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Analysis of Exercise Therapy in Elderly Users of Contemporary Wellness Line Dance Towards Improving Knee Joint Movement Function

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ABSTRACT

This study aims to analyze the effect of exercise therapy on knee joint function in elderly users of contemporary wellness training (line dancing). The analysis was conducted on pre-elderly elderly individuals aged 45-59 who actively participated in Line Dance training at Lippo Plaza Yogyakarta. This study used a descriptive quantitative method with 19 elderly users of contemporary wellness training (line dancing). Data collection was conducted through observation, documentation, and Range of Motion (ROM) measurements using a goniometer over eight sessions. The research instrument used a measuring tool with proven validity and reliability. The data analysis technique used SPSS software version 27 with data normality testing using Shapiro-Wilk. The results of the study indicate that: (1) The implementation of Line Dance has fulfilled the structured training components and is in accordance with the physical needs of the elderly; (2) Line Dance has contributed positively to improving the function of knee joint movement in the elderly. This is shown through changes in the Range of Motion (ROM) of the knee joint gradually in the flexion movement increasing by 12.43º and extension decreasing by 8.4º during eight meetings; (3) Contemporary wellness Line Dance can be a form of contemporary wellness-based exercise therapy carried out with light-moderate intensity (50% - 70%) with a duration of 60-90 minutes and carried out with a frequency of 2-3 times in 1 week. Thus, it can be concluded that Line Dance can be an exercise therapy to improve the function of knee joint movement.

1. Introduction

Modern life places substantial physical and psychological demands on individuals, making wellness increasingly relevant as a holistic framework for improving quality of life. Wellness refers to a comprehensive balance among psychological and physiological aspects, including physical, emotional, intellectual, social, vocational, spiritual, and environmental dimensions [12]. Qian and McDonough [10] emphasize that wellness is closely related to active living, stress management, healthy social relationships, meaning, and life purpose. Skarbek et al. [14] further reported that wellness-oriented activities can reduce stress, anxiety, and depression while improving mood and overall quality of life through physiological responses such as endorphin and norepinephrine release and decreased cortisol levels.

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The World Health Organization classifies the age group of 45-59 years as middle age or pre-elderly, 60-74 years as elderly, and 75-89 years as old age [19]. With increasing age, organ function gradually declines because of natural degenerative processes and disease-related factors. One important degenerative condition in pre-elderly and elderly populations involves the musculoskeletal system, particularly the joints. Fatmawati [4] reported that individuals entering the pre-elderly phase may experience changes in visual acuity, gait, posture, musculoskeletal capacity, mental condition, acute illness, and chronic disease.

Degenerative changes in the knee joint are influenced by reduced synovial fluid production, thinning of articular cartilage, decreased ligament elasticity, altered muscle tone, and reduced strength of supporting muscles such as the quadriceps and hamstrings [5]. Insufficient physical activity may accelerate knee joint stiffness, decrease flexibility, and weaken the supporting muscles [8]. These conditions are commonly associated with knee osteoarthritis and functional limitations. Exercise therapy has been widely recommended as a non-pharmacological strategy for relieving knee symptoms, improving physical function, and maintaining joint mobility [16], [18].

Exercise programs for pre-elderly and elderly participants must consider training phases, dosage, and training principles to ensure safety and optimal benefits [13]. Exercise that exceeds individual physical capacity may increase the risk of injury [1]. Therefore, exercise design for this population should apply the principles of safety, individualization, gradual progression, and adequate recovery [6]. Preliminary interviews with the Lippo Plaza Yogyakarta line dance instructor, Mrs. Benedicta Ully Krisnasari, identified three key considerations:

1. Pre-elderly participants tend to choose non-pharmacological alternatives because they are perceived as safer, more natural, and less dependent on medication.
2. Line dance is preferred because it is enjoyable, less monotonous, and creates social interaction that motivates participants to remain physically active.
3. Line dance is believed to improve blood circulation, strengthen lower-limb muscles, maintain joint flexibility, and stimulate memory.

Based on these initial findings and the increasing popularity of line dance among pre-elderly participants, this study analyzed exercise therapy among contemporary wellness line dance participants in relation to knee joint movement function. The analysis focused on the characteristics of exercise therapy, the contemporary wellness approach, and changes in knee joint range of motion.

2. Method

This study used a descriptive quantitative method to obtain numerical data that could be measured objectively and analyzed statistically. The descriptive approach was used to examine the relationship between the characteristics of contemporary wellness-based line dance exercise therapy and improvement in knee joint movement function. The study was non-experimental; the researchers observed, analyzed, and evaluated phenomena among participants who actively joined line dance activities. The research consisted of 10 meetings: one meeting for line dance movement analysis, eight meetings for range of motion (ROM) measurement, and one final meeting for evaluation. The study was conducted during line dance activities at Lippo Plaza, Jl. Laksda Adisucipto No. 32-34, Special Region of Yogyakarta, from April 1 to April 25, 2026.

The population consisted of all members who actively participated in line dance activities at the research location. The sample was selected using purposive sampling, a non-probability sampling technique based on specific criteria aligned with the research objectives. This technique was selected because the study required participants with particular characteristics relevant to the

analysis of contemporary wellness-based line dance exercise therapy and knee joint function. The inclusion criteria were as follows:

1. Participants were in the pre-elderly category, aged 45-59 years.
2. Participants were members who actively joined regular line dance activities at Lippo Plaza, Jl. Laksda Adisucipto No. 32-34, Special Region of Yogyakarta.
3. Participants had consistently participated in line dance activities for at least one month.
4. Participants joined line dance activities at least twice per week.
5. Participants were able to perform basic movement activities independently without permanent walking aids, such as wheelchairs or special canes.
6. Participants were able to understand research instructions, complete questionnaires independently or with limited assistance, and follow the established measurement procedures.
7. Participants were willing to participate by signing an informed consent form after receiving an explanation of the study procedures.

The data analysis was conducted to answer the research problem using a quantitative approach with SPSS version 27. The analyzed data included participant characteristics, knee joint function measured using ROM, and the implementation of contemporary wellness-based line dance exercise therapy. Descriptive analysis was used to summarize participant characteristics, training components, and ROM trends. The Shapiro-Wilk test was applied because the sample size was below 50 participants. A significance value greater than 0.05 indicated normally distributed data, whereas a value of 0.05 or lower indicated non-normal distribution. Paired comparisons were then used to evaluate changes in knee ROM between the first and eighth sessions.

3. Results and Discussion

The research data were analyzed according to participant characteristics, activity patterns, knee condition, medical history, exercise duration, exercise intensity, body mass index, and knee ROM measurements. The descriptive results are presented in Figures 1-8 and Tables 1-5.

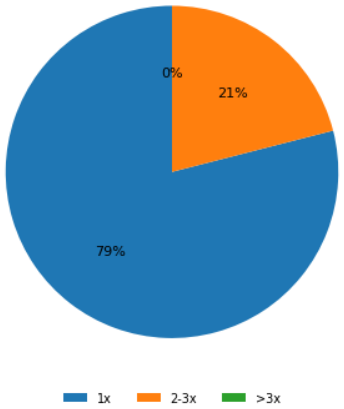

Fig. 1. Activities Outside Line Dance

Figure 1 shows that 79% of respondents reported one activity outside line dance, while 21% reported two to three activities. This finding indicates that line dance was the main physical activity for most participants, with their overall activity level generally categorized as low to moderate.

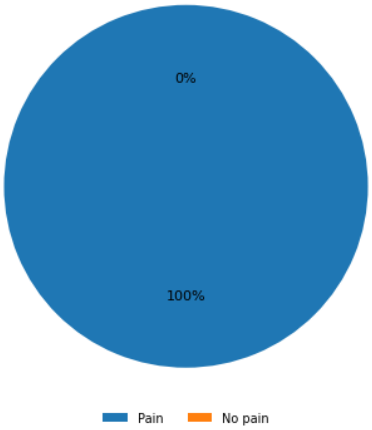

Fig. 2. Knee Pain Status

Figure 2 shows that all respondents (100%) reported having experienced knee pain, while no respondents were in the no-pain category. This result confirms that knee discomfort was a common condition among the participants before and during the observation period.

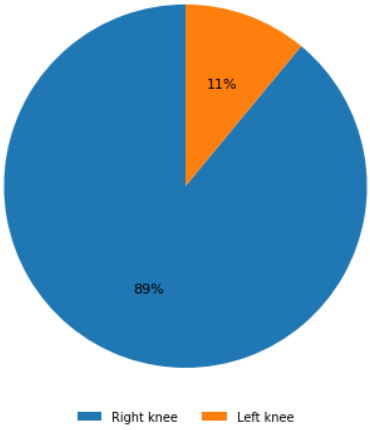

Fig. 3. Knee Pain Location

Figure 3 indicates that 89% of respondents experienced pain in the right knee, while 11% experienced pain in the left knee. Therefore, knee pain complaints were more dominant on the right side than on the left side.

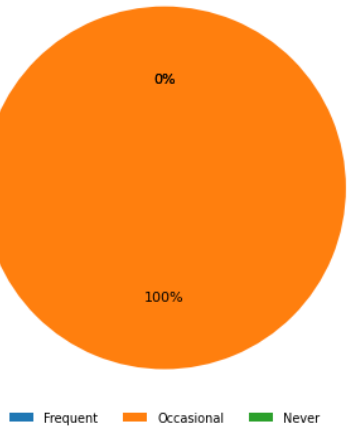

Fig. 4. Pain Frequency

Figure 4 shows that all respondents were in the occasional-pain category (100%). No respondents reported frequent pain or the absence of pain. These results indicate that the participants' knee pain was intermittent and occurred at certain times rather than continuously.

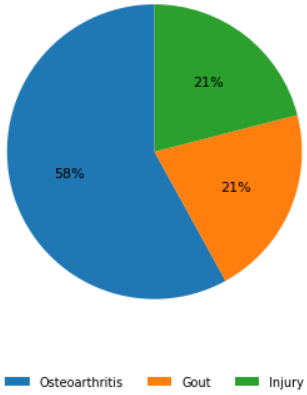

Fig. 5. Medical History

Figure 5 shows that osteoarthritis was the most common medical history among respondents (58%). Histories of gout and injury were each reported by 21% of respondents. Thus, osteoarthritis was the dominant musculoskeletal condition in the sample.

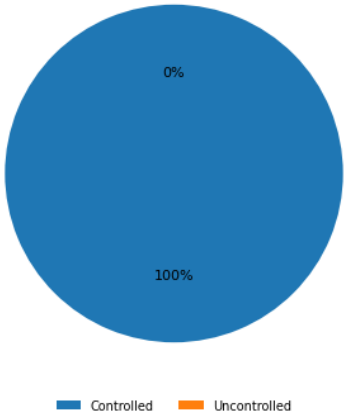

Fig. 6. Medical Condition Control

Figure 6 shows that all respondents with a disease history were in the controlled-condition category (100%). No respondents reported uncontrolled medical conditions during the study period.

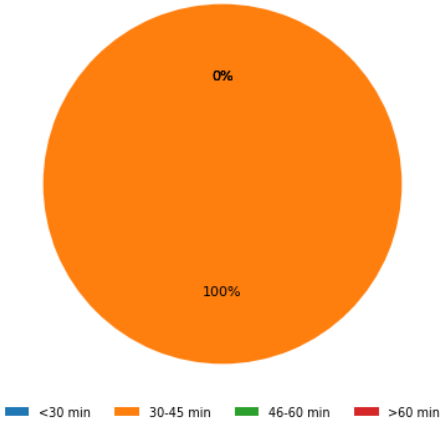

Fig. 7. Line Dance Duration

Figure 7 shows that all respondents performed line dance activities for 30-45 minutes per session (100%). No respondents reported other duration categories.

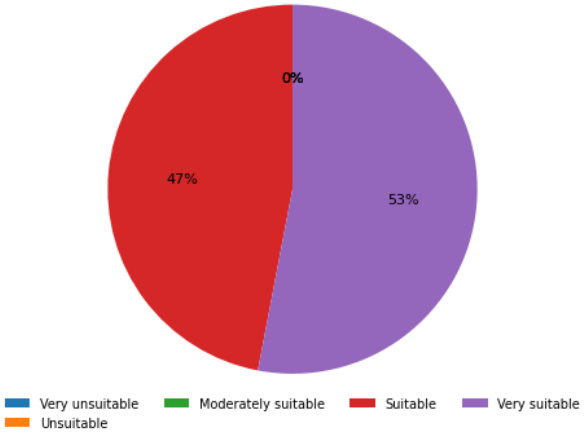

Fig. 8. Line Dance Intensity Level

Figure 8 shows that 53% of respondents rated the line dance intensity as very suitable, while 47% rated it as suitable. No respondents rated the intensity as quite suitable, not suitable, or very unsuitable. This finding suggests that the exercise intensity was acceptable for the participants' physical condition.

Table 1. Body Mass Index (BMI) of Respondents

Name	Height (cm)	Weight (kg)	BMI	Category
P1	158	64	25.6	Overweight
P2	155	62	25.8	Overweight
P3	154	65	27.4	Overweight
P4	160	64	25.0	Overweight
P5	159	63	24.9	Normal
P6	154	66	27.8	Overweight
P7	156	63	25.9	Overweight
P8	157	59	23.9	Normal
P9	161	56	21.6	Normal
P10	158	62	24.8	Normal
P11	156	65	26.7	Overweight
P12	157	69	28.0	Overweight
P13	154	58	24.5	Normal
P14	157	60	24.3	Normal
P15	155	66	27.5	Overweight
P16	160	62	24.2	Normal
P17	158	61	24.4	Normal
P18	154	58	24.5	Normal
P19	155	67	27.9	Overweight

Based on BMI analysis, 11 of the 19 respondents were classified as overweight, while eight respondents were in the normal category. This distribution is important because excessive body weight may increase mechanical loading on the knee joint and potentially influence joint discomfort and ROM.

Table 2. Knee Flexion Range of Motion Results

	Session							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
P1	117	120	123	125	126	128	129	130
P2	113	114	116	118	120	122	123	125
P3	118	120	123	124	126	127	130	130
P4	119	122	125	126	129	130	130	130

	Session							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
P5	115	116	117	118	119	120	121	122
P6	116	118	119	120	121	124	126	128
P7	116	118	121	123	125	127	130	130
P8	114	116	119	121	124	126	127	130
P9	119	121	124	125	126	128	130	130
P10	115	118	119	120	121	124	125	126
P11	115	117	120	121	124	125	126	128
P12	112	113	114	115	117	118	121	122
P13	115	118	120	123	126	128	130	130
P14	119	120	123	124	126	127	130	130
P15	116	117	119	120	123	125	128	130
P16	115	116	118	121	122	124	125	128
P17	119	120	121	124	126	127	129	130
P18	113	116	118	121	122	124	126	129
P19	116	119	122	123	124	127	128	130

Note: Values are presented in degrees (°).

Table 2 shows consistent improvement in knee flexion ROM across all respondents from the first to the eighth session. The mean knee flexion ROM increased from 115.89 ± 2.16° to 128.32 ± 2.67°, with an average improvement of 12.43°. This indicates that participants' knee flexion moved closer to the normal functional range after eight line dance sessions.

Table 3. Shapiro-Wilk Normality Test for Knee Flexion ROM

	Shapiro-Wilk		
Participants	**Statistic**	**Sig.**	**Description**
P1	0.945	0.660	Normal
P2	0.956	0.772	Normal
P3	0.946	0.670	Normal
P4	0.859	0.117	Normal
P5	0.975	0.933	Normal
P6	0.958	0.793	Normal
P7	0.942	0.630	Normal
P8	0.968	0.882	Normal
P9	0.814	0.619	Normal
P10	0.961	0.817	Normal
P11	0.960	0.810	Normal
P12	0.939	0.600	Normal
P13	0.925	0.471	Normal
P14	0.935	0.565	Normal
P15	0.945	0.664	Normal
P16	0.964	0.850	Normal
P17	0.932	0.539	Normal
P18	0.989	0.993	Normal
P19	0.975	0.935	Normal

Table 4. Knee Extension Range of Motion Results

	Session							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
P1	9	9	6	4	2	0	0	0
P2	7	6	5	3	1	0	0	0
P3	7	6	4	2	1	0	0	0
P4	8	6	4	3	0	0	0	0
P5	8	6	5	3	2	0	0	0
P6	9	9	7	5	4	3	2	0
P7	9	8	8	7	5	3	0	0

	Session							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
P8	8	6	4	3	1	0	0	0
P9	9	7	7	4	1	0	0	0
P10	10	8	8	5	3	0	0	0
P11	10	10	8	5	3	1	0	0
P12	11	10	8	6	3	1	0	0
P13	10	9	9	8	6	5	2	1
P14	8	7	5	4	1	0	0	0
P15	7	6	6	5	2	0	0	0
P16	7	5	4	2	0	0	0	0
P17	9	6	5	4	1	0	0	0
P18	7	5	4	2	1	0	0	0
P19	9	7	7	5	4	2	0	0

Note: Values are presented in degrees (°).

Table 4 shows a consistent decrease in knee extension limitation across all respondents from the first to the eighth session. The mean extension limitation decreased from 8.53 ± 1.22° to 0.05 ± 0.23°, with an average reduction of 8.47°. A lower extension value indicates that the knee joint became closer to full extension at 0°.

Table 5. Shapiro-Wilk Normality Test for Knee Extension ROM

	Shapiro-Wilk		
Participants	**Statistic**	**Sig.**	**Description**
P1	0.848	0.090	Normal
P2	0.782	0.101	Normal
P3	0.848	0.090	Normal
P4	0.828	0.057	Normal
P5	0.771	0.241	Normal
P6	0.946	0.672	Normal
P7	0.874	0.163	Normal
P8	0.871	0.153	Normal
P9	0.837	0.070	Normal
P10	0.867	0.142	Normal
P11	0.871	0.153	Normal
P12	0.893	0.248	Normal
P13	0.903	0.308	Normal
P14	0.853	0.103	Normal
P15	0.826	0.053	Normal
P16	0.822	0.185	Normal
P17	0.870	0.151	Normal
P18	0.789	0.139	Normal
P19	0.929	0.503	Normal

3.1. Analysis of the Training Phase on Knee Joint Movement Function

The training phase analysis showed that line dance consisted of approximately 5 minutes of warm-up, 45 minutes of core exercise, and 5 minutes of cool-down. The total duration was slightly shorter than the 60-90 minutes commonly recommended for structured exercise sessions [9]. However, for pre-elderly participants with knee discomfort, this duration can be considered acceptable as an introductory light-to-moderate activity, provided that the load is increased gradually. Effective warm-up is indicated by increased body temperature, heart rate, respiratory frequency, and blood flow to active muscles, as well as reduced muscle and joint stiffness [13]. During the warm-up phase, respondents reported increased body temperature, sweating, and increased heart rate. These responses suggest that the warm-up supported muscle flexibility, joint lubrication, and preparation for movement. Increased body temperature can promote vasodilation,

oxygen delivery, and muscle metabolism, thereby improving the elasticity of muscle fibers, tendons, and connective tissue.

3.2. Analysis of Exercise Dosage on Knee Joint Movement Function

The exercise frequency of twice per week can be categorized as promotive and preventive because it helps maintain physical health and reduce functional decline [9]. This frequency did not cause excessive fatigue or apparent overtraining, making it suitable for pre-elderly line dance participants. If the frequency is below twice per week, the training stimulus may be insufficient to produce physiological adaptation. Conversely, excessive frequency without adequate recovery, especially more than three to four sessions per week in older participants, may increase fatigue accumulation, mechanical stress on the knee joint, and the risk of overuse injury [11].

Heart rate was monitored during each line dance session to estimate exercise intensity. Maximum heart rate can be estimated using the formula 220 minus age [8]. With an average participant age of 50 years, the estimated maximum heart rate was 170 beats per minute. The observed average heart rate ranged from 92 to 112 beats per minute, corresponding to approximately 54-66% of the estimated maximum heart rate. Therefore, the line dance activity was categorized as light-to-moderate intensity [15]. This intensity is appropriate because it provides a balance between flexibility, endurance, and safety for participants with early degenerative musculoskeletal changes.

Line dance is classified as an aerobic exercise because it involves rhythmic, repetitive, and continuous movements performed at light-to-moderate intensity. Aerobic exercise uses oxygen as the primary source of energy production and supports cardiovascular, respiratory, musculoskeletal, and metabolic function [2], [19]. The movement patterns in line dance also provide repeated lower-limb activation, which may help maintain knee mobility and functional capacity.

3.3. Analysis of Exercise Principles on Knee Joint Movement Function

Overall, line dance applies several training principles that support movement-function improvement in pre-elderly participants, including overload, progression, specificity, individuality, continuity, reversibility, recovery, adaptation, variation, and safety. These principles were reflected in the participants' ability to follow movements gradually, adjust movement intensity to their physical capacity, and maintain regular attendance [11]. Participants also showed awareness of recovery after physical activity and the risk of reversibility, namely the loss of adaptation after prolonged inactivity. Reduced training continuity may lead to decreased muscle strength, flexibility, and cardiopulmonary capacity [3].

The variation of movements in the line dance program helped maintain participant motivation and supported physiological adaptation [11]. The program can therefore be interpreted as an exercise therapy strategy that prioritizes progression, individuality, safety, and continuity. Through repeated lower-limb movement, line dance may contribute to improved knee muscle strength, joint flexibility, balance, and functional capacity.

3.4. Suitability of Exercise Components for Contemporary Wellness Line Dance Participants

Respondents participated in a systematic exercise structure consisting of warm-up, core exercise, and cool-down phases. Although the total exercise duration was shorter than the commonly recommended duration for structured training, the program still included the main components required for safe exercise: physical preparation, musculoskeletal stimulus, and recovery. Future implementation may gradually extend the duration toward 60-90 minutes according to participant tolerance.

Observation results showed that most respondents considered the exercise intensity and duration suitable or very suitable for their physical condition. This indicates that the program considered the functional capacity of pre-elderly participants and could be performed without excessive burden. The line dance activity also reflected the principle of specificity by emphasizing lower-limb movement, the principle of progression through regular and staged practice, and the principle of individuality through movement adaptation according to participant ability.

The ROM measurement results showed increased knee flexion and reduced knee extension limitation. Increased flexion indicates improved ability to bend the knee. Knee flexion is influenced by the elasticity of flexor and extensor muscles, including the hamstrings and quadriceps, as well as the flexibility of periarticular tissues [4]. Reduced extension limitation indicates that the knee joint became closer to full extension at 0°. Extension improvement may be associated with reduced joint stiffness, better articular cartilage function, and optimized synovial fluid distribution [4]. Because ROM was measured using a goniometer, standardized positioning and measurement consistency are important to support reliable interpretation [20].

3.5. Analysis of the Contemporary Wellness Approach

A holistic wellness approach views individual well-being comprehensively, not only through physical condition but also through psychological, emotional, social, spiritual, and environmental aspects [12]. Observations and interviews indicated that line dance training at Lippo Plaza Yogyakarta considered participants' physical condition while also supporting social interaction and emotional well-being. The instructor stated that the training was intended to address not only physical needs but also psychological, emotional, social, and environmental aspects. This was reflected in the positive atmosphere during training and the visible enthusiasm of participants. One respondent stated that line dance practice improved mood and motivated regular attendance. Enjoyable group exercise may stimulate endorphin release, which can temporarily reduce pain perception by inhibiting pain-signal transmission in the central nervous system [7]. Continued participation may also support synovial-fluid distribution and knee ROM improvement.

4. Conclusions

This study indicates that contemporary wellness line dance at Lippo Plaza Yogyakarta can function as a structured, safe, and enjoyable exercise therapy for improving knee joint movement function in pre-elderly participants. The program included warm-up, core exercise, and cool-down phases and was performed at light-to-moderate intensity. Knee flexion ROM increased by an average of 12.43°, while knee extension limitation decreased by an average of 8.47° across eight sessions. These findings show that line dance can support knee mobility, flexibility, and functional movement. For future implementation, the exercise duration may be gradually adjusted toward 60-90 minutes with a frequency of two to three sessions per week, while maintaining safety, individualization, and adequate recovery.

Conflict of interest
The authors declare that there is no conflict of interest related to this research, authorship, or publication.

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