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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.
GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.
ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman** (**Кириллица**), ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ,რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

Содержание:

RETROSPECTIVE EVALUATION OF A COMMUNITY-BASED ELASTIC BAND EXERCISE PROGRAM USING A BALANCE PAD IN RURAL OLDER WOMEN

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Abstract.

Background: Older women living in rural areas may have limited access to structured exercise programs and are vulnerable to declines in muscle strength and balance. This study evaluated changes after an 8-week community-based exercise program using elastic-band exercise performed on a balance pad.

Methods: This retrospective observational study included 38 community-dwelling older women who participated in a rural musculoskeletal disorder prevention program. The program was conducted once weekly for 8 weeks, with 30-minute sessions. Grip strength, Functional Reach Test (FRT), and Korean Falls Efficacy Scale-International (KFES-I) scores were assessed before and after the program. Subgroup analyses were also performed according to fall experience in the previous 12 months.

Results: After the intervention, significant improvements were observed in left grip strength (20.95 ± 3.74 vs. 23.14 ± 3.93 kg, p<0.001), right grip strength (21.33 ± 2.57 vs. 23.82 ± 2.58 kg, p<0.001), FRT-left (25.47 ± 3.43 vs. 28.50 ± 3.28 cm, p<0.001), and FRT-right (25.82 ± 3.57 vs. 28.61 ± 3.44 cm, p<0.001). KFES-I scores significantly decreased from 60.24 ± 3.679 to 56.45 ± 5.75 (p<0.001), indicating improved fall-related self-efficacy. In subgroup analyses according to fall experience, both groups showed significant within-group changes in all variables. However, between-group differences in change scores should be interpreted cautiously because the subgroup analyses were exploratory and limited by small sample sizes.

Conclusions: These findings suggest that an 8-week elastic-band exercise program performed on a balance pad may be a feasible low-cost community-based intervention for rural older women. However, because of the retrospective single-group design, the findings should be interpreted cautiously, and further controlled studies are needed to confirm effectiveness.

Key words. Women, elastic band, balance pad, strength, balance, fall.

Introduction.

Accessibility to health care is closely related to overall health and influences physical activity, use of medical services, and the acquisition of health information [1]. The distribution of medical resources and economic and social conditions shape individuals' ability to manage health, while access to health information is critical for preventive care and health maintenance. Limited access reduces opportunities for early detection and timely treatment, thereby contributing to health disparities [2].

People living in rural areas generally have poorer access to both health information and healthcare institutions than those in urban settings. This gap is driven by geographic distance, adverse weather, financial constraints, and limited availability of specialized services [3]. Rural populations also tend to experience higher all-cause mortality and greater early mortality from major conditions, alongside lower preventive service use and more frequent unhealthy behaviors, which together affect life expectancy and healthy life expectancy. In addition, rural regions contain a higher proportion of older adults than urban areas, further increasing the burden of age-related health problems [4].

Physical inactivity is a major and preventable contributor to morbidity and mortality [5]. Participation in aerobic physical activity has declined over time and decreases markedly with age. Notably, older women show particularly low participation, and the gender gap widens among adults aged 70 years and older, suggesting greater vulnerability to functional decline in older women [6]. Aging is associated with deterioration in both health-related fitness and skill-related capacities. These changes are driven by progressive loss of muscle mass and strength, slower neuromuscular activation, and impaired sensory integration, which collectively compromise mobility and functional independence [7]. Consequently, interventions that target balance and muscle strength are essential to preserve function and reduce fall risk in older adults [8]. Resistance exercise performed under unstable surface conditions may simultaneously challenge neuromuscular coordination and postural control, offering a potentially practical approach for improving functional performance in rural older women [9].

In rural settings, older adults are often exposed to physical demands that differ from those in urban environments. Daily tasks such as farming, gardening, carrying loads, walking on uneven terrain, and prolonged squatting require continuous postural adjustment, trunk stabilization, and lower limb strength, thereby increasing reliance on dynamic balance control and sensorimotor integration [10]. Uneven ground surfaces commonly encountered in rural areas may further elevate fall risk by placing greater demands on proprioceptive and neuromuscular control systems. Despite these con-text-specific risks, evidence remains limited regarding feasible, community-based exercise strategies tailored to rural older women [11].

As populations age, age-related declines in muscle mass, balance, and bone density contribute to functional limitation, increased fall risk, and reduced mobility, which may lead to difficulties in independent daily living and psychosocial withdrawal [12]. Although aging is unavoidable, maintaining a healthy lifestyle particularly regular physical activity before disease onset has been associated with preserved function, im-proved quality of life, and reduced societal healthcare burden [13]. Therefore, scalable interventions that can be implemented within rural communities are needed to address functional decline and fall risk in older adults, especially among older women who may face compounded barriers to structured exercise participation [11]. In addition, sex-specific physiological changes should be considered when addressing functional decline in older women. Postmenopausal hormonal reduction, particularly decreased estrogen levels, accelerates loss of muscle mass, bone density, and neuro-muscular efficiency [14]. Older women generally exhibit lower absolute muscle mass and grip strength compared to men of similar age, and age-related sarcopenia progresses more rapidly in women due to combined endocrine and behavioral factors. These biological differences may increase susceptibility to balance impairment and fall risk, particularly in rural settings where structured exercise opportunities are limited [15,16]. Declines in physical function are closely related to limitations in daily living and are associated with an increased risk of falls. Falls are common among older adults and can have particularly serious consequences in those with osteoporosis or in those receiving anticoagulant therapy [17,18]. Fall-related injuries may include fractures, particularly of the hip and upper extremities, as well as head injuries and bleeding complications. Ap-proximately one-third of community-dwelling adults aged 65 years and older experience at least one fall down each year, and falls are associated with hospitalization, loss of independence, and increased morbidity [19]. In addition, falls may lead to temporary immobility and activity restriction, which can contribute to physical inactivity, malnutrition, loss of muscle strength, and further decline in functional capacity, thereby in-creasing the risk of recurrent falls [20].

However, limited evidence is available regarding feasible community-based exercise strategies combining resistance exercise and unstable-surface training for rural older women. Given the practical constraints in rural settings, accessible and low-cost exercise programs are needed. Therefore, this retrospective study aimed to investigate short-term pre–post changes in grip strength, dynamic balance, and fall-related self-efficacy after an 8-week elastic-band exercise program performed on a balance pad in community-dwelling rural older women. In addition, subgroup analyses were performed according to fall experience during the previous 12 months. The findings were intended to provide preliminary practice-based evidence for future controlled studies.

Materials and Methods.

Study Design:

This study was a retrospective observational analysis of routinely collected assessment data from an existing rural community exercise program. The program was implemented as part of the musculoskeletal disorder prevention initiative operated by the Agricultural Technology Center, and the present research analysis was planned after completion of the program. The study did not involve randomization, investigator-driven allocation, or a non-intervention comparator group.

Assessments were conducted as part of routine program evaluation at two time points: baseline testing was performed immediately before the first program session, and post-program testing was performed after completion of the final session at week 8. Prior to program participation, all participants provided written consent permitting the use of their personal information and program-related evaluation data for research purposes. For the present retrospective analysis, only de-identified data were extracted and analyzed. This retrospective analysis was approved by the Institutional Review Board of Cheongju University (approval number: 1041107-202404-HR-014-02). All data were de-identified before analysis, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Study Participants:

Participants were community-dwelling older women who enrolled in the rural musculoskeletal disorder prevention program delivered through the Agricultural Technology Center. Eligibility for the present analysis was determined using program records.

To be included, participants were required to (1) have completed all scheduled weekly sessions during the 8-week program (no missed sessions) and (2) have complete paired outcome measurements at both baseline (pre-program) and post-program (after week 8) assessments. Participants were excluded if they missed any weekly session, or if baseline or post-program assessments were missing, incomplete, or not recorded ac-cording to the program's standard schedule, making valid pre–post comparison impossible. Therefore, the analytic sample comprised complete cases with attendance-confirmed participation and paired baseline/post-program assessments for all study outcomes. Accordingly, 38 participants who attended all weekly sessions throughout the 8-week program and had paired pre- and post-program assessments were included in the final analysis. The present analysis included only community-dwelling older women with complete attendance and paired pre- and post-program assessments. Participants with incomplete demographic or outcome data were excluded from the final analysis.

Program Description:

The program evaluated in this study was an existing community-based exercise program delivered through the Agricultural Technology Center's musculoskeletal disorder prevention initiative. The program was implemented as usual community ser-vices, and the present study retrospectively analyzed routinely collected pre–post assessments from participants who completed the program. The program was conducted once weekly for 8 weeks, with a supervised 30-minute session each week.

Each weekly session was delivered as a 30-minute supervised program performed on a balance pad with an elastic resistance band (Figure 1). The session began with a 5-minute warm-up in which participants stood on the balance pad with feet shoulder-width apart and performed side-to-side weight shifting (Figure 1a). The main exercise component lasted 20 minutes and was performed while standing on the balance pad with the feet together. During this block, participants completed four 5-minute elastic-band tasks. First, participants maintained a stable trunk posture, extended the arms forward, then pulled the elbows backward to the sides; trunk rotation was added while keeping the elbows fixed to increase pulling demand (Figure 1b). Second, participants stepped on the elastic band with one foot and pulled the band with the opposite hand, incorporating shoulder abduction and trunk rotation while visually following the moving hand (Figure 1c). Third, the band was positioned under the armpits and participants pushed forward by extending the elbows with the shoulders held at approximately 90° of flexion (Figure 1d). Fourth, the band was secured under both feet and participants pushed upward with the hands raised overhead (approximately 180° of shoulder abduction) (Figure 1e). The session ended with a 5-minute cool-down consisting of stretching exercises (Figure 1f).

Outcome measurements:

The FRT was selected due to its established validity and sensitivity in detecting dynamic balance changes in community-dwelling older adults. Handgrip strength was included as a widely recognized indicator of global muscle strength and functional re-serve. The KFES-I was selected to assess psychological components of fall-related self-efficacy, which may influence activity participation and movement confidence. The assessment tools used in this study have demonstrated excellent reliability in older adult populations.

The grip strength test is a simple and reliable method for objectively assessing upper limb muscle strength. In this study, the evaluation was performed using the JAMAR Hand Dynamometer (Sammons Preston, USA), which is internationally standardized and widely used in Korea.

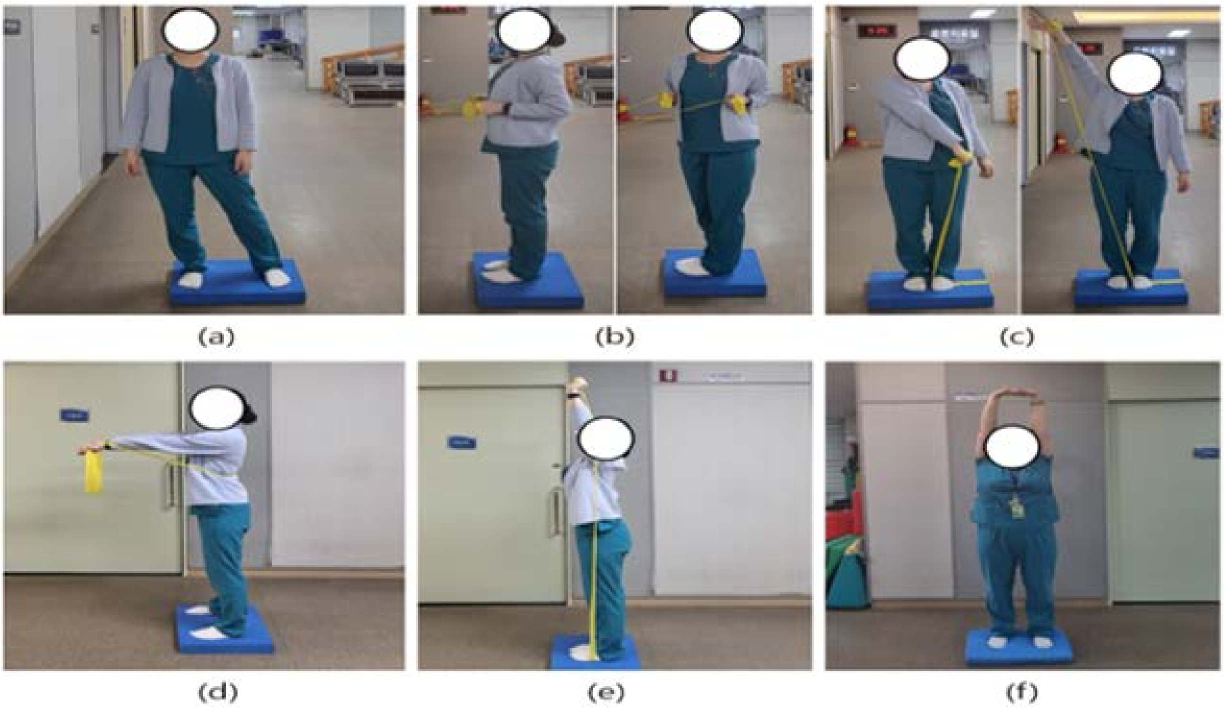

Figure 1. *Components of the 8-week community exercise program: elastic-band resistance exercises performed on a balance pad. (a) Warm-up (5 min): side-to-side weight shifting. (b–e) Main exercises (20 min total; 5 min each): (b) pull with trunk rotation, (c) step-on band cross-body pull with shoulder abduction and trunk rotation (bilateral), (d) forward push with the band positioned under the armpits (≈90° shoulder flexion), and (e) overhead push with the band secured under both feet (≈180° shoulder abduction). (f) Cool-down (5 min): stretching.*

Table 1. *Participant's general characteristics (N = 38).*

Characteristic	**Value**
Age (years)	77.26 ± 14.87
Height (cm)	154.39 ± 25.45
Weight (kg)	57.36 ± 12.47
BMI (kg/m^2)	24.35 ± 3.27
Fall in the previous 12 months (yes, %)	21 (55.26)

Abbreviations: *BMI: Body Mass Index. Notes: data are reported as mean ± SD or percentage.*

Table 2. *Analysis of changes in post-test relative to pre-test of all subjects (N = 38).*

Evaluation	**Pre-test**	**Post-test**	***t***	***p***
GS left (kg)	20.95 ± 3.74	23.14 ± 3.93	-6.71	<0.001**
GS right (kg)	21.33 ± 2.57	23.82 ± 2.58	-7.15	<0.001**
FRT left (cm)	25.47 ± 3.43	28.50 ± 3.28	-8.38	<0.001**
FRT right (cm)	25.82 ± 3.57	28.61 ± 3.44	-7.74	<0.001**
KFES-I (score)	60.24 ± 3.67	56.45 ± 5.75	7.22	<0.001**

Abbreviations: *GS: Grip Strength; FRT: Functional Reach Test; KFES-I: Korean Version of the Falls Efficacy Scale–International; ** p < 0.001. Notes: data are reported as mean ± SD.*

Table 3. *Comparative analysis of changes within the group based on fall experience.*

Group	Evaluation	Pre-test	Post-test	*t*	*p*
FNEG (n = 17)	GS left (kg)	20.95 ± 3.03	22.71 ± 3.22	-4.44	<0.001**
	GS right (kg)	22.01 ± 2.04	23.74 ± 1.99	-5.55	<0.001**
	FRT left (cm)	25.94 ± 3.73	29.06 ± 3.36	-5.83	<0.001**
	FRT right (cm)	25.24 ± 2.43	27.82 ± 3.18	-5.69	<0.001**
	KFES-I (score)	60.71 ± 3.19	56.82 ± 4.43	-6.54	<0.001**
FEG (n = 21)	GS left (kg)	21.75 ± 4.30	23.49 ± 4.47	-5.16	<0.001**
	GS right (kg)	20.95 ± 2.86	23.88 ± 3.02	-5.65	<0.001**
	FRT left (cm)	25.10 ± 3.20	28.05 ± 3.23	-5.90	<0.001**
	FRT right (cm)	26.29 ± 4.28	29.24 ± 3.59	-5.41	<0.001**
	KFES-I (score)	59.86 ± 4.06	56.14 ± 6.73	-4.46	<0.001**

Abbreviations: *FNEG: Fall Non-Experience Group; FEG: Fall Experience Group; GS: Grip Strength; FRT: Functional Reach Test; KFES-I: Korean Version of the Falls Efficacy Scale–International; ** $p < 0.001$. Notes: data are reported as mean ± SD.*

Table 4. *Exploratory comparison of change scores between groups according to fall experience.*

Evaluation	FNEG (n = 17)	FEG (n = 21)	*t*	*p*
GS left (kg)	-1.76 ± 1.63	-2.53 ± 2.24	1.17	0.246
GS right (kg)	-1.74 ± 1.30	-3.09 ± 2.50	2.21	0.049*
FRT left (cm)	-3.12 ± 2.20	-2.95 ± 2.29	-0.22	0.823
FRT right (cm)	-2.59 ± 1.87	-2.81 ± 2.50	0.49	0.622
KFES-I (score)	3.88 ± 2.44	3.71 ± 2.81	0.15	0.876

Abbreviations: *FNEG: Fall Non-Experience Group; FEG: Fall Experience Group; GS: Grip Strength; FRT: Functional Reach Test; KFES-I: Korean Version of the Falls Efficacy Scale–International; * $p < 0.05$. Notes: data are reported as mean ± SD.*

Participants were seated with the shoulder in a neutral position, elbow flexed at 90 degrees, forearm in a neutral position, and wrist extended be-tween 0–30 degrees. They were instructed to squeeze the handle with maximum force. Each hand was tested twice, and the higher value was used for analysis. Grip strength is closely associated with overall muscle strength, physical function, and frailty, making it a valuable indicator of physical health in older adults. Handgrip strength was recorded in kilograms (kg) as displayed by the dynamometer.

The FRT is a reliable and widely used tool to assess dynamic balance, particularly in older adults and individuals at risk of falling. The test involves having the participant stand next to a wall-mounted measuring tape, extend one arm forward at shoulder height, and reach as far forward as possible without losing balance or taking a step. The distance between the starting position of the fingertips and the furthest reach point is measured. This test provides a quantitative measure of dynamic balance. It is simple, quick to administer, and effective in predicting fall risk in community-dwelling older adults.

KFES-I is a self-reported questionnaire designed to assess fear of falling during various daily activities. It consists of 16 items, each rated on a 4-point Likert scale (1 = not at all concerned to 4 = very concerned) indicating the level of concern about falling while performing specific tasks such as walking around the house, going out, or taking a bath. The total score ranges from 16 to 64, with higher scores indicating a greater fear of falling. The FES-I has been shown to have high reliability and validity and is widely used for quantifying fear of falling in older adults. In this study, KFES-I was utilized.

Statistical Analysis:

All statistical analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics and outcome variables. Continuous variables are presented as mean ± standard deviation, and categorical variables as number and percentage. The normality of continuous variables and change scores was assessed using the Shapiro–Wilk test because of the small sample size. Pre–post changes in the total sample were analyzed using paired t-tests. Subgroup analyses according to fall experience were conducted as exploratory analyses. Between-group differences in baseline values and change scores were initially examined using independent t-tests. When normality assumptions for change scores were not satisfied, nonparametric sensitivity analyses using the Mann–Whitney U test were performed. In addition, ANCOVA models adjusted for baseline values were used as sensitivity analyses for between-group comparisons. The minimum required sample size was estimated using G*Power version 3.1 for the primary paired pre–post comparison in the total sample, not for subgroup comparisons. Therefore, subgroup analyses should be interpreted cautiously because of the limited statistical power. A p-value of less than 0.05 was considered statistically significant.

Results.

A total of 38 community-dwelling older women were included in the final analysis (Table 1). The mean age of the participants was 77.26 ± 14.87 years. The mean height, weight, and body mass index were 154.39 ± 25.45 cm, 57.36 ± 12.47 kg, and 24.35 ± 3.27 kg/m², respectively. Twenty-one participants (55.26%) self-reported at least one fall during the previous 12 months.

Significant improvements were observed in all outcome measures after completion of the 8-week program (Table 2). Left grip strength increased from 20.95 ± 3.74 to 23.14 ± 3.93 kg ($t = -6.71$, $p < 0.001$), and right grip strength increased from 21.33 ± 2.57 to 23.82 ± 2.58 kg ($t = -7.15$, $p < 0.001$).

Dynamic balance, assessed by the Functional Reach Test, also improved significantly, with FRT-left increasing from 25.47 ± 3.43 to 28.50 ± 3.28 cm ($t = -8.38$, $p < 0.001$) and FRT-right increasing from 25.82 ± 3.57 to 28.61 ± 3.44 cm ($t = -7.74$, $p < 0.001$). In addition, KFES-I scores significantly decreased from 60.24 ± 3.67 to 56.45 ± 5.75 ($t = 7.22$, $p < 0.001$), indicating improvement in fall-related self-efficacy.

In the fall non-experience group, all outcome measures showed significant pre–post changes after the 8-week program (Table 3). Left grip strength increased from 20.95 ± 3.03 to 22.71 ± 3.22 kg ($t = -4.44$, $p < 0.001$), and right grip strength increased from 22.01 ± 2.04 to 23.74 ± 1.99 kg ($t = -5.55$, $p < 0.001$). FRT-left increased from 25.94 ± 3.73 to 29.06 ± 3.36 cm ($t = -5.83$, $p < 0.001$), and FRT-right increased from 25.24 ± 2.43 to 27.82 ± 3.18 cm ($t = -5.698$, $p < 0.001$). KFES-I scores decreased from 60.71 ± 3.19 to 56.82 ± 4.43 ($t = -6.54$, $p < 0.001$).

Similarly, in the fall experience group, all measured outcomes improved significantly after the intervention. Left grip strength increased from 21.75 ± 4.30 to 23.49 ± 4.47 kg ($t = -5.16$, $p < 0.001$), and right grip strength increased from 20.95 ± 2.86 to 23.88 ± 3.02 kg ($t = -5.65$, $p < 0.001$). FRT-left increased from 25.10 ± 3.20 to 28.05 ± 3.23 cm ($t = -5.90$, $p < 0.001$), and FRT-right increased from 26.29 ± 4.28 to 29.24 ± 3.59 cm ($t = -5.41$, $p < 0.001$). KFES-I scores decreased from 59.86 ± 4.06 to 56.14 ± 6.73 ($t = -4.46$, $p < 0.001$).

When the magnitude of change was compared between groups, a significant between-group difference was observed only for right grip strength (Table 4). The fall experience group showed a greater change in right grip strength than the fall non-experience group (-3.09 ± 2.50 vs. -1.74 ± 1.30, $t = 2.21$, $p = 0.049$). In contrast, no significant between-group differences were found for left grip strength ($p = 0.246$), FRT-left ($p = 0.823$), FRT-right ($p = 0.622$), or KFES-I scores ($p = 0.876$). These findings suggest that both groups demonstrated broadly similar improvements across most outcomes, regardless of fall experience, with the exception of right grip strength. Because the subgroup sample sizes were small, ANCOVA adjusted for baseline values was additionally performed as a sensitivity analysis. The baseline-adjusted ANCOVA did not confirm significant between-group differences in any outcome, including right grip strength. Therefore, the subgroup findings should be interpreted cautiously.

Discussion.

This retrospective observational study evaluated short-term pre–post changes associated with an 8-week community-based exercise program consisting of elastic-band resistance exercise performed on a balance pad in rural older women. The principal findings were as follows. First, significant improvements were observed in bilateral grip strength and dynamic balance, as assessed by the Functional Reach Test, after participation in the program. Second, KFES-I scores significantly decreased, suggesting an improvement in fall-related self-efficacy. Third, when participants were stratified according to fall experience during the previous 12 months, both subgroups showed significant within-group improvements across all measured outcomes. However, between-group subgroup comparisons did not provide robust evidence of differential changes according to fall experience after considering the small subgroup sample sizes and sensitivity analyses. Overall, these findings suggest that a brief, low-cost, community-deliverable exercise program may be associated with multidimensional functional benefits in rural older women, although the results should be interpreted cautiously because of the retrospective single-group design.

Interpretation of the main findings in a rural community context.

The present study is meaningful in that it provides practice-based evidence from a real-world rural setting, where older women may face limited access to structured exercise, preventive services, and rehabilitation resources. As noted in the Introduction, rural residence is often associated with reduced healthcare accessibility, lower preventive service use, and a greater burden of age-related functional problems [1-4]. In addition, older women are particularly vulnerable to declines in muscle strength, balance, and physical activity participation [6,12,14-16]. In this context, the present findings suggest that an exercise program requiring minimal space and low-cost equipment may still be associated with favorable short-term changes in physical and psychological outcomes relevant to fall-related function. The fact that the program was delivered through an Agricultural Technology Center initiative further supports its potential feasibility within existing rural community infrastructures.

Grip strength outcomes.

Bilateral grip strength significantly increased after the 8-week program. Although grip strength is an upper-extremity measure, it is widely recognized as a practical indicator of overall muscle strength, functional reserve, frailty status, and general health in older adults [21,22]. Therefore, the observed improvement may reflect not only local upper-limb adaptation but also broader functional adaptation to repeated exercise participation.

A plausible explanation is related to the structure of the intervention itself. The program incorporated repeated elastic-band pulling and pushing movements while participants stood on an unstable surface. Such tasks likely required coordinated activation of the upper limbs, trunk, and postural muscles, may have contributed to improved neuromuscular coordination, although learning effects related to repeated testing cannot be excluded [23-26]. In older adults, even relatively brief training exposure may improve motor unit recruitment, intermuscular coordination, and efficiency of force transmission, which could contribute to measurable gains in grip strength [25,26]. These mechanisms may be particularly relevant in rural older women, who often have fewer opportunities to engage in structured resistance exercise [11,23].

The present findings are also consistent with previous studies reporting that elastic-band training can improve strength-related outcomes in older women. Hernandez-Martinez et al. [27] reported beneficial effects of elastic-band training on physical performance in older women, while Valdés-Badilla et al. [28] also found improvement in physical-functional outcomes after elastic-band exercise in older women with sarcopenia. Although the frequency and training dose of those interventions were greater than in the present study, the direction of change was similar. This suggests that even a once-weekly community-based format may still be associated with detectable strength-related improvement when the program includes repeated resistance tasks performed in a controlled and supervised manner. However, given the absence of a comparator group, the current findings should be interpreted as program-associated changes rather than definitive evidence of effectiveness.

Dynamic balance outcomes.

Dynamic balance improved significantly on both sides, as shown by the increase in FRT distance after the intervention. The FRT is a simple but clinically meaningful tool for evaluating dynamic balance and forward stability in older adults, and poorer performance has been associated with instability, mobility limitation, and increased fall risk [29,30]. Therefore, the improvement observed in the present study suggests potential enhancement of balance-related function relevant to daily mobility.

One likely explanation is that the balance pad increased postural demands during exercise. Standing on an unstable surface challenges proprioceptive input, postural control, and continuous weight-shifting ability [31,32]. Because the participants simultaneously performed elastic-band movements, the program may have promoted dynamic integration of upper-limb movement with trunk stabilization and balance control. Such combined demands may be particularly important for older adults because daily activities rarely require isolated strength or isolated balance alone; rather, they depend on coordinated control of posture and movement under changing environmental conditions. In rural settings, where uneven terrain and physically demanding daily tasks are common, improvements in dynamic balance may be especially relevant [10,11]. The improvement in FRT performance should also be interpreted in the context of rural daily life. Older adults living in rural areas may engage in seasonally variable physical activities, including agricultural work, gardening, walking on uneven terrain, carrying loads, and domestic tasks. These activities require lower-extremity strength, trunk control, anticipatory postural adjustment, and dynamic balance. Therefore, changes in physical activity or ADLs outside the program may have contributed to the observed improvement in FRT performance. Because this study did not measure seasonal workload, daily step count, physical activity level, or ADL participation, the independent effect of the exercise program on dynamic balance cannot be fully isolated.

These findings are supported by previous literature indicating that unstable-surface or multimodal exercise programs can improve balance performance in older adults. Rizzato et al. [9] reported that multimodal training on unstable surfaces may produce greater gains in dynamic balance than training performed on stable surfaces. Similarly, Ferreira et al. [33] and Eckardt [34] demonstrated that structured exercise programs incorporating balance-challenging components were associated with improvements in functional balance-related outcomes. Although intervention details differ across studies, the current results are conceptually aligned with the broader evidence that balance-oriented training can improve functional reach and postural control in older populations.

KFES-I and fall-related self-efficacy.

KFES-I scores significantly decreased after the 8-week program, indicating improved fall-related self-efficacy and reduced fear of falling. This result is clinically important because fear of falling is not merely a psychological symptom; it can reduce physical activity participation, increase avoidance behavior, contribute to deconditioning, and ultimately worsen functional decline [35-38]. In rural older women, this issue may be especially relevant because environmental demands are often greater and access to supervised exercise opportunities may be more limited [16,36].

Several mechanisms may explain the decrease in KFES-I scores. First, repeated exposure to supervised and progressively challenging tasks may reduce perceived threat during movement. When older adults repeatedly practice weight shifting, reaching, and balance-related tasks in a safe setting, they may develop greater confidence in their own postural control. Second, physical improvements in strength and balance may reinforce perceived physical capability, thereby reducing concern about falling during daily activities. In other words, the psychological change may have been supported by simultaneous physical change. This interpretation is consistent with previous work showing associations between exercise participation, balance confidence, and reduced fear of falling [38-40].

The present finding is also in line with prior intervention studies. Chittrakul et al. [39] showed that a multicomponent physical exercise intervention improved fall-related outcomes in pre-frail older adults, while a recent randomized trial comparing the Otago Exercise Program and gaze stability exercise also demonstrated improvements in fear of falling [40]. Although the present program was shorter and less intensive than many established exercise interventions, the direction of change was comparable. This suggests that even a modest, pragmatic rural community program may have meaningful psychological relevance when it combines repeated movement practice with postural challenge. However, the decrease in KFES-I scores should also be interpreted cautiously. Participation in a supervised community program may have increased participants' confidence, perceived attention from instructors, and motivation to move safely. Therefore, nonspecific participation effects, including placebo effects or the Hawthorne effect, may have partly contributed to the improvement in fall-related self-efficacy. Future controlled studies are needed to distinguish the specific effects of the exercise components from the effects of supervised participation and social engagement.

Clinical and community implications.

The present study has several practical implications. First, the intervention was implemented within a routine community service setting rather than under tightly controlled laboratory conditions. This enhances its relevance for real-world application. Second, the program used only a balance pad and elastic resistance band, both of which are relatively inexpensive and portable. Such characteristics are especially important in rural settings, where access to specialized rehabilitation equipment and personnel may be limited. Third, the observed improvements across physical and psychological domains suggest that brief multicomponent programs may offer broader benefits than interventions targeting a single domain only. For rural community-dwelling older women, a low-cost program that simultaneously addresses strength, balance, and fall-related confidence may therefore be a practical option for preventive community health initiatives.

Limitations and future directions.

Several limitations should be considered. First, the retrospective single-group pre–post design does not allow causal inference and cannot exclude alternative explanations such as temporal effects, regression to the mean, placebo effects, or the Hawthorne effect. Second, the observed improvement in grip strength may have been influenced by a learning effect related to repeated use of the JAMAR dynamometer, because no separate familiarization session or non-exercise control group was included. Third, only participants with complete attendance and paired assessments were included, which may introduce selection bias and limit generalizability to less adherent or more functionally limited individuals. Fourth, the subgroup analyses according to fall experience were exploratory and likely underpowered because of the small sample sizes in the fall non-experience and fall experience groups. In addition, several change-score variables did not satisfy normality assumptions. Although sensitivity analyses using nonparametric tests and baseline-adjusted ANCOVA were performed, subgroup findings should be interpreted as hypothesis-generating rather than confirmatory. Fifth, seasonal variation in agricultural and domestic activities was not measured. Because these activities may influence physical activity levels, lower-extremity function, trunk control, and dynamic balance in rural older adults, their potential contribution to the observed FRT changes cannot be excluded. Sixth, fall history was based on self-reported falls during the previous 12 months. Therefore, recall bias may have affected the classification of participants into fall non-experience and fall experience groups, particularly because minor falls without fracture or medical treatment may have been forgotten or underreported. Finally, no follow-up assessment was performed, and actual fall incidence after the intervention was not recorded. Therefore, further prospective controlled studies with larger samples, objective monitoring of physical activity, standardized familiarization procedures, and longer follow-up periods are needed to confirm the effectiveness and clinical relevance of this program.

Conclusion.

In conclusion, participation in an 8-week community-based elastic-band exercise program performed on a balance pad was associated with significant pre–post improvements in grip strength, dynamic balance, and fall-related self-efficacy in rural older women. However, because this study used a retrospective single-group design, the observed changes may have been influenced by learning effects, nonspecific participation effects, seasonal physical activity, and other uncontrolled factors. Subgroup analyses according to fall experience were exploratory and should be interpreted cautiously. Future prospective controlled studies with larger samples, standardized familiarization procedures, objective physical activity monitoring, and longer follow-up are needed to confirm the effectiveness and clinical relevance of this program.

Conflict of Interest.

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