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Original Article

Nursing Section

Effect of Ball and Balloon Blowing Exercises on Non Specific Low Back Pain among Undergraduate Students: A Prospective Interventional Study

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ABSTRACT

Introduction: Non Specific Low Back Pain (NSLBP) is one of the most common musculoskeletal conditions globally, adversely affecting quality of life, and occurring without any identifiable cause. Among undergraduate students, the incidence of NSLBP is considerably high due to prolonged sitting during theory sessions and extended standing hours during clinical duties.

Aim: To determine the effectiveness of ball and balloon blowing exercises on NSLBP among undergraduate students.

Materials and Methods: The present prospective interventional study was conducted over a period of three months, from April 2022 to June 2022. Among 724 undergraduate students surveyed at Yenepoya (Deemed to be University), Mangaluru, Karnataka, India using the Oswestry Low Back Pain Disability Questionnaire, 70 participants were identified as having 0-40% non specific low back pain. These participants were randomly assigned to the control group (n=35) and the intervention group (n=35). Participants in the intervention group performed ball and balloon blowing exercises for 10 minutes twice daily for 21 days. Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS).

Results: The majority of participants in both the intervention and control groups were 19-years-old and males. The paired t-test revealed a significant reduction ($p<0.001$) in pain scores in the intervention group between pretest and post-test 1, as well as between pretest and post-test 2. In contrast, no significant change was observed in the control group ($p>0.05$). These findings indicate that ball and balloon blowing exercises are effective in reducing non specific low back pain.

Conclusion: Ball and balloon blowing exercises are an effective, non pharmacological intervention for reducing non specific low back pain.

Keywords: Diaphragmatic breathing, Musculoskeletal health, Non pharmacological intervention, Pain Management

INTRODUCTION

Lower Back Pain (LBP) is an extremely prevalent condition, affecting the majority of individuals at some point in their lives [1]. The incidence of LBP peaks during the third decade of life and has emerged as an increasing concern among adolescents worldwide [2].

In 2020, 619 million people globally were affected by LBP, with projections suggesting this number may rise to 843 million by 2050 [3]. The global age-standardised rate for LBP was 832 per 100,000 people in 2020 [3]. According to the World Health Organisation (WHO) 2023 report, individuals of all ages — including children and adolescents — can experience LBP, and most people encounter it at least once in their lifetime [4].

Non Specific LBP (NSLBP) represents the most common form of LBP, accounting for approximately 90% of cases, and is more prevalent among women [4]. The lifetime prevalence of LBP and NSLBP among adolescents has been reported as 48.98% and 13.89%, respectively [5]. NSLBP affects individuals across all age groups and is a major contributor to the global disease burden.

The NSLBP lacks a clearly defined etiology; therefore, treatment focuses primarily on alleviating pain and managing its consequences [6]. It is estimated that around 90% of all LBP cases are classified as non specific [7,8]. Non Specific low back pain occurs without identifiable structural alterations such as disc compression, nerve root involvement, bone or joint fractures, or significant spinal deformities like scoliosis or lordosis [9,10]. Only 10% of low back pain cases are associated with identifiable pathological conditions [9,10].

The cylindrical portion of the diaphragm, located adjacent to the inner lower rib cage, lies within the Zone of Apposition (ZOA) [11]. The abdominal muscles help maintain diaphragmatic tension, and the ZOA plays an important role in spinal stability. When the ZOA is reduced, transversus abdominis activity decreases, which can destabilise the lumbar spine and contribute to NSLBP [12].

Functional movement requires a balance between mobility and stability throughout the kinetic chain, integrating basic movement patterns accurately and efficiently. Proper posture and spinal stabilisation depend largely on normal breathing mechanisms. Evidence suggests that disturbances in breathing patterns are associated with discomfort and motor control deficits [13].

The ball and balloon blowing exercise is designed to enhance functional efficiency and alleviate discomfort. These exercises are structured in such a way that all core muscles are actively engaged during performance, thereby helping to reduce NSLBP [14]. Among undergraduate nursing students, the incidence of NSLBP is significantly high due to prolonged sitting during theory sessions and extended standing during clinical activities, which often involve manual handling and academic stress [15].

Several studies have demonstrated that ball and balloon blowing exercises effectively reduce non specific low back pain [15-17]. However, in many cases, NSLBP lacks a clear anatomical cause, making effective treatment complex. Furthermore, there is a paucity of studies involving undergraduate students.

Therefore, the aim of present study was to identify undergraduates with NSLBP and to assess the effectiveness of ball and balloon blowing exercises in reducing back pain and improving academic outcomes.

MATERIALS AND METHODS

The present prospective interventional study was conducted at Yenepoya (Deemed to be University), Mangaluru, Karnataka, India. over a period of three months, from April 2022 to June 2022. Ethical clearance was obtained from the Scientific Review Board and the Institutional Ethics Committee (Ref. No.: YEC2/889) of the concerned university. Written informed consent was obtained from all participants, and confidentiality was maintained throughout the study.

Inclusion criteria: Participants who had minimal (0-20%) or moderate (21-40%) low back pain, as assessed by the Oswestry Low Back Pain Disability Questionnaire (ODI) [18], were included in the study.

Exclusion criteria: Undergraduates with a previous history of fracture, radiculopathy, amputation, spinal deformity, or degenerative diseases were excluded from the study.

Sample size calculation: During the first phase, a survey was conducted among undergraduate students to identify those with NSLBP. A total of 724 undergraduates from nursing and physiotherapy programs were surveyed, among whom 70 participants were found to have minimal (0-20%) or moderate (21-40%) low back pain, based on the ODI [18].

The Oswestry Low Back Pain Disability Questionnaire (ODI) is one of the most widely used and validated tools to assess the extent to which back pain affects a patient's ability to perform daily activities. The questionnaire consists of 10 sections, including pain intensity, personal care (e.g., washing, dressing), lifting, walking, sitting, standing, sleeping, sexual activity (if applicable), social life, and traveling. Each section is scored from 0 to 5, with 0 indicating no disability and 5 indicating maximum disability.

The 70 participants identified with minimal and moderate disability were randomly allocated into two groups using a simple random sampling technique (lottery method): an intervention group (n=35) and a control group (n=35).

Study Procedure

A demographic proforma was used to collect basic information such as age, gender, program of study, year of study, duration of pain, and frequency of pain. The Numeric Pain Rating Scale (NPRS) was used to assess pain intensity, ranging from 0 to 10, where 0 indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain, 7-9 indicates severe pain, and 10 represents the worst possible pain [19].

The pretest was conducted on day one, followed by post-test 1 on day 14 and post-test 2 on day 21 for both groups. Data collection was first completed for the control group, followed by the intervention group.

The researcher demonstrated and taught the intervention to the participants in a common hall, and the exercises were practiced six days a week. Each session lasted 5-10 minutes, performed twice daily for three weeks, under the researcher's supervision.

For the intervention, participants were instructed to lie on their backs with their feet placed against a wall. The knees and hips were bent at a 90-degree angle toward the wall. A ball (4-6 inches in diameter) was placed between the knees to engage the core muscles. One hand was placed above the head, and a balloon was held in the other hand. Participants were instructed to inhale through the nose and exhale through the mouth while performing a posterior pelvic tilt. They were asked to pause for three seconds with the tongue positioned on the roof of the mouth to prevent airflow from the balloon, and then repeat the process four to five times [16,20].

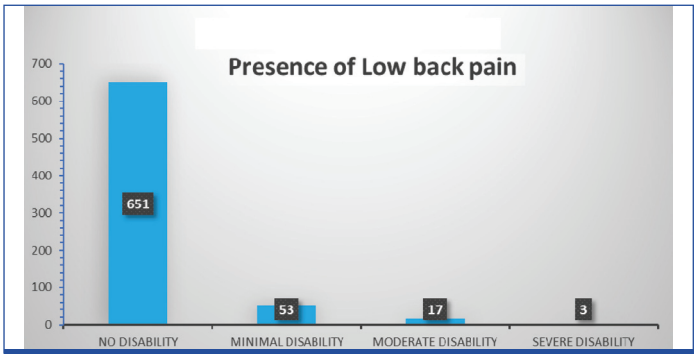
STATISTICAL ANALYSIS

The collected data were analysed and interpreted using descriptive and inferential statistics with Statistical Package of Social Sciences (SPSS) software. The demographic variables were analysed using descriptive statistics, including frequency, percentage, mean, and Standard Deviation (SD).

A paired t-test was used to evaluate the effectiveness of ball and balloon blowing exercises within groups, and an unpaired t-test was applied to compare between groups. A p-value <0.05 was considered statistically significant.

RESULTS

In the first phase of the study, undergraduate students were surveyed for low back pain using the Oswestry Low Back Pain Disability Questionnaire. Out of 724 undergraduates, 53 participants had minimal disability, 17 participants had moderate disability, and 3 participants had severe disability [Table/Fig-1].



[Table/Fig-1]: Distribution of undergraduates based on the presence of Non Specific Low Back Pain (NSLBP) (n=724).

The findings showed that most participants in both the intervention and control groups were male and belonged to the 19-year age group. The majority were enrolled in the B.Sc. Nursing program and were in their third year of study. About half of the participants in both groups reported having non specific low back pain for a duration of one month. Most participants in both groups experienced pain less than three times per day [Table/Fig-2].

The distrubution of participants according to their pain scores (mild versus moderate) across three time points: pretest, post-test 1, and post-test 2 has been depicted in [Table/Fig-3]. During the pretest phase, there was no significant difference between the groups (p=0.63), indicating comparable baseline pain levels.

However, following the intervention, a significant difference was observed. At post-test 1, a greater proportion of participants in the intervention group reported mild pain 29 (82.8%) compared to the control group 15 (42.9%), and this difference was statistically significant (p=0.001). The trend persisted in post-test 2, where 32 participants (91.4%) in the intervention group reported mild pain, compared to only 8 participants (22.9%) in the control group, showing a highly significant difference (p=0.001).

These findings suggest that the ball and balloon blowing exercise was effective in significantly reducing pain levels among participants over time.

The comparison of pain scores within the intervention and control groups at various time points using the paired t-test has been depicted in [Table/Fig-4]. In the intervention group, pain scores significantly decreased in all comparisons. The average pain score dropped from 3.44±0.98 at the pretest to 2.44±0.95 at post-test 1 (p=0.01*), and further declined to 1.90±0.73 at post-test 2 (p=0.01*), indicating the intervention's effectiveness over time. The comparison between post-test 1 and post-test 2 also revealed a significant reduction (t=7.5, p=0.01*), suggesting ongoing improvement.

In contrast, the control group showed no significant changes in pain scores over time. The average scores remained relatively consistent: from pretest to post-test 1 (4.31±1.06 to 4.90±0.87, p=0.82), from pretest to post-test 2 (4.31±1.06 to 5.50±0.91, p=0.57), and from post-test 1 to post-test 2 (4.90±0.87 to 5.50±0.91, p=0.39).

S. No.	Variables	Intervention group n (%)	Control group n (%)
1.	**Age (in years)**		
	18	10 (31.2)	09 (25.7)
	19	17 (48.5)	15 (42.9)
	≥20	08 (22.8)	11 (31.4)
2.	**Gender**		
	Male	18 (51.4)	19 (54.3)
	Female	17 (48.6)	16 (45.7)
3.	**Programme of study**		
	B.Sc. Nursing	21 (60.0)	23 (65.7)
	BPT	14 (40.0)	12 (34.3)
4.	**Year of study**		
	1st	6 (17.1)	-
	2nd	12 (34.3)	10 (28.6)
	3rd	13 (37.1)	16 (45.7)
	4th	4 (11.5)	9 (25.7)
5.	**Duration of non specific low back pain**		
	1-month	16 (45.7)	14 (40.0)
	2-months	14 (40.0)	13 (37.1)
	3-months and above	05 (14.2)	08 (22.9)
6.	**Frequency of pain (in a day)**		
	<3 times	17 (48.6)	25 (71.4)
	3-5 times	16 (45.7)	10 (28.6)
	> 5 times	02 (05.7)	12 (34.3)

[Table/Fig-2]: Distribution of participants according to baseline characteristics (N=70).
Abbreviations: B.Sc: Bachelor of Science; BPT: Bachelor of Physiotherapy; The data is expressed as frequency (f) and percentage in parenthesis (%)

Observations	Scores	Groups		Statistical value
		Intervention group (n=35)	Control group (n=35)	p-value
Pretest	Mild pain	21 (60.0)	19 (54.3)	0.63
	Moderate pain	14 (40.0)	16 (45.7)	
Post-test 1	Mild pain	29 (82.8)	15 (42.9)	0.001**
	Moderate pain	06 (17.2)	20 (57.1)	
Post-test 2	Mild pain	32 (91.4)	08 (22.9)	0.001**
	Moderate pain	03 (8.57)	27 (77.1)	

[Table/Fig-3]: Distribution of participants based on pain score.
The statistical tests used: Chi-square test/likelihood ratio. The data is expressed as frequency (f) and percentage in parenthesis (%). Level of significance: **p<0.01-highly significant, *p <0.05-significant, p>0.05-non significant.

Statistical value				
Study groups	**Observations**	**Mean±SD**	**t**	**p**
Intervention group (n=35)	Pretest vs. Post-test 1	3.4±0.98	14.4	0.01*
		2.4±0.95		
	Pretest vs. Post-test 2	3.4±0.98	16.2	0.01*
		1.9±0.78		
	Post-test 1 vs. Post-test 2	2.4±0.95	7.5	0.01*
		1.9±0.78		
Control group (n=35)	Pretest vs. Post-test 1	4.3±1.06	4.7	0.82
		4.9±0.87		
	Pretest vs. Post-test 2	4.3±1.06	4.1	0.57
		5.5±0.91		
	Post-test 1 vs. Post-test 2	4.9±0.87	4.0	0.39
		5.5±0.91		

[Table/Fig-4]: Intragroup comparison of pain scores within the study groups at different points of observation (N=70).
The statistical tests used: paired t-test. Level of significance: *p<0.05 significant, p>0.05 non significant.

These findings highlight the effectiveness of the intervention in significantly alleviating pain, unlike the control group, where pain levels did not show any improvement.

The intervention group consistently demonstrated greater improvement (positive mean differences) over time compared to the control group, which showed either negative or minimal improvement has been depicted in [Table/Fig-5].

Observations	Study groups		p-value
	Control group (n=35)	Intervention group (n=35)	
	Mean difference		
Pretest - Post-test 1	-0.6	0.92	<0.001***
Pretest - Post-test 2	-1.2	1.55	<0.001***
Post-test 1- Post-test 2	-0.6	0.5	<0.001***

[Table/Fig-5]: Intergroup comparison of post-test pain scores between the study group (N=70).
The statistical tests used: Unpaired t-test. Level of significance: ***p <0.001-very highly significant, p>0.05-non significant.

DISCUSSION

The results of present study indicate that ball and balloon blowing exercises are effective, non-pharmacological methods for alleviating Non specific Low Back Pain (NSLBP) among undergraduate students. A significant reduction in pain levels was observed in the intervention group, as shown by the paired t-test results ($p < 0.001$), while the control group did not exhibit any significant changes. These findings align with earlier research suggesting that ball and balloon blowing exercises can positively influence pain management and musculoskeletal health [15-17].

The prevalence of NSLBP among young adults, particularly healthcare students such as nurses and physiotherapists, is reported to be high due to prolonged sitting during theory sessions and extended standing during clinical practice [5,21]. In the present study, the majority of participants were aged 18-19 years, similar to earlier studies in which college students (mean age 21 years) frequently reported early symptoms of low back pain, often attributed to poor posture and prolonged static positions [22,23].

The gender distribution in present study showed a slight male predominance, which contrasts with some earlier studies where female students reported a higher prevalence of low back pain. However, consistent with our findings, several researchers have noted that gender differences in low back pain prevalence among young adults are not always statistically significant [22].

The mechanism by which ball and balloon blowing exercises alleviate NSLBP is likely due to enhanced diaphragmatic breathing and core muscle activation. Activities such as balloon blowing are recognised for engaging deep core stabilising muscles, including the diaphragm, transversus abdominis, and pelvic floor, all of which are essential for maintaining spinal stability. By increasing intra-abdominal pressure and promoting balanced engagement of the core muscles, these exercises may help reduce mechanical strain on the lumbar spine, thereby alleviating pain [24].

Furthermore, using simple, inexpensive, and easily accessible methods such as balloon blowing can be especially beneficial for individuals with limited time and resources, including students who spend extended periods sitting during lectures and standing during clinical practice. This approach not only helps relieve physical discomfort but may also improve overall well-being, given the strong association between chronic musculoskeletal pain and psychological distress [1].

Compared to conventional core-strengthening or stretching routines, balloon-blowing exercises represent a creative and straightforward approach that may also enhance body awareness, an important factor in pain management [25].

Limitation(s)

It is important to acknowledge that, although the study demonstrated encouraging outcomes, there are certain limitations to consider. The sample size was relatively small, and the duration of the intervention was limited to 21 days. The study was limited to a single setting, pain assessment was conducted only using the Numeric Pain Rating Scale (NPRS). and the intervention focused solely on ball and balloon blowing exercises without considering other physical or psychological contributing factors. Further studies involving larger and more diverse populations, as well as longer follow-up periods, are recommended to validate these findings and explore the long-term benefits of these exercises.

CONCLUSION(S)

The present study found that ball and balloon blowing exercises have a significant impact on reducing NSLBP among undergraduate students. The findings suggest that engaging in these exercises effectively alleviates pain. This exercise is simple to administer and can be performed independently at home or in a hostel setting. The benefits can be observed within a short period, and the method is highly cost effective. With continued practice, this exercise may also help improve posture and contribute to better musculoskeletal health. Future research should explore variations in exercise duration, intensity, and frequency to determine the most effective protocols for different subgroups of individuals with low back pain.

REFERENCES

[1] Hoy D, Brooks P, Blyth F, Buchbinder R. The Epidemiology of low back pain. Best Pract Res Clin Rheumatol. 2010;24(6):769-81.
[2] Ganesan S, Acharya AS, Chauhan R, Acharya S. Prevalence and risk factors for low back pain in 1,355 young adults: A cross-sectional study. Asian Spine J. 2017;11(4):610-17
[3] Ferreira ML, De Luca K, Haile LM, Steinmetz JD, Culbreth GT, Cross M, et al. Global, regional, and national burden of low back pain, 1990-2020, its attributable risk factors, and projections to 2050: A systematic analysis of the Global Burden of Disease Study 2021. Lancet Rheumatol. 2023;5(6):e316-e329.
[4] Low back pain [Internet]. Who.int. [cited 2025 May 1]. Available from: https://www.who.int/news-room/fact-sheets/detail/low-back-pain.
[5] Masiero S, Sarto F, Cattelan M, Sarto D, Del Felice A, Agostini F, et al. Lifetime Prevalence of Non-specific Low Back Pain in Adolescents: A Cross-sectional Epidemiologic Survey. Am J Phys Med Rehabil. 2021;100(12):1170-75.
[6] Maher C, Underwood M, Buchbinder R. Non-specific low back pain. The Lancet. 2017;389(10070):736-47.
[7] Robinault L, Niazi IK, Kumari N, Amjad I, Menard V, Haavik H. Non-specific low back pain: An inductive exploratory analysis through factor analysis and deep learning for better clustering. Brain Sci. 2023;13(6):946.
[8] Violante FS, Mattioli S, Bonfiglioli R. Low-back pain. In: Handbook of Clinical Neurology [Internet]. Elsevier; 2015. p. 397-410. [cited 2024 Nov 24]. Available from: https://linkinghub.elsevier.com/retrieve/pii/B9780444626271000202.
[9] Waterman BR, Belmont PJ, Schoenfeld AJ. Low back pain in the United States: Incidence and risk factors for presentation in the emergency setting. Spine J. 2012;12(1):63-70.
[10] Balagué F, Mannion AF, Pellisé F, Cedraschi C. Non-specific low back pain. The Lancet. 2012;379(9814):482-91.
[11] Loring SH, Mead J. Action of the diaphragm on the rib cage inferred from a force-balance analysis. J Appl Physiol. 1982;53(3):756-60.
[12] Bye PT, Esau SA, Walley KR, Macklem PT, Pardy RL. Ventilatory muscles during exercise in air and oxygen in normal men. J Appl Physiol. 1984;56(2):464-71.
[13] Bradley H, Esformes J. Breathing pattern disorders and functional movement. Int J Sports Phys Ther. 2014;9(1):28-39.
[14] Shetty CB, Fathima N. Effectiveness of exercise with balloon for low back pain in young adults: A quasi experimental study. Indian J Physiother Occup Ther - Int J. 2020;14(4):20-26. [cited 2024 Nov 24]; Available from: http://medicopublication.com/index.php/ijpot/article/view/11293.
[15] Menzel N, Feng D, Doolen J. Low back pain in student nurses: Literature review and prospective cohort study. Int J Nurs Educ Scholarsh. 2016;13(1):19-25.
[16] Fernandes J, Chougule A. Effects of hemibridge with ball and balloon exercise on forced expiratory volume and pain in patients with chronic low back pain: An experimental study. Int J Med Res Health Sci. 2017;6(8):47-52. [cited 2025 May 2]. Available from: https://www.ijmrhs.com/medical-research/effects-of-hemibridge-with-ball-and-balloon-exercise-on-forced-expiratory-volume-and-pain-in-patients-with-chronic-low-b.pdf.
[17] Smrcina Z, Woelfel S, Burcal C. A Systematic Review of the Effectiveness of Core Stability Exercises in Patients with Non-Specific Low Back Pain. Int J Sports Phys Ther. 2022;17(5):766-74.
[18] Fairbank JCT, Pynsent PB. The Oswestry Disability Index. Spine. 2000;25(22):2940-53.
[19] Haefeli M, Elfering A. Pain assessment. Eur Spine J. 2006;15(S1):S17-S24.
[20] Seo K, Cho M. The effects of a balloon-blowing exercise in a 90/90 bridge position using a ball on the pulmonary function of females in their twenties. J Phys Ther Sci. 2018;30(10):1267-70.
[21] Al Amer HS. Low back pain prevalence and risk factors among health workers in Saudi Arabia: A systematic review and meta-analysis. J Occup Health. 2020;62(1):e12155.
[22] Casas S AS, Patiño S MS, Camargo L DM. Association between the sitting posture and back pain in college students. Rev Univ Ind Santnader Salud. 2016;48(4):446-54.
[23] Feleke M, Getachew T, Shewangizaw M, Gebremickael A, Boshe M. Prevalence of low back pain and associated factors among medical students in Wachemo University Southern Ethiopia. Sci Rep. 2024;14(1):23518.
[24] Mohan V, Paungmali A, Sitilertpisan P, Henry LJ, Omar FA, Azhar FZ. The effect of core stability training with ball and balloon exercise on respiratory variables in chronic non-specific low back pain: An experimental study. J Bodyw Mov Ther. 2020;24(4):196-202.
[25] Gunarathna K. A comparitive study between balloon blowing exercise in 90/90 hemibridge position with ball and core strengthening exercises on chronic low back pain in adults. IOSR-JDMS. 2023;22(10):32-35.

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