

# The Effect of Yoga Combined Elastic Band Exercise Program on Health - Physical Fitness and Balance in Older Adults

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## Abstract

**Purpose.** The study and compare the effects of yoga combined elastic band training programs on health, - physical fitness, and balance in older adults.

**Material & Methods.** The sample group consisted of 32 older adults aged 60–69 years in Ban Mek Yai, Nong Mek Subdistrict, Nong Han District, Udon Thani Province, Thailand. They were divided into 2 groups, 16 people per group: the exercise group trained with yoga combined elastic band training programs and the control group for 6 weeks, 3 days a week, 40 minutes a day. The tests were conducted pretest and posttest. Data on muscle strength and endurance were collected using the Chair Stand Test and arm curl test, Flexibility was collected using the Chair Sit and Reach test and balance using the single leg stance and time up and go test. Data were analyzed using the mean, standard deviation, and t-test with a statistical significance level of .05.

**Results.** The Physical fitness (Arm Curl Test, Chair Stand Test, Chair Sit and Reach Test) and balance (Time up and Go test and Single Leg Stance Test) statistically had significant differences between the pre- and post-six weeks in the exercise group but the control group was not statistically significant and posttest statistically had significant differences between the control group and the exercise group, but the pretest was not statistically significant.

**Conclusions.** However, after six weeks of combined yoga with elastic band training programs, the order adults had improved muscle strength, endurance, flexibility, and balance. Consequently, this exercise regimen is considered a healthy alternative for older adults.

**Keywords:** Yoga, Elastic band, Heath-physical fitness, Balance, Older adults.

## Introduction

Aging is a natural process that unfolds in living organisms over time. The musculoskeletal system undergoes physiological changes in aging, including a decline in muscular strength, muscle endurance, flexibility, and balance, along with functional alterations in cardiopulmonary endurance. These changes contribute to reduced adaptability and an increase in functional impairment (Howe et al., 2011). This causes physical

instability that is at risk of injury and accidents in the elderly. There should be preparation to cope with physical changes. Therefore, it is necessary to promote the health of the elderly more. As the World Health Organization (2023) recommends that a long-life expectancy alone is not enough, it is necessary to have good health as well. If the elderly have sufficient physical activity, it will be the foundation of good health (World Health Organization, 2023; Xiong, Ye, Wang, Zheng, 2021;

Cotman Berchtold, 2007).

Exercise for the elderly is mainly found to be beneficial by helping to reduce blood pressure, especially systolic blood pressure, reduce peripheral vascular resistance, increase HDL-C system, reduce body fat, increase heart efficiency, increase insulin sensitivity, improve muscle size and joint movement, increase muscle strength, reduce bone loss rate, increase blood volume to the brain, increase brain efficiency (Singhacharu, 2016), and increase balance and balance, reduce the risk of falls and accidents in the elderly (Atwinijtrakarn, 2019). The mechanism that transmits falls and balance depends on many factors, including gender, age, deterioration of vision, hearing, joint movement, muscle strength, and flexibility. Therefore, while walking or changing postures, the body cannot maintain the center of mass of the body in a balanced base and falls occur (Atwinijtrakarn, 2019). Therefore, exercise for the elderly should be activities that promote balance and weight-bearing exercises that are appropriate for the individual, are safe, and do not cause harm or injury to muscles and joints, such as walking or running slowly, cycling, swimming, physical exercise, Chinese boxing, yoga, etc. (Siripanich, 2012).

Yoga is a physical and mental exercise. Physical exercise is the practice of various yoga postures. Mental exercise is the conscious focus on inhaling and exhaling while holding a pose, changing poses, or practicing breathing in various forms. It can be practiced with a variety of equipment, such as yoga belts, elastic bands, blankets, pillows, chairs, and blindfolds (Chanhasorn, 2022). Practicing yoga has many health benefits, such as increasing strength and flexibility, increasing the efficiency of the respiratory system, and reducing stress. It uses asana training techniques, physical posture training, breathing, and meditation together to treat diseases by stretching and relaxing alternately. This causes physical instability, which can lead to injury and accidents in older adults (Wongrachit, 2018).

Resistance exercise is a form of exercise that uses weight resistance or pressure on striated muscles. Striated muscles contract during resistance exercise. Muscle contraction occurs by using energy from the body's chemical processes. Chemical energy is then converted into mechanical energy, namely force or tension muscle contraction against weight (Hoeger & Hoeger, 2012; Sharkey & Gaskill, 2013). Elastic bands are convenient, economical, and safe for the elderly. Every time they are stretched, there is a reflex that affects the development and treatment of muscle function (Chaiyodsilp, 2022). It was found that the highlight of exercising with elastic bands is a reflex or pulling force from being pulled to stretch,

called the Stretch reflex. Every time the rubber is stretched, which is a special property of such elastic bands, it affects the nervous system that senses muscle and joint tension (Proprioception) to react and respond to the tensile force of the rubber being stretched (Boonlert, 2021). Therefore, it helps protect and restore the muscular system, joints and bones, and enhances physical fitness. Exercises using elastic bands help increase muscle strength and improve flexibility and balance (Karbunrat, 2015).

Since previous studies have used only one yoga program and elastic bands, there have been no studies done on combining yoga with elastic bands. Therefore, to promote health, increase strength, endurance, flexibility and better balance, researchers have designed a training program combining yoga with elastic bands to help develop physical fitness, balance and quality of life in the elderly.

## Material and methods

### *Study participants*

Participants were recruited from Ban Mek Yai, Nong Mek Subdistrict, Nong Han District, Udon Thani Province, Thailand. The sample size was determined from Cohen's table (Cohen, 1988) by setting the alpha value at the significance level of 0.05, the effect size at 0.80 and the power of the test at 0.75. The sample size was 23 people. To prevent missing, the researcher increased the sample size to 25 people per group, divided into an experimental group and a control group.

Inclusion criteria were elderly people aged 60–69 years who Time up and Go test at a level greater than up to 20 seconds, can help themselves, pass the Physical Activity Readiness Assessment (PAR-Q) and agreed to participate in the research and sign the consent form to join the program.

Exclusion criteria were a history of cardiovascular or respiratory illness, neuromuscular or musculoskeletal diseases affecting postural control or vision deficits influencing the study's outcome, and injuries that occurred during the training program. Participants completed less than 80% of the study period, and subjects requested to discontinue training.

Approval for this experiment was obtained from the ethics human in Nakhon Ratchasima Rajabhat University (the approval number is HE 140/2024; 27 September 2024). Before participation, each individual provided written informed consent after being informed about the study protocols, risks, and benefits. The Declaration of Helsinki guided the conduct of this investigation.

### *Study organization*

Participants underwent a 2-week, 3-day fa-

familiarization program of yoga combined with an elastic band exercise program conducted by the instructor before the testing session. The exercise group engaged in a 60-minute yoga combined with an elastic band exercise program consisting of: 10 poses (Tree pose, Swin tree pose, Forward stretch pose, Cow face pose, Head to knee pose, sitting bending pose, Knee pressing to chest pose, Leg lifting pose, Modified pier pose and dead body pose in figure 1), performed 3 breaths, 4 times divided into a 10-minute warm-up phase, a 40-minute exercise phase, and a 10-minute cool-down phase. The control group did not engage in any exercise activities. Throughout the 6-week, 3 d·wk<sup>-1</sup>, 60 min·d<sup>-1</sup> study.

#### Outcome measurements

The tests were carried out as established by Jones and Rikli (2013) details as follows:

1. The Chair Stand Test reflects lower body strength. The Participants were asked to sit on the chair with arms crossed over their chest, and they were encouraged to complete as many stand-ups as possible in 30 seconds. Scoring was based on the total repetitions completed in 30 seconds. The number of stands is recorded.

2. The Biceps Curl Test reflects upper body strength. The participants were asked to perform as many bicep curls as possible in 30 seconds, using a 5-pound dumbbell for females and an 8-pound dumbbell for males. Scoring was based on the total repetitions completed in 30 seconds.

3. The Chair Sit and Reach Test is measured

in distance (cm) and reflects lower body flexibility. The participants were asked to sit on the edge of a chair with the left knee bent at 90° and the left foot flat on the floor while keeping the right knee straight and the right leg extended forward. Participants were instructed to attempt to touch their toes using both hands. The most flexible side of an individual was used for assessment. The distance in centimeters between the fingers and toes was measured. Overlap of the fingers was measured in positive increments, while the distance between untouched fingers was measured in negative increments.

4. The single-leg stance test is measured in time (seconds) and reflects static balance. The Participants were timing the moment the subject began to stand on one leg, with arms at the sides of the body and eyes open, and stopping the timer if the foot touched the floor or handgrips.

5. The Time Up-and-Go test is measured in time (seconds) and reflects agility and dynamic balance. The Participants measured the time it takes the test subject to stand up from a chair, walk a distance of 3 meters, and return to sit on the chair.

#### Statistical Analyses

The mean and  $\pm$ SD were used to present the statistical data. An independent t-test was used to analyze the differences in height, weight, age, and body mass index between the 2 Groups. An independent t-test was used to compare the flexibility, muscle strength and endurance, and bal-

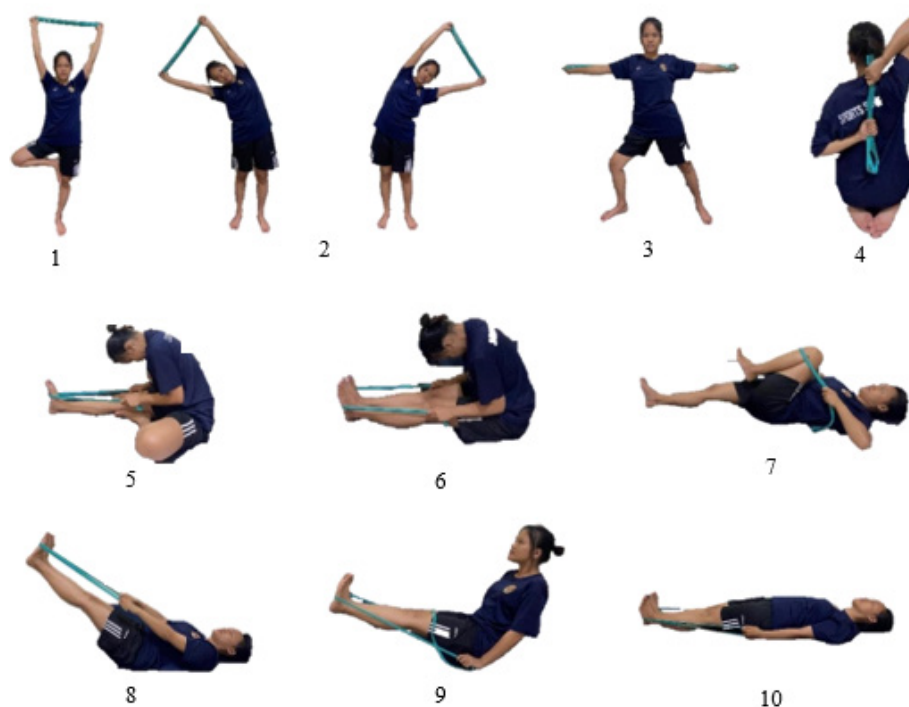
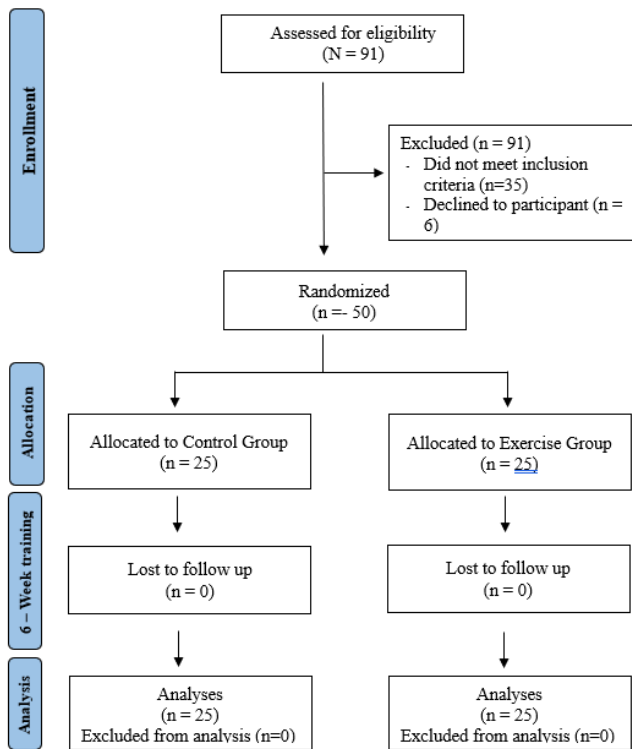


Figure 1. Yoga combined Elastic Band Exercise



**Figure 2. CONSORT flow diagram of participants through the intervention.**

ance of the 2 Groups both at baseline and after 8 weeks. Flexibility, muscle strength and endurance, and balance at baseline and after 8 weeks were compared using a paired t-test to determine the changes within the 2 Groups. A type I error of 5% was used to determine statistical significance. The data were analyzed using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp., 2012).

## Results

The analysis covered the baseline characteristics of the 36 older adults, as outlined in Table 1. Age, gender, body weight, height, and BMI showed no significant differences between the two groups after a 6-week training period.

In Table 2 and Figure 3, the results show im-

provements in all measured variables of post-intervention in the exercise group. The physical fitness and balance in the exercise group showed statistically significant differences between pre- and post-intervention (six weeks). Specifically, muscle strength, as measured by the arm curl test ( $p < .001$ ) and chair stand test ( $p < .001$ ), demonstrated a substantial increase, highlighting enhanced muscular strength in both the upper and lower body. Flexibility also improved ( $p < .001$ ), suggesting enhanced extensibility of the hamstrings and lower back. Additionally, both static balance ( $p < .001$ ) and dynamic balance ( $p < .001$ ) improved, indicating enhanced movement efficiency. In contrast, the control group showed no statistically significant changes, including in muscle strength as measured by the arm curl test ( $p = 0.157$ ), a decrease in the chair stand test ( $p = 0.319$ ), a decrease in flexibility ( $p = 0.928$ ), and no significant changes in static balance ( $p = 0.402$ ) or dynamic balance ( $p = 0.063$ ). Furthermore, the posttest showed statistically significant differences between the exercise group and the control group, but the pretest did not. The exercise group had significantly higher mean values for muscle strength, flexibility, and balance compared to the control group. However, there were no differences between the two groups at the pretest.

## Discussion

It was found that the flexibility in the sitting bending posture of the elderly group practicing yoga postures had a statistically significant change at the 0.05 level because the nature of yoga practice with elastic bands is stretching, bending, leaning, arching, twisting joints, tendons, and muscles, it affects the properties of connective tissue, especially tendons and fascia, causing changes in Collagen remodeling, resulting in more flexible tissue. It also helps reduce the muscle's tension by adjusting the function of sensory receptors in the muscles spindle and Golgi tendon organ, increasing the range of motion of the joints that is consistent with many past research studies

**Table 1. The measures of basal characteristics in control and exercise groups**

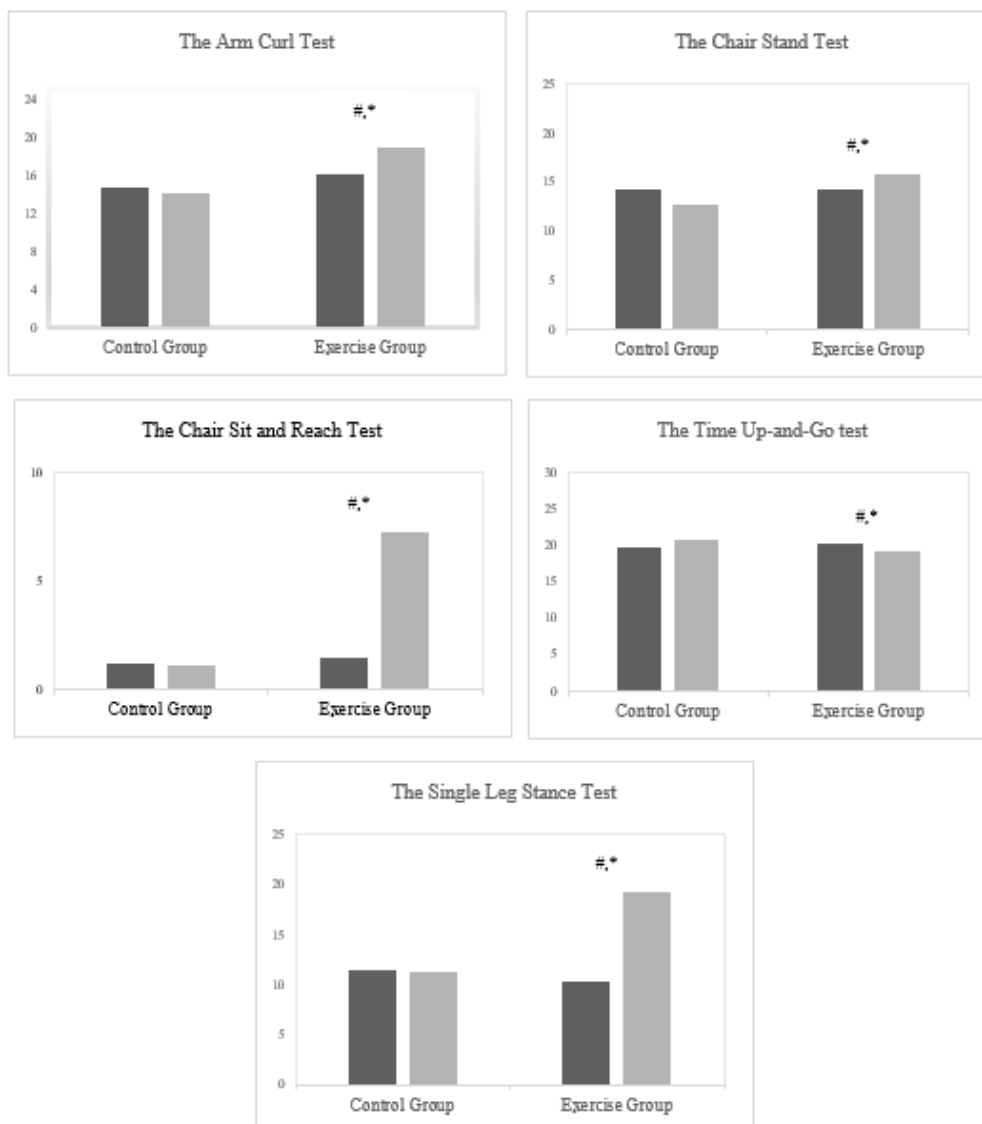
Variables	Control Group (n=25)	Exercise Group (n=25)
Gender		
Male	3	3
Female	22	22
Age (Years)	66.50 ± 2.82	64.43 ± 2.75
Weight (Kilometer)	54.75 ± 12.27	56.68 ± 8.12
Height (Centimeter)	156.12 ± 9.58	155.18 ± 8.18
BMI (kilometer / Meter <sup>2</sup> )	22.53 ± 3.56	23.61 ± 4.35

Data are expressed as mean ± SD. BMI: body mass index; \*Significant  $p < 0.05$  control group vs. exercise group

**Table 2.** The measures of physical fitness were assessed during pre- and post-six weeks in control and exercise groups

Variables	Control Group (CO) (n=25)		p-value	Exercise Group (EX) (n=25)		p-value	p-value CO vs EX	
	Pretest	Posttest		Pretest	Posttest		pretest	posttest
Arm Curl Test (reps)	14.92±4.54	14.16±4.10	0.157	16.12±2.93	18.92±4.19	<0.001 <sup>#</sup>	0.273	<0.001 <sup>*</sup>
Chair Stand Test (reps)	14.24±3.53	13.80±3.39	0.319	14.32±3.94	15.84±4.29	<0.001 <sup>#</sup>	0.940	0.033 <sup>*</sup>
Chair Sit and Reach Test (Centimeter)	1.22±6.03	1.12±5.07	0.928	1.47±2.72	7.27±4.05	<0.001 <sup>#</sup>	0.852	<0.001 <sup>*</sup>
Time up and Go test (Second)	19.78±1.68	20.91±1.86	0.063	20.23±1.75	19.19±1.48	<0.001 <sup>#</sup>	0.365	0.001 <sup>*</sup>
Single Leg Stance Test (Second)	11.43±4.98	11.24±4.56	0.402	10.38±3.89	12.39±5.08	<0.001 <sup>#</sup>	0.413	0.050 <sup>*</sup>

Data are expressed as mean ±SD. <sup>#</sup>Significant  $p < 0.05$  pretest vs. posttest period, <sup>\*</sup>Significant  $p < 0.05$  control group vs. exercise group

**Figure 3.** Physical fitness during pre- and post-six weeks in control and exercise groups.

<sup>#</sup>Significant  $p < 0.05$  pretest vs. posttest period, <sup>\*</sup>Significant  $p < 0.05$  control group vs. exercise group.

that accept that yoga practice can develop muscle flexibility (Amin & Goodman, 2014; Donahoe-Fillmore & Grant, 2019; Tiffany Field, 2016; Mears et al., 2019; Mears et al., 2018, Gothe & McAuley, 2016; Noradechanunt et al., 2017).

It was found that the muscle strength and endurance in the arm curl and Chair Stand of the elderly group practicing yoga combined elastic band had a statistically significant change at the 0.05 level because yoga combined elastic band is mainly an isometric type of exercise, it helps in the improvement of muscular strength as it is found in any resistive exercise. Yoga combined elastic band training among the participants in this study has helped to improve muscular strength by better neural drive from the brain involving both the mechanisms of recruitment and rate coding of muscle contraction to achieve greater force which resulted in greater muscular strength which is consistent with many past research studies that accept that yoga practice can develop muscle strength and endurance (Gothé & McAuley, 2016; Noradechanunt, Worsley, & Groeller, 2017).

It was found that the balance in the static and dynamic balance of the elderly group practicing yoga combined elastic band had a statistically significant change at the 0.05 level because yoga practice of poses such as Tree pose, Swin tree pose, Forward stretch pose, Cow face pose and others can benefit the body in many ways. Starting with strengthening the core muscles, which are important for supporting the spine and maintaining balance in the body. These yoga poses also help develop joint stability, allowing for better weight-bearing and reducing the risk of injury. In addition, yoga practice helps develop concentration and awareness of different parts of the body, especially in the Dead body pose, which helps train the perception and control of body movement. Meanwhile, poses such as the Cow face pose and sitting bending pose help increase muscle flexibility, which is an important factor in movement and maintaining balance in the body. Practicing the Leg lifting pose and the Knee pressing to chest pose play an important role in developing the sensory nervous system, allowing the body to be more aware of position and movement while the Tree pose and the Swin tree pose help to strengthen the leg muscles, which are the foundation of good balance which is consistent with many past research studies that accept that yoga practice can develop balance (Gothé & McAuley, 2016; Wooten et al., 2018; Okubo et al., 2017, Ni et al., 2014; Nick et al., 2016; Noradechanunt et al., 2017).

Yoga is a multimodal activity that improves muscle strength, balance, and flexibility in the elderly, and physical activity policies should continue to promote yoga as an activity that enhanc-

es physical and mental well-being in these older adults.

## Conclusion

After six weeks of combined yoga with elastic band training programs, the order adults had improved muscle strength, endurance, flexibility, and balance.

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## Supplementary Information

### Article details

The online version available at  
[https://doi.org/10.15391/prrht.2025-10\(1\).06](https://doi.org/10.15391/prrht.2025-10(1).06)

### Acknowledgement

We would like to express our sincere gratitude to all the participants who generously dedicated their time and effort to this study. Additionally, we extend our appreciation to the community leaders who facilitated the smooth conduct of the intervention sessions and data collection procedures.

### Conflict of interest

The authors declare no conflict of interest regarding the publication of this research study.

### Funding Statement

This article did not receive financial support from the state, public or commercial organizations.

**Received: January 11, 2025; Accepted: January 27, 2025**

**Published: February 28, 2025**

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Conceptualization, T.T., P.B., P.S., and P.J.; methodology, T.T., P.B., and P.J.; software, T.T., and P.B.; check, T.T., P.B., and P.J.; formal analysis, T.T., P.B., P.S. and P.J.; investigation, T.T., P.S., and P.J.; resources, T.T., and P.J.; data curation, T.T., P.B., and P.J.; writing - rough preparation, T.T., P.B., and P.J.; writing - review and editing, T.T., P.S., and P.B.; visualization, T.T., and P.J.; supervision, T.T., and P.J.; project administration, T.T., P.S., and P.J.; receiving funding, T.T., P.B., P.S., and P.J. All authors have read and agreed with the published version of the manuscript.