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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 ВИНТИ 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 ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებშიდან.

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. Корректур авторам не высылаются, 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 computer-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 საქურაღებოლ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დაიცვათ 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 შედეგების 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 ფხიხლებში 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.

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CONTEXTUAL ANALYSIS OF ADAPTED BOXING AND KICK-/KNEE-STRIKE EXERCISE MODULES IN MULTIDISCIPLINARY NEUROREHABILITATION AND NURSING CARE: SECONDARY ANALYSIS OF TWO PROSPECTIVE STUDIES

Gani Uakkazy¹, Chingiz Shashkin², Natalya Slivkina^{3*}, Viktor Tkachev^{3*}, Mirbanu Aikhozhayeva³, Gulbana Khussainova³, Raushan Baigenzheyeva⁶, Zilola Mavlyanova⁴, Raikhan Burumbaeva³, Mereke Alaidarova¹, Joseph Almazan⁵, Amangali Akanov⁷.

¹Department of Nursing, NJSC "Astana Medical University", Astana, Kazakhstan.

²Clinic of Modern Neurology and Neurorehabilitation "Shashkin Clinic", Almaty, Kazakhstan.

³Department of Rehabilitation and Sports Medicine, NJSC "Astana Medical University", Astana, Kazakhstan.

⁴Samarkand State Medical University, Samarkand, Uzbekistan.

⁵Department of Medicine, School of Medicine, Nazarbayev University, Astana, Kazakhstan.

⁶Department of Epidemiology and Biostatistics, NJSC "Astana Medical University", Astana, Kazakhstan.

⁷Central Clinical Hospital for Veterans of the Patriotic War, Astana, Kazakhstan.

Abstract.

Introduction: Martial arts-inspired exercise programs are increasingly used as adjuncts to neurorehabilitation for gait and balance impairments.

Objective: To perform a descriptive secondary analysis of two martial arts-inspired rehabilitation modules implemented within multidisciplinary inpatient neurorehabilitation and nursing care.

Methods: A post hoc secondary analysis was conducted using aggregated results from two prospective parallel-group studies (total N = 96). The first study included a mixed cohort of patients with gait impairments, whereas the second included patients with Parkinson's disease after DBS. Group mean values before rehabilitation and two weeks after completion of the rehabilitation course were extracted, and within-study net effects were calculated as the difference between changes in intervention and control groups.

Results: Both exercise modules were associated with improvements in mobility and balance within their respective studies. The net effect for Timed Up and Go (TUG) was 0.5 s for kick-/knee-strike training and 0.7 s for adapted boxing, while for TUG-cognitive it was 0.1–0.2 s. For the Mini-BESTest total score, the net effect was 0.7 points and 1.3 points, respectively. In the adapted boxing study, the Barthel Index showed a net improvement of +2.2 points. Numerical differences between studies were small.

Conclusion: Both structured martial arts-inspired rehabilitation modules were associated with small numerical improvements in mobility and balance outcomes within multidisciplinary inpatient neurorehabilitation and nursing care. The findings provide insight into the integration of martial arts-inspired rehabilitation approaches within multidisciplinary neurorehabilitation and nursing care pathways.

Key words. Neurorehabilitation, gait impairments, Parkinson's disease, DBS, Mini-BESTest, Timed Up and Go, adapted boxing, martial arts-inspired exercise.

Introduction.

Axial motor symptoms—gait impairment and postural instability—remain among the key causes of falls, loss of independence, and reduced quality of life in patients with

Parkinson's disease (PD). These impairments often respond incompletely to dopaminergic therapy and may persist even after surgical treatment, including deep brain stimulation (DBS), creating a need for additional non-pharmacological strategies to improve mobility and balance [1-4].

Physical neurorehabilitation is a cornerstone of care for patients with PD and gait disturbances. Clinical guidelines support multicomponent exercise programs targeting gait, balance, strength, and dual-task performance [5-7].

Such interventions are widely implemented within multidisciplinary rehabilitation programs, including inpatient settings. This perspective is consistent with broader nursing research from Kazakhstan emphasizing the importance of organizational readiness, interdisciplinary collaboration, and the development of nursing services as components of effective professional functioning and continuity of patient care [8-10].

However, practical rehabilitation protocols vary considerably in their specific content, dosage, and cueing principles. As a result, the rehabilitation-related role and practical integration of individual exercise modules within multidisciplinary neurorehabilitation and nursing care programs remain insufficiently described.

In addition to motor symptoms, patients with Parkinson's disease and those undergoing DBS often require complex multidisciplinary care, including nursing support for postoperative monitoring, complication prevention, patient education, rehabilitation adherence, and long-term functional management [11-13]. These challenges highlight the importance of effective rehabilitation and supportive care strategies in this population. From a nursing care perspective, mobility- and balance-oriented rehabilitation modules are relevant because nurses are involved in monitoring functional status, identifying fall risk, reinforcing patient adherence, and supporting continuity of care during and after inpatient neurorehabilitation.

Among exercise modalities proposed for PD rehabilitation, martial arts-inspired approaches have attracted increasing attention. Strike-based exercises and adapted boxing may engage coordinated upper- and lower-limb movements, multiplanar motor control, and responses to external cues. These characteristics may stimulate both anticipatory and

reactive postural control mechanisms. In contrast, kick- and knee-strike exercises may place greater emphasis on lower-limb strength, coordination, and anticipatory postural adjustments. While such theoretical differences are plausible, empirical comparisons between these approaches remain limited. Adapted boxing programs, particularly non-contact boxing such as the Rock Steady Boxing (RSB) program, have gained popularity as therapeutic physical exercise for patients with Parkinson's disease. A retrospective observational study of 62 Parkinson's disease patients participating in the RSB program demonstrated significant improvements in the 30-second sit-to-stand test and the Timed Up and Go test, indicating improved functional mobility [14].

Both exercise modules have been previously implemented within structured inpatient neurorehabilitation programs and have demonstrated beneficial effects on gait and balance outcomes in separate prospective studies. However, the practical integration of these exercise modules within multidisciplinary inpatient neurorehabilitation remains insufficiently characterized.

A descriptive side-by-side analysis may provide contextual rehabilitation insight into the range and magnitude of effects associated with different exercise modules when implemented within similar rehabilitation settings.

Aim.

The aim of the present study was to perform a descriptive secondary analysis of two martial arts-inspired rehabilitation modules implemented within multidisciplinary inpatient neurorehabilitation and nursing care, focusing on mobility, balance, and functional rehabilitation outcomes.

To facilitate contextual interpretation within this descriptive secondary analysis, the conceptual differences between the two intervention modules are summarized in Figure 1.

Materials and Methods.

Study design:

The present study was designed as a descriptive secondary analysis intended to explore rehabilitation-related patterns across two independently conducted neurorehabilitation studies.

Data sources:

The analysis was based on data extracted from two previously published prospective studies: the primary kick-/knee-strike study (Raissova, K., Uakkazy, G., Shashkin, C., Akhmadeeva, G., Kurmasheva, A., & Alaidarova, M.) and the primary adapted boxing study (Uakkazy, G. B., Shashkin, C. S., Akhmadeeva, G. N., Muratbaykyzy, A., Myrzaev, J. T., Kozykenov, A. A., Saltabaeva, U. S., & Kutybaeva, B. S.). These two publications served as the sole primary data sources for the present secondary analysis. For clarity, they are hereafter referred to as Study 1 (kick-/knee-strike) and Study 2 (adapted boxing).

From each publication, group-level outcome values before and after the rehabilitation course were obtained, together with descriptive study characteristics including sample size, group allocation, age range, diagnostic spectrum and disease stage (if reported), inclusion and exclusion criteria, parameters of the standard neurorehabilitation program, and the dose of the additional exercise module.

Key methodological characteristics (study design, population, intervention dose, and outcome measures) were extracted and are presented descriptively to allow transparent interpretation of study context and potential sources of bias.

Data extraction:

Group mean outcome values for the control and intervention groups were extracted from the primary publications. Extracted variables included baseline and post-rehabilitation values for the Mini-BESTest and TUG/TUG-cognitive scales, as well as Barthel Index scores were reported.

Data were extracted by one researcher and subsequently independently verified by a second reviewer against the original published tables prior to calculations. The data extraction process was not blinded. Any discrepancies identified during the verification process were resolved through discussion between the two reviewers, with reference to the original publications until agreement was reached.

The process of data extraction and analysis workflow is summarized in Figure 2.

Two previously published studies were used as data sources. Group-level data (pre/post means, sample sizes, and outcome measures including TUG, TUG-cognitive, Mini-BESTest domains, and Barthel Index where available) were extracted. Absolute changes (Δ) and net effects were calculated from group-level data.

Participants (as reported in the primary studies):

Participant characteristics were extracted from the two primary source studies (Study 1 and Study 2). In the kick-/knee-strike exercise study (N=50), patients with gait impairment were included: Parkinson's disease (Hoehn and Yahr stage ≥ 3), parkinsonism, dystonic syndrome, and post-DBS patients with gait impairment; age 50–78 years.

In the adapted boxing study (N=46), patients with sporadic Parkinson's disease (Hoehn and Yahr stage ≥ 2) who had undergone deep brain stimulation were included; age 49–75 years.

Interventions (as reported in the primary studies):

In both studies, participants underwent standard multidisciplinary neurorehabilitation lasting 10 days (excluding clinic weekends), with a session duration of approximately 4 hours.

In addition to the standard program, intervention groups performed either:

kick-/knee-strike exercises for approximately 20 minutes daily, or adapted boxing exercises for approximately 30 minutes daily.

The duration of the additional exercise module differed between studies: 20 min/day for kick-/knee-strike exercises and 30 min/day for adapted boxing.

The structure and timing of both studies are illustrated in Figure 3.

Timeline diagram showing the structure of both included studies. Both studies included baseline assessment, a 10-day inpatient neurorehabilitation program, and post-intervention assessment.

Outcomes:

In both studies, assessments were performed before and after the rehabilitation course, according to the timing reported in the original publications.

The primary scales included:

Mini-BESTest (total score and the domains Anticipatory Postural Adjustments, Reactive, Sensory, and Dynamic Gait; maximum score 28) [15,16].

Timed Up and Go (TUG) and TUG-cognitive tests [17,18].

The Barthel Index was reported only in the adapted boxing study and was therefore analyzed descriptively in the present comparison.

Statistical analysis:

Based on published mean values, absolute changes were calculated as follows: improvement = pre – post for time-based outcomes (TUG/TUG-cognitive; seconds) and improvement = post – pre for score-based scales (Mini-BESTest, Barthel Index).

The analysis was based on aggregate-level published data. Net effects were calculated descriptively as $\Delta(\text{intervention}) - \Delta(\text{control})$. Formal inferential statistical analyses were not performed because individual-level data and measures of variability were unavailable.

Ethical considerations:

This secondary analysis used aggregated data derived from previously published studies. No individual-level or identifiable patient data were accessed. Because all data were publicly available and anonymized, ethical approval was not required for the present analysis.

Results.

Two primary source studies were included in this secondary analysis: Study 1 (kick-/knee-strike exercises) and Study 2 (adapted boxing): (1) a kick-/knee-strike exercise study (N = 50; control n = 25, intervention n = 25) and (2) an adapted boxing study (N = 46; control n = 23, intervention n = 23).

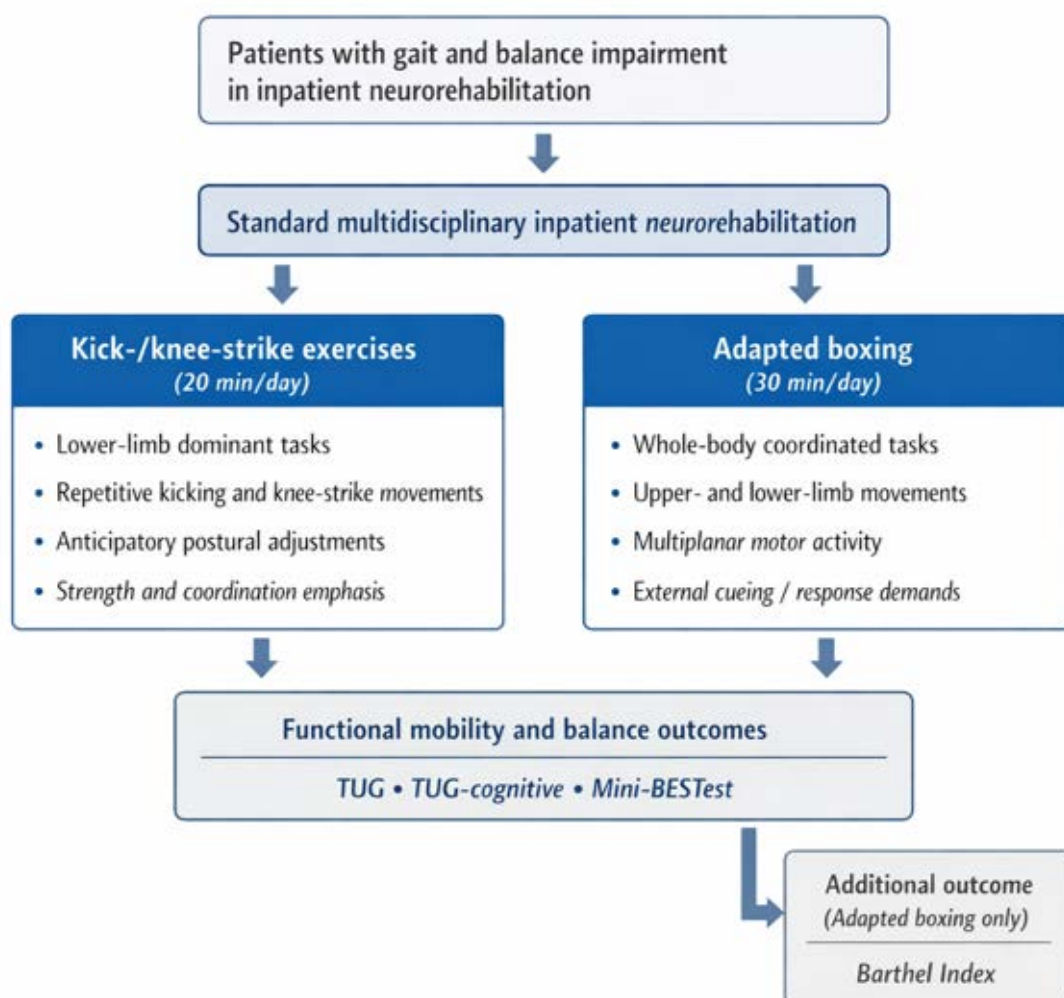


Figure 1. Conceptual diagram of differences between the two martial arts-inspired intervention modules.

Both interventions were implemented as add-ons to a standard multidisciplinary inpatient neurorehabilitation program. Kick-/knee-strike exercises mainly emphasized repetitive lower-limb movements, strength, coordination, and anticipatory postural control, whereas adapted boxing involved coordinated upper- and lower-limb tasks, multiplanar movement patterns, and external cueing demands. Both programs targeted functional mobility and balance outcomes, assessed primarily by the TUG, TUG-cognitive, and Mini-BESTest scales. The Barthel Index was additionally reported only in the adapted boxing study.

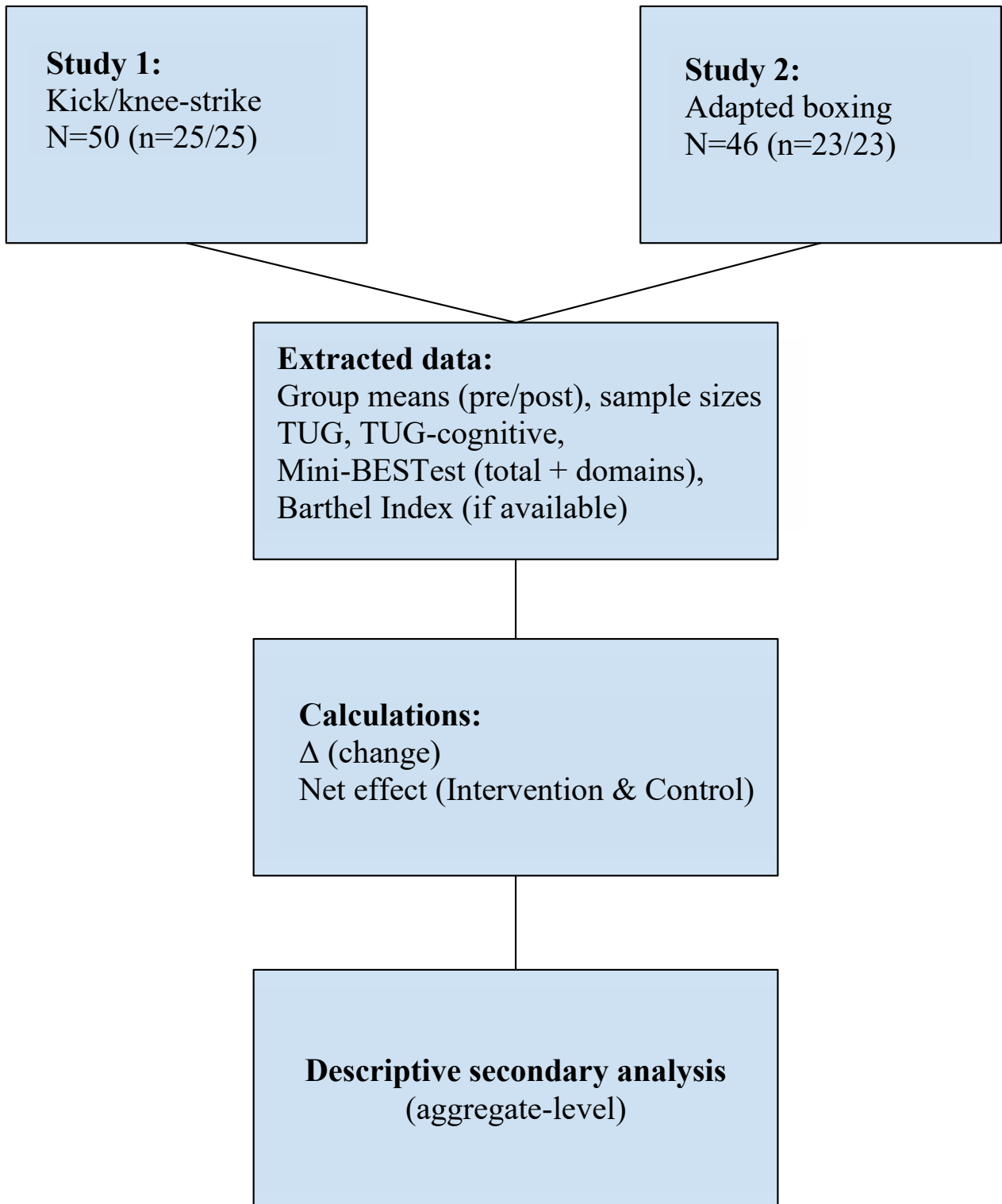


Figure 2. Flow diagram of data sources, extraction, and analysis process.

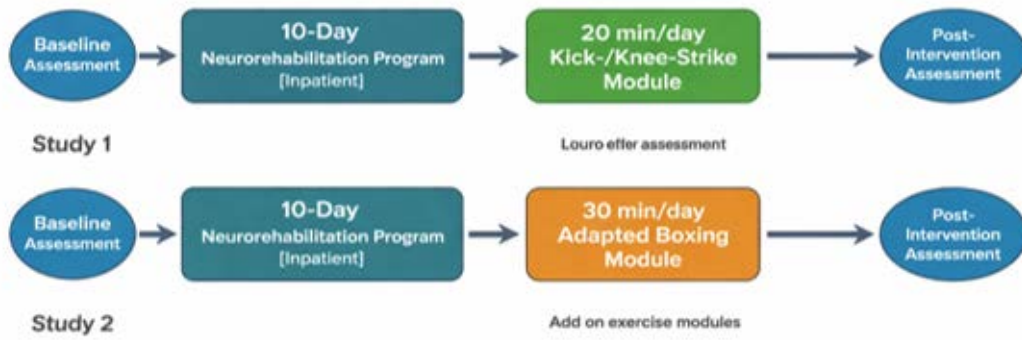


Figure 3. Timeline of included studies.

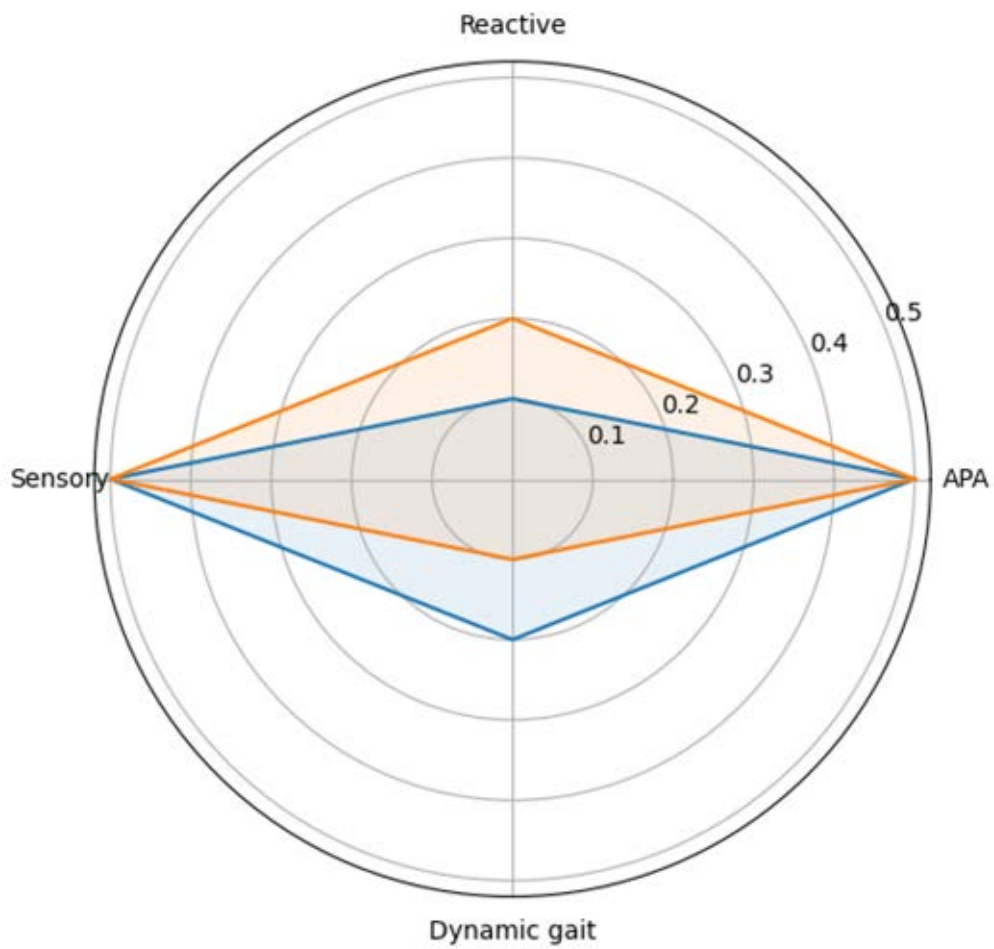


Figure 4. Mini-BESTest domain-level net effects.

Table 1. Characteristics of included studies.

Parameter	Study 1: kick-/knee-strike exercises	Study 2: Adapted boxing
Setting	Inpatient multidisciplinary neurorehabilitation (“Shashkin clinic”)	Inpatient multidisciplinary neurorehabilitation (“Shashkin clinic”)
Primary study design (as reported)	Prospective controlled study, 2 parallel groups	Prospective controlled study, 2 parallel groups
Total sample size	N = 50	N = 46
Groups	Control n = 25; Intervention n = 25	Control n = 23; Intervention n = 23
Population / diagnosis	Mixed gait disorders: PD (Hoehn–Yahr ≥ 3), parkinsonism, dystonic syndrome, and post-DBS gait disorders	Sporadic PD (Hoehn–Yahr ≥ 2), all post-DBS
Age, years	50–78	49–75
Sex, n	Men 21; Women 29	Men 18; Women 28
Standard neurorehabilitation	Yes (both groups)	Yes (both groups)
Add-on exercise module (intervention)	+20 min/day kick-/knee-strike exercises	+30 min/day adapted boxing
Program duration	10 consecutive days (no weekend breaks)	10 consecutive days (no weekend breaks)
Assessment time points	Pre-rehabilitation and two weeks after completion of the rehabilitation course	Pre-rehabilitation and two weeks after completion of the rehabilitation course
Outcomes reported	TUG, TUG-cognitive, Mini-BESTest	TUG, TUG-cognitive, Mini-BESTest, Barthel Index
Disease duration	Not explicitly reported in the original studies	Not explicitly reported in the original studies
Hoehn–Yahr stage	≥ 3 (Parkinson's disease)	≥ 2 (Parkinson's disease)
Medication status	Participants may have been on Parkinson's disease medication as part of standard treatment	Participants may have been on Parkinson's disease medication as part of standard treatment
Randomization methods	Allocation method not fully described in the original publications	Allocation method not fully described in the original publications

Table 2. Primary outcomes: TUG and Mini-BESTest total (changes and net effect).

Study	Outcome	Group	Pre	Post	Δ improvement*	Net effect**
kick-/knee-strike	TUG (s)	Control	9.9	8.4	1.5	
		Intervention	10.1	8.1	2.0	
		Net effect (Intervention – Control)				0.5 s
kick-/knee-strike	Mini-BESTest total (points)	Control	17.9	21.8	3.9	
		Intervention	18.1	22.7	4.6	
		Net effect (Intervention – Control)				0.7 points
Adapted boxing	TUG (s)	Control	9.8	8.3	1.5	
		Intervention	10.1	7.9	2.2	
		Net effect (Intervention – Control)				0.7 s
Adapted boxing	Mini-BESTest total (points)	Control	18.5	22.9	4.4	
		Intervention	18.3	24.0	5.7	
		Net effect (Intervention – Control)				1.3 points

* For time-based measures (TUG), Δ improvement = Pre – Post. For score-based measures (Mini-BESTest), Δ improvement = Post – Pre.

** Net effect = Δ (intervention) – Δ (control).

Table 3. Summary of net effects (for quick reviewer reading).

Outcome	Net effect: kick-/knee-strike	Net effect: Adapted boxing	Descriptive numerical difference
TUG (s)	0.5	0.7	+0.2
TUG-cognitive (s)	0.1	0.2	+0.1
Mini-BESTest total (points)	0.7	1.3	+0.6
Mini-BESTest — APA (points)	0.5	0.5	0.0
Mini-BESTest — Reactive (points)	0.1	0.2	+0.1
Mini-BESTest — Sensory (points)	0.5	0.5	0.0
Mini-BESTest — Dynamic gait (points)	0.2	0.1	–0.1
Barthel Index (points)	NA	+2.2	NA

Baseline values for the Mini-BESTest were similar between the control and intervention groups within both studies, ranging from 17.9 to 18.1 for the kick-/knee-strike group and 18.3 to 18.5 for the adapted boxing group.

Functional mobility (TUG and TUG-cognitive):

In both studies, improvements in TUG and TUG-cognitive were observed in the control and intervention groups (Table 2). The improvement in TUG ranged from 0.5 seconds for kick-/knee-strike training to 0.7 seconds for adapted boxing. The net effect for TUG-cognitive was 0.1 to 0.2 seconds in both groups.

Balance (Mini-BESTest):

The Mini-BESTest total score increased in both intervention groups (Table 3). The net improvement was 0.7 points for kick-/knee-strike training and 1.3 points for adapted boxing.

In the domain of Dynamic Gait, a notable difference was observed between the two programs, with the kick-/knee-strike study showing a net effect of 0.2 points, while the adapted boxing study showed a net effect of 0.1 points (Table 3). This small difference may reflect variation in dynamic balance responses between the intervention modules. In summary, both studies demonstrated improvements in balance within their respective intervention groups.

A domain-level visualization of these patterns is presented in Figure 4.

Radar chart showing domain-level net effects for the Mini-BESTest. Domains include Anticipatory Postural Adjustments (APA), Reactive Postural Control, Sensory Orientation, and Dynamic Gait. Values represent net effects ($\Delta(\text{intervention}) - \Delta(\text{control})$) for each domain.

Activities of daily living (Barthel Index):

The Barthel Index showed a net improvement of +2.2 points in the adapted boxing study, indicating a modest improvement in activities of daily living.

Discussion.

The present study provides a contextual overview of two structured martial arts-inspired rehabilitation modules implemented within multidisciplinary neurorehabilitation and supportive nursing care.

This secondary analysis of two published studies examined the rehabilitation-related outcome patterns of two martial arts-inspired exercise modules—adapted boxing and kick-/knee-strike exercises—when implemented as add-ons to standard inpatient neurorehabilitation programs. Both interventions were associated with improvements in mobility and balance outcomes relative to control conditions within their respective studies.

Domain-level comparison and hypothetical mechanisms:

At the Mini-BESTest domain level, descriptively larger changes were observed in both studies for the Anticipatory Postural Adjustments and Sensory Orientation domains. Slightly greater improvements in the Reactive Postural Control domain were observed in the adapted boxing study compared with the kick-/knee-strike exercise study.

These observations should be interpreted cautiously. One possible explanation is that adapted boxing involves coordinated upper- and lower-limb movements, multiplanar motor tasks,

and responses to external cues, which may engage elements of reactive postural control. However, these observations remain speculative and require confirmation in future studies.

Evidence context:

Physical exercise is widely recognized as a key component of rehabilitation in Parkinson's disease, and clinical physiotherapy guidelines emphasize the importance of targeted training of gait, balance, strength, and dual-task performance [7,19].

Recent review-level evidence suggests that boxing-based exercise may be feasible in people with Parkinson's disease and may be associated with improvements in both motor and non-motor outcomes, with generally high adherence and an acceptable safety profile [20]. However, the available literature remains heterogeneous in terms of intervention content, patient populations, and outcome reporting, and the magnitude of reported effects is generally modest.

At the same time, more conservative synthesis-level evidence indicates that these effects may be limited or uncertain. A recent systematic review with meta-analysis reported no statistically significant effects of boxing interventions on several outcomes, including Timed Up and Go (TUG), dual-task TUG, balance confidence, 6-min walking test, and health-related quality of life, although only a small number of studies were eligible for quantitative synthesis [21].

Consistent with this cautious interpretation, a systematic review restricted to randomized controlled trials found that boxing interventions were associated primarily with improvements in balance and quality of life, whereas findings for other functional outcomes remained inconsistent, reflecting the limited number and heterogeneity of available randomized studies [22].

Beyond review-level evidence, smaller clinical studies provide additional, but still preliminary, support for the potential multidimensional effects of boxing-based exercise. For example, a pilot randomized controlled trial comparing boxing with and without kicking techniques demonstrated that both interventions were feasible and safe and were associated with improvements in balance, without significant differences between protocols [23]. Similarly, a 12-week community-based boxing program was associated with improvements in motor symptoms, non-motor symptom burden, depressive symptoms, and quality of life, although not all domains, such as apathy, showed significant change [24].

Taken together, these findings indicate that boxing-based and related martial arts-inspired exercise interventions may be beneficial for people with Parkinson's disease, but the current evidence base remains limited, methodologically heterogeneous, and characterized by generally small effect sizes. This context supports cautious interpretation of descriptive findings, such as those reported in the present study, and highlights the need for more robust, directly comparative trials within standardized rehabilitation frameworks.

Practical Implications.

Within an inpatient neurorehabilitation setting, both kick-/knee-strike exercises and adapted boxing may be considered as potential options for additional therapeutic exercise in patients with gait and balance impairments. When selecting a specific protocol, clinicians may reasonably consider the

patient's predominant motor deficits, cognitive status, fall risk, tolerance of exercise intensity, and the available institutional resources, including staff expertise and equipment. Within multidisciplinary neurorehabilitation and nursing care settings, such exercise modules may also support rehabilitation-oriented nursing care, monitoring of exercise tolerance and fall risk, reinforcement of adherence to rehabilitation activities, and continuity of functional support during inpatient care [11-13,25,26].

Limitations.

Several limitations should be considered when interpreting the findings of the present study.

First, the analysis was based on two independent studies rather than a direct head-to-head trial. The study populations differed substantially in diagnostic composition, disease stage, and clinical characteristics. In particular, the kick-/knee-strike study included a heterogeneous cohort of gait disorders, whereas the adapted boxing study included patients with Parkinson's disease after DBS. These differences limit direct comparability between studies.

Second, only published aggregate-level data were available for analysis. Individual participant-level data and measures of variability were unavailable, which precluded formal inferential statistical analyses, adjustment for potential confounders, and estimation of statistical uncertainty.

Third, the duration of the additional exercise intervention differed between studies (20 vs 30 minutes/day), which may have influenced the observed differences in outcomes.

Fourth, detailed baseline disease severity measures, including UPDRS scores and disease duration, were not consistently reported in the original studies and therefore could not be included in the present analysis.

Finally, both studies were conducted at a single center with relatively short follow-up periods, which may limit external validity and the interpretation of long-term rehabilitation effects.

Future Directions.

Future studies using unified and standardized rehabilitation designs may help clarify the role of different martial arts-inspired exercise protocols within a unified study design. Such studies should use standardized intervention dose and intensity, harmonized inclusion criteria with clearly defined disease stages, control of relevant baseline covariates, and longer follow-up periods to evaluate both the durability and clinical significance of rehabilitation outcomes.

Conclusion.

Structured adapted boxing and kick-/knee-strike exercise modules were associated with modest improvements in mobility and balance outcomes when implemented within multidisciplinary inpatient neurorehabilitation and nursing care. The present secondary analysis provides rehabilitation-related insight into how different exercise-based rehabilitation approaches may contribute to functional mobility, balance-oriented rehabilitation pathways, and supportive nursing care settings within multidisciplinary neurorehabilitation programs.

Declarations.

Ethics approval and consent to participate:

This study is a secondary analysis of previously published data and did not require additional ethical approval, as it used de-identified aggregate data from published sources. Ethical procedures for the primary studies are described in the original publications.

Data availability:

All data used in this secondary analysis were extracted from the two primary source studies described in the manuscript (Study 1 and Study 2).

Conflicts of interest:

The authors declare no conflicts of interest.

Funding:

No targeted funding was received.

Author contributions:

Conceptualization: G.B. Uakkazy, C.S. Shashkin, M. Alaidarova.

Methodology: G.B. Uakkazy, C.S. Shashkin, V. Tkachev.

Data curation: G.B. Uakkazy, G.S. Khussainova, M. Aikhozhayeva.

Formal analysis: G.B. Uakkazy, R.K. Burumbaeva.

Visualization: V. Tkachev, M. Aikhozhayeva.

Writing—original draft: G.B. Uakkazy, V. Tkachev, N.V. Slivkina.

Writing—review & editing: M. Alaidarova, J. Almazan, Z.F. Mavlyanova, A. Akanov.

Validation: R.K. Burumbaeva, G.S. Khussainova.

Supervision: N.V. Slivkina, Z.F. Mavlyanova.

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Аннотация.

Введение: Программы упражнений, основанные на элементах боевых искусств, всё чаще применяются в качестве дополнения к нейрореабилитации нарушений походки и равновесия.

Цель: Провести описательный вторичный анализ двух тренировочных модулей, основанных на элементах боевых искусств, реализованных в рамках многопрофильной стационарной нейрореабилитации и сестринского ухода.

Материалы и методы: Проведен пост-хок вторичный анализ агрегированных результатов двух проспективных

исследований с параллельными группами (общая выборка N = 96). В первом исследовании включена гетерогенная когорта пациентов с нарушениями походки, во втором — пациенты с болезнью Паркинсона после DBS. Извлечены средние групповые значения до реабилитации и через две недели после завершения курса. Чистый эффект рассчитывался как разница изменений между интервенционной и контрольной группами.

Результаты: Оба тренировочных модуля ассоциированы с улучшением показателей мобильности и равновесия в рамках соответствующих исследований. Чистый эффект для теста Timed Up and Go (TUG) составил 0,5 с для упражнений с ударами ногами/коленями и 0,7 с для адаптированного бокса; для TUG-cognitive — 0,1–0,2 с. Для шкалы Mini-BESTest чистый эффект составил 0,7 и 1,3 балла соответственно. В исследовании адаптированного бокса индекс Бартел составил +2,2 балла. Числовые различия между исследованиями были незначительными.

Выводы: Оба тренировочных модуля были ассоциированы с небольшими числовыми улучшениями мобильности и равновесия в рамках многопрофильной стационарной нейрореабилитации и сестринского ухода. Полученные результаты предоставляют контекстуальное представление о возможной роли упражнений, основанных на элементах боевых искусств, в программах нейрореабилитации. Для уточнения клинической значимости данных подходов необходимы дальнейшие стандартизированные исследования.

Ключевые слова: нейрореабилитация, нарушения походки, болезнь Паркинсона, DBS, Mini-BESTest, Timed Up and Go, адаптированный бокс, упражнения боевых искусств.

აბსტრაქტი

შესავალი: საბრძოლო ხელოვნებაზე დაფუძნებული სავარჯიშო პროგრამები სულ უფრო ხშირად გამოიყენება სიარულისა და ბალანსის დარღვევების ნეირორეაბილიტაციის დამატებით მეთოდად.

მიზანი: საბრძოლო ხელოვნებაზე დაფუძნებული ორი სარეაბილიტაციო მოდულის აღწერითი მეორეული ანალიზის ჩატარება, რომლებიც განხორციელდა მრავალპროფილური სტაციონარული ნეირორეაბილიტაციისა და საექთნო მოვლის ფარგლებში.

მასალა და მეთოდები: ჩატარდა აღწერითი მეორეული ანალიზი ორი პროსპექტიული პარალელური ჯგუფის კვლევის აგრეგირებული შედეგების გამოყენებით (სულ N = 96). პირველ კვლევაში ჩართული იყო სიარულის დარღვევების მქონე შერეული კოჰორტა, ხოლო მეორე კვლევაში — პარკინსონის დაავადების მქონე პაციენტები DBS-ის შემდეგ. ამოღებული იქნა ჯგუფური საშუალო მაჩვენებლები რეაბილიტაციამდე და სარეაბილიტაციო კურსის დასრულებიდან ორი კვირის შემდეგ, ხოლო თითოეული კვლევის ფარგლებში წმინდა ეფექტი გამოითვალა ინტერვენციულ და საკონტროლო ჯგუფებში ცვლილებებს შორის სხვაობის საფუძველზე.

შედეგები: ორივე სავარჯიშო მოდული ასოცირებული იყო მობილობისა და ბალანსის გაუმჯობესებასთან შესაბამის კვლევებში. Timed Up and Go (TUG)-ის წმინდა ეფექტი იყო 0.5 წამი ფეხისა და მუხლის დარტყმებზე დაფუძნებული ვარჯიშებისთვის და 0.7 წამი ადაპტირებული კრივისთვის, ხოლო TUG-cognitive-ისთვის — 0.1–0.2 წამი. Mini-BESTest-ის საერთო ქულის წმინდა ეფექტი შეადგენდა შესაბამისად 0.7 და 1.3 ქულას. ადაპტირებული კრივის კვლევაში Barthel-ის ინდექსმა აჩვენა +2.2 ქულიანი წმინდა გაუმჯობესება. კვლევებს შორის წმინდა ეფექტების რიცხვობრივი განსხვავებები მცირე იყო;

დასკვნა: ორივე სტრუქტურირებული საბრძოლო ხელოვნებაზე დაფუძნებული სარეაბილიტაციო მოდული ასოცირებული იყო მობილობისა და ბალანსის მაჩვენებლების მცირე რიცხვობრივ

გაუმჯობესებებთან მრავალპროფილური სტაციონარული ნეირორეაბილიტაციისა და საექთნო მოვლის ფარგლებში. მიღებული შედეგები აღწერით წარმოდგენას იძლევა იმის შესახებ, თუ როგორ შეიძლება ინტეგრირდეს ფიზიკურ ვარჯიშებზე დაფუძნებული სარეაბილიტაციო მიდგომები მობილობისა და ბალანსზე ორიენტირებულ ნეირორეაბილიტაციის პროგრამებში. ამ სარეაბილიტაციო მიდგომების კლინიკური მნიშვნელობის უკეთ განსაზღვრისათვის საჭიროა დამატებითი სტანდარტიზებული კვლევები ჰარმონიზებული პოპულაციებითა და ინტერვენციის დიზაინით.

საკვანძო სიტყვები: ნეირორეაბილიტაცია, სიარულის დარღვევა, პარკინსონის დაავადება, DBS, Mini-BESTest, Timed Up and Go, ადაპტირებული კრივი, საბრძოლო ხელოვნებაზე დაფუძნებული ვარჯიში.