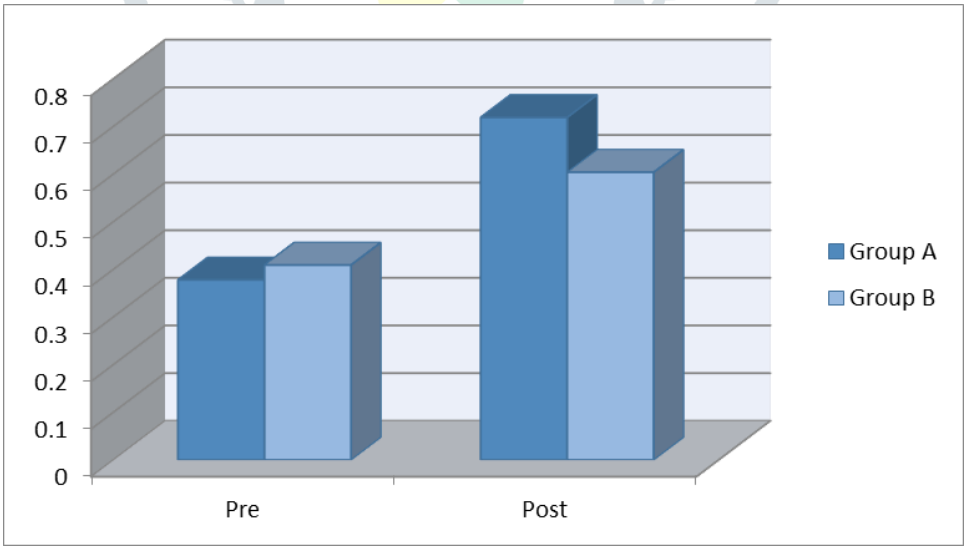
Interpretation: There is a significance difference between two variables. Also, Positive relation between variables

Group-B Non-Experimental Group			
S.NO	**Subjects**	**Pre-test**	**Post-test**
1	**1**	**0.3**	**0.5**
2	**2**	**0.21**	**0.43**
3	**3**	**0.5**	**0.61**
4	**4**	**0.32**	**0.46**
5	**5**	**0.5**	**0.71**
6	**6**	**0.6**	**0.79**
7	**7**	**0.34**	**0.51**
8	**8**	**0.23**	**0.4**
9	**9**	**0.27**	**0.5**
10	**10**	**0.6**	**0.81**
11	**11**	**0.7**	**0.88**
12	**12**	**0.3**	**0.5**
13	**13**	**0.40**	**0.56**
14	**14**	**0.18**	**0.32**
15	**15**	**0.37**	**0.53**
16	**16**	**0.1**	**0.3**
17	**17**	**0.5**	**0.68**
18	**18**	**0.43**	**0.62**
19	**19**	**0.33**	**0.54**
20	**20**	**0.7**	**0.9**
21	**21**	**0.61**	**0.8**
22	**22**	**0.53**	**0.73**
23	**23**	**0.41**	**0.7**
24	**24**	**0.2**	**0.49**
25	**25**	**0.6**	**0.83**

t-Test: Paired Two Sample for Means		
	Pre-test	**Post-test**
Mean	0.4092	0.604
Variance	0.028583	0.0293417
Observations	25	25
Pearson Correlation	**0.971725**	
Hypothesized Mean Difference	0	
Df	24	
t Stat	**-24.0317**	
P(T<=t) one-tail	0.0000	
t Critical one-tail	1.710882	
P(T<=t) two-tail	0.0000	
t Critical two-tail	**2.063899**	

Interpretation: There is a significance difference between two variables. Also, Positive relation between variables

	Pre	*Post*
Group A	0.378	0.7192
Group B	0.4092	0.604



Beck-Depression Inventory

Group-A Experimental Group

S.NO	Subjects	Pre-test	Post-test
1	1	36	16
2	2	41	20
3	3	38	15
4	4	29	10
5	5	38	12
6	6	43	18
7	7	28	11
8	8	40	16
9	9	31	9
10	10	36	14
11	11	48	22
12	12	51	20
13	13	35	15
14	14	43	16
15	15	33	8
16	16	37	11
17	17	29	12
18	18	39	11
19	19	40	10
20	20	38	15
21	21	53	23
22	22	48	20
23	23	55	21
24	24	33	18
25	25	28	8

t-Test: Paired Two Sample for Means		
	Pre-test	**Post-test**
Mean	38.8	14.84
Variance	58.91667	20.64
Observations	25	25
Pearson Correlation	**0.813935**	
Hypothesized Mean Difference	0	
Df	24	
t Stat	**25.09485**	
P(T<=t) one-tail	0.0000	
t Critical one-tail	1.710882	
P(T<=t) two-tail	0.0000	
t Critical two-tail	**2.063899**	

Interpretation: There is a significance difference between two variables. Also, Positive relation between variables

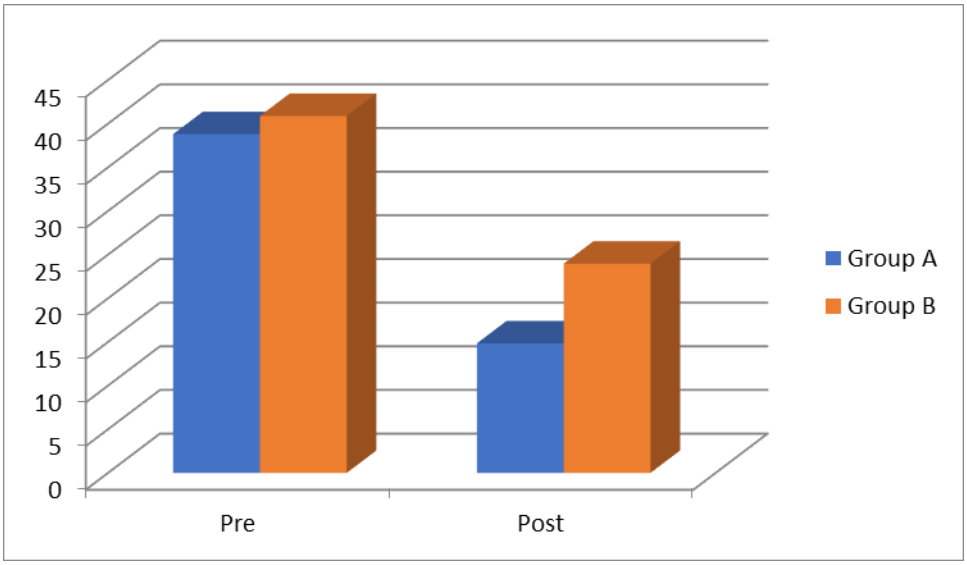
Group-B Non-Experimental Group			
S.NO	**Subjects**	**Pre-test**	**Post-test**
1	**1**	**43**	**33**
2	**2**	**58**	**37**
3	**3**	**38**	**26**
4	**4**	**29**	**17**
5	**5**	**26**	**10**
6	**6**	**40**	**26**
7	**7**	**48**	**32**
8	**8**	**51**	**30**
9	**9**	**44**	**26**
10	**10**	**53**	**23**
11	**11**	**37**	**18**
12	**12**	**43**	**26**

13	**13**	**39**	**18**
14	**14**	**46**	**32**
15	**15**	**28**	**14**
16	**16**	**38**	**15**
17	**17**	**36**	**20**
18	**18**	**49**	**33**
19	**19**	**29**	**20**
20	**20**	**35**	**22**
21	**21**	**31**	**18**
22	**22**	**41**	**23**
23	**23**	**43**	**25**
24	**24**	**39**	**20**
25	**25**	**58**	**35**

t-Test: Paired Two Sample for Means		
	Pre-test	**Post-test**
Mean	40.88	23.96
Variance	77.77667	50.873333
Observations	25	25
Pearson Correlation	**0.848452**	
Hypothesized Mean Difference	0	
Df	24	
t Stat	**18.07379**	
P(T<=t) one-tail	0.0000	
t Critical one-tail	1.7109	
P(T<=t) two-tail	0.0000	
t Critical two-tail	**2.063899**	

Interpretation: There is a significance difference between two variables. Also, Positive relation between variables

	Pre	*Post*
Group A	38.8	14.84
Group B	40.88	23.96



The discussion centers on osteoarthritis (OA) knee, a prominent cause of knee pain and functional limitations. OA often results in reduced range of motion, muscle flexibility, and strength loss. While the relationship between bony pathology and pain remains unclear, depression emerges as a potential influential factor. Depression, either as a reaction to physical and social challenges or as a comorbid condition, might intensify the pain experience in individuals with OA.

Existing research primarily emphasizes quadriceps muscle strengthening, neglecting the role of hamstring muscle strength. This study aimed to evaluate the impact of hamstring muscle strengthening on OA knee, encompassing individuals aged 45-60. Results indicate significant differences between groups, with the experimental group exhibiting noteworthy reductions in pain, increased functional activities, and improved psychosocial well-being. This aligns with previous studies emphasizing the positive outcomes of hamstring and quadriceps strengthening on pain, gait velocity, and daily activities in knee OA patients.

The findings correlate with studies by Ashraf Ramadan Hafez et al., emphasizing the effectiveness of hamstring and quadriceps strengthening exercises in improving pain intensity, gait velocity, and daily activities in knee OA patients. Strengthening the hamstring muscle significantly contributed to enhanced functional ability in the experimental group.

However, limitations include a small sample size and reliance on a single physiotherapist, impacting external validity. A larger, multicenter randomized clinical trial is suggested for broader generalization. Additionally, the short treatment duration and lack of follow-up are acknowledged limitations, warranting future studies with extended treatment courses and proper follow-ups.

In conclusion, OA knee poses a significant global health challenge, leading to chronic disability. Identifying risk factors is crucial for preventive care. Conservative treatments, especially exercise, demonstrate effectiveness in reducing pain and disability. The study's evidence suggests that strengthening the hamstring muscle contributes to pain reduction, improved muscular strength, functional ability, and psychological well-being, ultimately enhancing the quality of life for individuals with OA knee. Depression emerges as a frequent correlate of OA disability, influencing the pain experience. The release of 'happy hormones' may play a role in alleviating depressive symptoms.

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