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ORIGINAL ARTICLE

THE EFFECTS OF SIX-WEEK ELASTIC BAND STRETCHING ON BALANCE, FLEXIBILITY, AND MUSCLE STRENGTH IN OLDER ADULTS

Piangpen Bussamongkhon[1], Warunee Kitraksa[2], Umaporn Kensila[3], Thanumporn Thonglong[2]*

1. Faculty of Nursing, Sakon Nakhon Rajabhat University, Sakon Nakhon, Thailand
2. Department of Sports Science, Faculty of Science, Udon thani Rajabhat University, Udon Thani, Thailand
3. Department of Community nurse, Faculty of Nursing, Udon thani Rajabhat University, Udon Thani, Thailand

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***Corresponding Author**
Thanumporn Thonglong
thanumporn.th@udru.ac.th

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ABSTRACT

Elastic band exercises may help older adults maintain physical function. This study examined the effects of a six-week elastic band stretching program on flexibility, muscle strength, muscular endurance, and dynamic balance. Forty community-dwelling older adults from Sam Phrao Subdistrict, Udon Thani Province, participated; the inclusion criteria specified an age range of 60 to 69 years. Participants were divided into an intervention group (n = 20) and a control group (n = 20). The intervention group completed the program for six weeks. Strength, muscular endurance, flexibility, and agility-course performance were assessed before and after the intervention. Within-group changes were analyzed using paired t-tests, and between-group differences were analyzed using independent-samples t-tests, with significance set at $p < .05$. The intervention group showed significant improvements in all measured outcomes ($p \leq .003$). In the control group, arm curl performance decreased and agility-course completion time increased (both $p = .002$), while other outcomes did not change significantly. No outcome differed significantly between groups at pretest, whereas all reported outcomes differed significantly at posttest ($p \leq .034$). The six-week program was associated with improvements in strength, muscular endurance, flexibility, and agility-course performance among the participating older adults.

Keywords: *Elastic band; older adults; stretching*

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BACKGROUND

Population aging has increased the demand for accessible exercise programs that help older adults maintain physical function. The number of people aged 60 years or older worldwide is projected to rise from 1.1 billion in 2023 to 1.4 billion by 2030 (World Health Organization [WHO], 2025). In Thailand, 13.68 million people, or 20.8% of the population, were aged 60 years or older in 2024 (National Statistical Office of Thailand, 2025). Maintaining muscle strength, flexibility, and balance is essential for independent daily living as this population grows.

Muscle strength and endurance significantly contribute to everyday activities such as rising from a chair, walking, and carrying objects. A systematic review estimated that sarcopenia affect 17.3% of community-dwelling older adults in Thailand; however, sarcopenia encompasses more than just low muscle strength (Whaikid & Piaseu, 2024). Elastic band resistance training been shown to improve physical capacity in older women with sarcopenic obesity, although evidence from this specific group may not be directly applicable to all community-dwelling older adults (Liao et al., 2018).

Flexibility contributes to the range of motions available for daily activities. In a six-week study of older women, static stretching, dynamic stretching, and eccentric exercise all improved measures of lower-limb flexibility, but their effects on strength and functional performance differed (Namsawang et al., 2024). A subsequent study involving older adults with leg tightness or suspected sarcopenia also found that responses varied depending on the type of exercise and the

outcome measured (Muanjai et al., 2025). Therefore, flexibility and strength should be assessed as separate outcomes.

Elastic bands can be used to guide a limb into a stretching position and to provide resistance during active movement, each involving different potential mechanisms. Repeated stretching may increase joint range of motion by improving tolerance to the stretching sensation and modestly reducing in overall muscle–tendon stiffness. A systematic review supports these mechanisms for static stretching. However, since participants were predominantly younger adults, direct application to older adults should be approached with caution (Ingram et al., 2025). When a participant actively moves against an elastic band, the band's tension provides an external load that requires muscle force. Repeated contractions may improve strength and muscular endurance, depending on the resistance applied and the progression of the exercises. These explanations are plausible for the present program, but muscle activation, stiffness, stretch tolerance, and neuromuscular adaptation were not measured in this study.

Balance and mobility are crucial for safe movement. Approximately 20–30% of adults aged 65 years and older experience at least one fall annually; this statistic reflects the incidence of falls rather than the prevalence of balance impairments (Pillay et al., 2024). Reviews suggest that elastic band exercises may enhance flexibility, lower-limb strength, and balance-related performance in older adults (Yeun, 2017; Li et al., 2024; Meng et al., 2025). While improved strength and the practice of controlled movements may contribute to better dynamic performance, a reduction in falls rates cannot be concluded without directly measuring fall events (Li et al., 2024; Meng et al., 2025).

Previous studies have often focused on resistance training, a specific physical outcome, or particular subgroups of older adults. The present study examines the changes in muscle strength, muscular endurance, flexibility, and dynamic movement performance following a six-week elastic band stretching program in community-dwelling Thai older adults. The study aims to compare these outcomes before and after the program between an intervention group and a control group. The agility course test was interpreted as a measure of dynamic movement performance rather than balance alone.

METHOD

Research design and setting

This research is quasi-experimental with pre and post with control group design. Respondents received baseline measurements and were followed up for six weeks to obtain the effect of elastic band stretching program and then remeasured as a post-test. And was conducted from November to December 2024 in the Ban Sam Phrao community activity area Sam Phrao Subdistrict, Mueang District, Udon Thani Province, Thailand.

Participants

The study included community-dwelling older adults aged 60–69 years from Sam Phrao Subdistrict, Mueang District, Udon Thani Province. Forty participants were enrolled, with 20 assigned to the intervention group and 20 to the control group. The source manuscript describes the recruitment methods as "convenience sampling," but does not specify how residents were approached or how eligible participants were allocated to the two groups. Therefore, recruitment and allocation cannot be considered random. These procedures should be clearly documented from the study records before applying a more specific sampling label. Additionally, the manuscript's reported sample size calculation requires verification. The calculation was based on Cohen's (1988) criteria, using an effect size of 0.60 and a power of 0.80, which yielded required sample size of 18 participants per groups. To account for potential dropouts, an additional 10% was added, resulting in 20 participants per group and a total sample size of 40 participants.

Eligibility criteria required participants to be aged 60–69 years, able to walk independently, and to answer "no" to all seven questions on the Physical Activity Readiness Questionnaire (PAR-Q). The questionnaire was administered prior to enrollment to identify any responses indicating the need for further assessment before exercise. Individuals reporting a neuromuscular or musculoskeletal injury affecting the lower limbs or lower back within the preceding six months were excluded. All participants received detailed information about the testing and exercise procedures before providing written informed consent. While, the official PAR-Q+ documentation can be cited to explain the purpose of pre-exercise screening, the specific version actually administered in this study should be verified before referring to it as the PAR-Q+ (PAR-Q+ Collaboration, 2024).

Intervention

The elastic band stretching program targeted both upper- and lower-body regions, including the neck, shoulders, chest, arms, back, trunk, hips, legs, and calves. The selection of elastic bands was based on evidence indicating that band-based exercises can improve physical performance in older adults. The prescribed 20-second hold and three repetitions per position align with published flexibility exercise recommendations (American College of Sports Medicine [ACSM], 2019; Li et al., 2024). These sources support the general exercise approach but do not specify how the ten specific positions used in this study were developed (American College of Sports Medicine [ACSM], 2019).

Participants in the intervention group attended three supervised sessions per week for six weeks, totaling 18 planned sessions. Each session lasted approximately 30 minutes and comprised ten elastic band positions. Participants held each position for 20 seconds and completed it for three sets. A 10-second rest was provided *between sets of the same position*, and a 20-second rest was provided *between successive positions*. Thus, the ten positions accounted for 10 minutes of holding time and, if all prescribed rest intervals were observed, 6 minutes and 20 seconds of rest. The activities occupying the remainder of 30-minute session were not specified in the source protocol. The earlier reference to "four weeks" has been corrected to six weeks to match the title and abstract; session records should confirm that all 18 sessions were delivered *(American College of Sports Medicine [ACSM], 2019)*.

All sessions were supervised by a trained exercise instructor who demonstrated the positions, observed participants' technique and timing, and corrected movements as needed. The researcher recorded attendance at each session. However, the source manuscript does not specify the band color or resistance, target stretching intensity, criteria for increasing band tension or range of motion, or adherence results. These details must be retrieved from the original training records before intensity or progression can be accurately reported.

Instruments

The following instruments were used: (a) The Demographic

Data Form, developed by the researcher, to collect information on age, weight, height, and BMI; (b) back flexibility was assessed using the Back Extension Test, and lower body flexibility was assessed using the Sit-and-Reach Test; (c) arm muscle strength was measured using the Hand Grip Dynamometer Test, back muscle strength using the Back Dynamometer Test, and leg muscle strength using the Leg Dynamometer Test; (d) arm muscle endurance was evaluated with the 30-Second Arm Curl Test, leg muscle endurance with the 30-Second Chair Stand Test, and dynamic balance was assessed using an agility course. All assessments followed standardized procedures described by Rikli and Jones (2013). All tests were administered at both the pretest and posttest stages of training.

Ethical considerations

The participants provided written informed consent to participate in the study, which was approved by the Research Ethics Review Committee of Udon Thani Rajabhat University on December 14, 2022 [approval number: 0622.7/840], in accordance with the 2013 revision of the Declaration of Helsinki.

Statistical analysis

Data were presented as mean ± SD. The Kolmogorov–Smirnov test was used to assess data normality, and the results indicated no significant deviations from normality (all $p > .05$), supporting the use of parametric tests. Paired t-tests were conducted to compare pretest and posttest values within each group, while independent-samples t-tests compared the intervention and control groups at both pretest and posttest for muscle strength, muscular endurance, flexibility, and agility-course time. Statistical significance was set at $p < .05$. All analyses were performed using IBM SPSS Statistics for Windows, version 21.0.

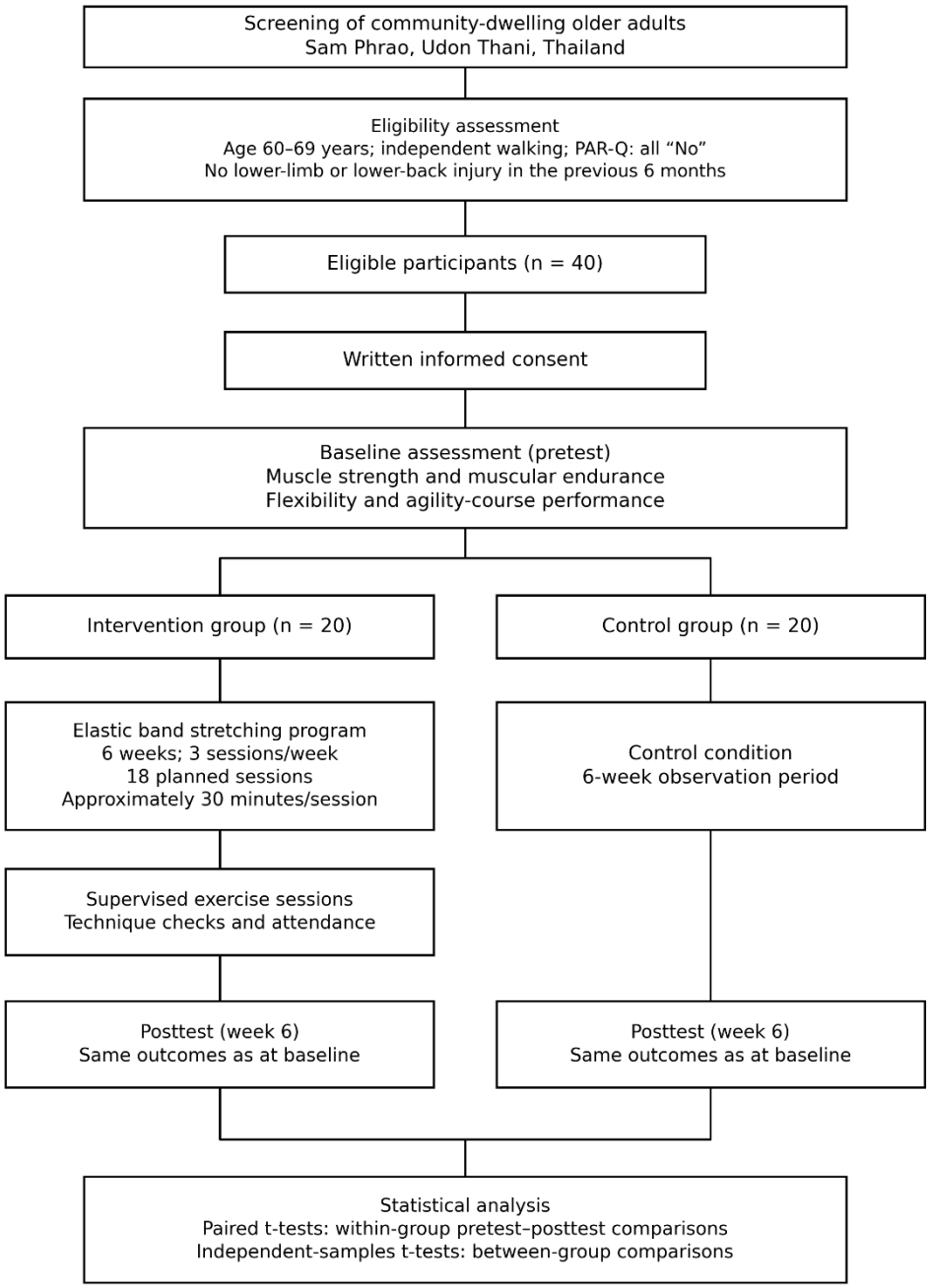


Figure 1. Flowchart of the six-week elastic band stretching study.

RESULT

Age, weight, and height differences between subjects in the Experimental and the Control groups are presented in Table 1.

Table 1. The description of figure is written below the figure

	Experimental Group		Control Group	
	$\bar{x}$	SD	$\bar{x}$	SD
Age (years.)	66.09	2.67	67.23	2.72
Weight (Kg.)	64.72	3.08	58.29	2.77
Height (cm.)	152.28	7.25	157.47	7.50
Body Mass Index (kg/m^2)	35.87	1.71	22.54	0.05

In the experimental group, muscle strength (back extension, leg extension, and handgrip strength), muscle endurance (30-second chair stand-sit test and 30-second arm curl tests), flexibility (back extension and sit-and-reach tests), and balance (timed up-and-go tests) showed significant differences ($p < 0.05$) (Table 2).

Table 2. The comparison of means and standard deviations between pretest and posttest in experimental group

	Pre-test		Post-test		t	p
	$\bar{x}$	SD	$\bar{x}$	SD		
Muscle Strength						
Back Strength Muscle (Kg/ 1 kg)	0.94	0.29	1.13	0.43	-3.410	.003*
Leg Strength Muscle (Kg/ 1 kg)	0.91	0.47	1.22	0.52	-4.852	< .001*
Arm Strength Muscle (Kg/ 1 kg)	0.35	0.11	0.44	0.11	-5.350	< .001*
Muscle Endurance						
30 Second Chair Stand (reps)	13.60	4.19	16.55	4.29	-8.393	< .001*
30 Second Arm Curl (reps)	18.65	4.14	22.75	4.97	-6.712	< .001*
Flexibility						
Back Extension (cm.)	23.38	6.32	30.83	8.84	-5.183	< .001*
Sit and Reach (cm.)	7.35	3.61	14.64	5.50	-4.565	< .001*
Balance						
Agility Corse (sec.)	18.40	1.30	16.44	2.05	4.058	.001*

** $p < .05$*

In the control group, there were no significant differences in muscle strength (back extension strength, leg extension strength, handgrip strength), muscle endurance (30-second chair stand-sit test and 30-second arm curl test), or flexibility (back extension and sit-and-reach tests). However, balance, as measured by the timed up-and-go test) showed a statistically significant difference at the 0.05 level (Table 3).

Table 3. The comparison of means and standard deviations between pretest and posttest in control group

	Pre-test		Post-test		t	p
	$\bar{x}$	SD	$\bar{x}$	SD		
Muscle Strength						
Back Strength Muscle (Kg/ 1 kg)	0.96	0.42	0.85	0.36	1.763	.094
Leg Strength Muscle (Kg/ 1 kg)	0.89	0.36	0.91	0.29	-0.554	.586
Arm Strength Muscle (Kg/ 1 kg)	0.30	0.09	0.32	0.06	-1.601	.126
Muscle Endurance						
30 Second Chair Stand (reps)	13.00	2.02	12.70	1.56	0.922	.386
30 Second Arm Curl (reps)	17.90	3.52	16.00	3.42	3.671	.002*
Flexibility						
Back Extension (cm.)	22.30	8.15	20.50	5.25	1.725	.101
Sit and Reach (cm.)	7.11	6.74	5.90	5.99	1.750	.096
Balance						
Agility Corse (sec.)	17.90	1.98	19.68	1.89	-3.521	.002*

** $p < .05$*

The comparison of means and standard deviations between the experimental and control groups showed no significant difference in the pretest. However, in the posttest, statistically significant differences were observed at the 0.05level in the following areas: muscle strength (back, leg, and arm muscle strength), muscle endurance (30-second chair stand and 30-second arm curl), flexibility (back extension and sit-and-reach), and balance (agility course) (Table 4).

Table 4. The comparison of means and standard deviations between the experimental group and the control group

		Experimental Group		Control Group		t	p
		$\bar{x}$	SD	$\bar{x}$	SD		
Muscle Strength							
Back Strength Muscle	Pretest	0.94	0.29	0.96	0.42	-0.206	.838
(Kg/ 1 kg)	Posttest	1.13	0.43	0.85	0.36	2.293	0.028*
Leg Strength Muscle	Pretest	0.91	0.47	0.89	0.36	0.152	.880
(Kg/ 1 kg)	Posttest	1.22	0.52	0.91	0.29	2.226	.034*
Arm Strength Muscle	Pretest	0.35	0.11	0.30	0.09	1.457	0.154
(Kg/ 1 kg)	Posttest	0.44	0.11	0.32	0.06	4.099	< .001*

Muscle Endurance							
30 Second Chair Stand	Pretest	13.60	4.19	13.00	2.02	0.577	0.567
(reps)	Posttest	16.55	4.29	12.70	1.56	3.766	0.001
30 Second Chair Stand	Pretest	18.65	4.14	17.90	3.52	0.617	0.541
(reps)	Posttest	22.75	4.97	16.00	3.42	5.003	< .001*
Flexibility							
Back Extension	Pretest	23.38	6.32	22.30	8.15	0.468	0.642
(cm.)	Posttest	30.83	8.84	20.50	5.25	4.488	< .001*
Sit and Reach	Pretest	7.35	3.61	7.11	6.74	0.146	0.885
(cm.)	Posttest	14.64	5.50	5.90	5.99	4.800	< .001*
Balance							
Agility Corse	Pretest	18.40	1.30	17.90	1.98	0.923	0.363
(sec.)	Posttest	16.44	2.05	19.68	1.89	-5.190	< .001*

*$p < .05$

DISCUSSION

The findings of the present study indicate that after six weeks of training, the elastic band stretching program yielded significant benefits. Participants in experimental group demonstrated notable improvements, with statistically significant differences ($p < .05$) observed in muscle strength, muscular endurance, flexibility, and balance. In contrast, the control group showed no significant changes. These results may be attributed to the mechanism by which muscle stretching enhances flexibility in both muscles and joints, enabling older adults to achieve a greater range of motion and reduce movement restrictions. This is supported by evidence showing reductions in passive joint stiffness following stretching in older adults, decreases in muscle-tendon unit stiffness through static stretching, and increases in range of motion and stretch tolerance with long-term stretching (Akagi et al., 2023; Liao et al., 2018; Muanjai et al., 2025). Stretching decreases tension in muscles and connective tissues, thereby enhancing the range of motion, as confirmed by meta-analytic evidence demonstrating reduced muscle and tendon stiffness after chronic static stretching. (Muanjai et al., 2025). Connective tissues, such as tendons and muscle fascia, also adapt to stretching resulting in improved flexibility and joint function, as supported by meta-analyses chronic stretch training. Recent studies further corroborate the positive effects of stretching on flexibility in older adults (Akagi et al., 2023; Liao et al., 2018; Muanjai et al., 2025).

In the exercise program, determining the frequency and duration of exercise is crucial for promoting physiological adaptations in older adults. Training three days per week provides repeated stimulation to muscles and connective tissues, leading to gradual improvements in flexibility, strength, and neuromuscular coordination, while allowing adequate recovery time to reduce the risk of injury. This approach aligns with American College of Sports Medicine (ACSM, 2018) guidelines, which recommend moderate-intensity flexibility and resistance exercises two to three times per week as sufficient for older adults. A training duration of 30 minutes per session provides a balanced workload that effectively targets multiple muscle groups while remaining appropriate for the physical capacity of older adults, without causing excessive fatigue. Regarding the number of sets and rest intervals, performing three sets per posture with a 20-second hold and short rest periods ensures that each muscle group receives adequate stimulation to induce adaptations in flexibility, strength, and muscular endurance, while minimizing the risk of injury.

Furthermore, elastic bands possess high flexibility, enabling them to stretch extensively and provide increasing resistance as they are extended. This characteristic promotes greater muscle activation during stretching, which can help enhance muscle strength. As a result, elastic band exercises lead to improvements in both muscle strength and endurance. Research has demonstrated that stretching and exercising with elastic bands can significantly increase muscle strength and endurance in older adults (Liao et al., 2018; Li et al., 2024).

Muscle stretching improves the strength of muscles involved in balance, such as the leg and back muscles. Strengthening these muscles positively affects body control and balance (Reddy & Alahmari, 2016). Additionally, muscle stretching increases the flexibility of muscles and joints, which is crucial for maintaining balance. Improved flexibility allows muscles and joints to better adapt to various movements, enabling the body to maintain balance across different postures effectively (Jung et al., 2023). Studies also indicate that muscle stretching contributes to overall body balance by improving the function of muscles involved in balance (Reddy & Alahmari, 2016). Consistent with the present findings, Bagiartana and Huriah (2023) reported greater improvements in back and leg muscle strength and dynamic balance in older adults who completed a four-week core stability exercise program than in the control group. Although their intervention differed from the elastic band stretching program used in the present study, the findings support the relevance of back and lower-limb muscle function to dynamic balance. However, the present study did not directly examine whether improvements in muscle strength mediated changes in balance performance. Furthermore, muscle stretching stimulates sensory perception related to changes in muscle length and tension in response to internal forces during stretching. This includes the perception of joint position, a key mechanism for maintaining balance through the sensorimotor system. Therefore, muscle stretching helps improve balance ability and prevent falls. In addition, research focusing specifically on stretching with elastic bands in older adults has found that such interventions can further enhance balance and stability. For example, studies show that resistance bands effectively improve in improving both strength and balance in the elderly population due to their capacity to provide adjustable resistance and engage muscles during stretching exercises (Young Ran Yeun, 2017; Reddy & Alahmari, 2016; Kwak et al., 2016).

This study has several limitations that should be acknowledged. First, the sample size was relatively small and drawn from a single community, which may limit the generalizability of the findings to other populations or regions. Second, the six-week intervention may have been insufficient to observe long-term adaptations in muscle strength, flexibility, or balance; therefore, longer-term studies are needed to evaluate sustained effects. Third, the study did not include a post-intervention follow-up, leaving the retention of benefits over time unknown. Fourth, participants' physical

activities outside the program were not strictly monitored, which could have influenced the outcomes. Finally, the study primarily focused on physical fitness parameters and did not assess other factors such as psychological well-being, functional independence in daily activities, or quality of life among older adults.

Limitations and implications

This study has several limitations that should be considered when interpreting the findings. First, the sample size was relatively small, comprising only 40 community-dwelling older adults recruited from a single community in Sam Phrao Subdistrict, Udon Thani Province. Therefore, the findings may not be generalizable to older adults with different demographic, health, or physical activity characteristics, nor to populations in other geographical regions. Second, the intervention lasted only six weeks. Although significant improvements were observed in muscle strength, muscular endurance, flexibility, and dynamic movement performance, this relatively short intervention period does not permit conclusions regarding the long-term effects or sustainability of these improvements. Third, no follow-up assessment was conducted after the completion of the intervention; consequently, it remains unclear whether the observed improvements were sustained after the program ended. Fourth, physical activities performed outside the supervised sessions were not strictly monitored, and variations in participants' daily physical activity may have influenced the outcomes. In addition, the study did not assess psychological well-being, functional independence, or quality of life, all of which are important dimensions of healthy aging. Finally, while the study measured functional outcomes, it did not directly assess the physiological mechanisms underlying the observed changes, such as muscle activation, muscle–tendon stiffness, or neuromuscular adaptations.

Despite these limitations, the findings have practical implications for community-based exercise programs targeting older adults. The six-week elastic band stretching program was associated with improvements in muscle strength, muscular endurance, flexibility, and dynamic movement performance. This suggests that elastic band-based exercise may be a practical and accessible approach to promoting physical function among community-dwelling older adults. Because elastic bands are relatively simple to use and the intervention was delivered through supervised sessions, this type of program may be adaptable to community health promotion activities, elderly clubs, and other settings where access to conventional exercise equipment is limited. Beyond physical performance, exercise interventions have also been investigated for cardiovascular outcomes in older adults. Rohmana et al. (2025) reported reductions in systolic and diastolic blood pressure following ergonomic and isometric handgrip exercises in older adults with hypertension, with larger reductions observed in the ergonomic exercise group. Although these interventions and outcomes differed from those of the present study, their findings suggest that future evaluations of elastic band stretching could include blood pressure alongside physical performance measures to examine its potential broader health effects. However, these findings should be interpreted as evidence of short-term improvements within the study population rather than evidence of long-term effectiveness or fall prevention.

Future studies should recruit larger and more diverse samples from multiple communities and employ randomized allocation whenever feasible. Longer intervention periods and follow-up assessments are also recommended to determine whether improvements in physical function are sustained over time. Additionally, future research should monitor participants' physical activity outside intervention, systematically document exercise adherence and progression, more systematically, and include outcomes such as activities of daily living, psychological well-being, quality of life, and actual fall events. Measuring physiological and neuromuscular mechanisms may further clarify how elastic band stretching contributes to improvements in physical function among older adults.

CONCLUSION AND RECOMMENDATION

The study found that stretching exercises can improve flexibility, muscle strength, muscle endurance, and balance in the elderly individuals. Additionally, resistance band stretching programs can be implemented in elderly populations, potentially reducing common health issues in this age group. This approach may also lower healthcare costs associated with muscle pain, mobility issues, and fall-related incidents, while enhancing overall physical movement efficiency.

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