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Common Lower Limb Discomforts in DanceSport Athletes: A Foundation for Designing Therapeutic Dance Exercises

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Abstract

Aim: The study aimed to prevent and manage muscle strain and discomfort in DanceSport athletes at Tangub City National High School by developing a structured training program. It held academic significance as it contributed to the limited literature on injury prevention and functional conditioning among adolescent DanceSport athletes. The study also benefited the discipline and the local community by introducing a culturally responsive, low-cost training regimen that used localized terms and improvised household equipment, making it adaptable to resource-limited settings. Its technical novelty lay in the integration of biomechanical principles, rhythmic movement, and progressive overload into the FlexiPower routine, which comprised five targeted exercises designed to meet the physical demands of dancesport while promoting safe and sustained performance.

Methodology: A muscle strain and discomfort assessment was conducted, examining the frequency, intensity, and location of muscle issues using a 5-point Likert scale. Data were collected using the assessment tool, interview and observation.

Results: The study revealed that dancesport athletes commonly experience mild to moderate muscle discomfort, particularly in the calves, thighs, hips, and lower back. Overtraining, fatigue, and limited flexibility were identified as key contributing factors. Athletes also reported discomfort during specific movements such as jumps, spins, and quick directional changes. These findings highlight the physical demands of DanceSport and the need for a targeted training approach. In response, the FlexiPower program was developed to address these issues through structured strength, flexibility, and recovery exercises, aiming to enhance performance while minimizing injury risk.

Conclusion: The study concludes that dancesport athletes frequently experience muscle discomfort in key areas such as the calves, thighs, hips, and lower back, primarily due to overtraining, fatigue, and biomechanical strain. These issues can hinder performance and increase injury risk if left unaddressed. The FlexiPower program effectively responds to these needs by providing a structured, evidence-based approach that integrates strength training, flexibility exercises, and recovery strategies. Its targeted design promotes physical resilience, reduces discomfort, and supports overall performance enhancement in DanceSport athletes.

Keywords: FlexiPower, Holistic training, FlexiStep circuit, HipFlex surge, SpinGuard

INTRODUCTION

Muscle strain is a prevalent condition among DanceSport athletes, particularly in the lower extremities, due to the sport's high physical demands. As a discipline that merged artistic expression with athletic rigor, DanceSport places intense stress on muscles, joints, and tendons, making dancers highly susceptible to injury (Quinlan et al., 2021)**.** Muscle strain occured when excessive mechanical tension is applied to muscles, leading to pain, impaired motor function, and extended recovery periods (Wang et al., 2022) . These injuries commonly affect the muscle-tendon junction, where excessive tensile loading results in acute pain, swelling, and limited range of motion (McHugh et al.,

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2019) . Despite the growth of sport science literature, muscle strain remained a persistent issue in DanceSport, highlighting the need for deeper biomechanical insights and targeted preventive strategies.

While numerous studies have examined injury patterns in high-impact sports such as gymnastics and ballet, DanceSport remains underrepresented in sports medicine research. Movements characteristic of DanceSport—such as spins, jumps, and rapid directional changes—can lead to muscle overuse and strain, causing both acute and chronic injuries (Frontiers in Sports and Active Living, 2023). The absence of sport-specific biomechanical evaluations and evidence-based interventions reveals a significant gap in the literature. Although prior research has underscored the importance of conditioning, warm-up routines, and recovery practices, most studies focus on general injury prevention rather than DanceSport-specific protocols (Costa et al., 2020). Additionally, risks associated with improper warm-up techniques, muscular imbalances, and inadequate recovery remain largely unaddressed in holistic training models (Smith et al., 2022).

This study aimed to address these gaps by developing a specialized training plan tailored to the biomechanical demands of DanceSport. Unlike generic injury prevention programs, this research integrates flexibility training, strength development, and neuromuscular conditioning. Through movement analysis, it identifies high-risk motions and formulates precise preventive strategies. By proposing a systematic injury prevention framework, the study contributes to the growing field of sports science while offering practical applications for dancers, coaches, and health professionals.

Moreover, the study aligned with the United Nations Sustainable Development Goal 3: Good Health and Well-Being. It incorporates insights from athletes, coaches, physical therapists, and dance trainers to design a program aimed at preventing injuries and improving injury management. This approach not only enhances athletic performance but also promotes long-term health and career sustainability.

Ultimately, this research sought to provide DanceSport athletes with a scientifically grounded approach to reducing lower extremity discomfort, optimizing performance, and extending career longevity. The findings will also support coaches and trainers in implementing effective, evidence-based methods to maximize training outcomes and minimize avoidable injuries.

Objectives

This study aimed to develop a specialized exercise routine training plan for DanceSport athletes at Tangub City National High School in Tangub City, Misamis Occidental.

Specifically, the study sought to:

1. identify the common muscle discomforts experienced by DanceSport athletes during and after training or performance;
2. determine the specific muscles in the lower extremities that are most affected by strain in DanceSport athletes;
3. examine the underlying causes of muscle discomfort, including contributing factors such as overuse, poor flexibility, and improper technique;
4. identifiy the most frequently affected lower extremity regions specifically the ankles and feet, calves, and thighs; and
5. design a training plan that addresses the management and prevention of lower extremity muscle strain, incorporating targeted exercises for strength development, flexibility enhancement, and improved recovery.

METHODS

Research Design

This study employed a qualitative research design supported by quantitative data, structured through the Input-Process-Output (IPO) model. The IPO framework was used to guide the flow of the study: the input phase gathered qualitative and quantitative data through interviews, focus group discussions, and biomechanical assessments; the process phase was designing and developing of a training intervention. The output was the training program titled "FlexiPower: Sculpting Strength and Flexibility for DanceSport," which includes five newly developed exercises: *Hipflex Surge, SpinGuard Core Work, PowerStep Stability Drill, FlexiStep Circuit, and DanceFlow Recovery.* The program aims to enhance dancers' range of motion, reduce muscular discomfort, and prevent injuries during training and performance.

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Population and Sampling

Purposive sampling was used in the study.The participants were three male and female dancesport athletes, one Physical Therapist and five experts in dancesports and dance exercise.The selection of participants with direct experience and relevance to the study objectives. This sampling approach ensired the inclusion of participants most likely to experience and expertise in muscle strain and dancesport dance exercise relevant to the study.

Instrument

To assess the muscle strain and discomfort among the participants, structured questionnaire was developed and piloted to assess the frequency, intensity, and location of muscle discomfort or strain. A 5-point Likert scale was used to measure the severity of discomfort (1 = no discomfort to 5 = severe discomfort) experienced during and after training or competition. A custom framework based on the IPO was created to structure the training plan's development. The IPO model provided the structure for input, process, and output stages. The instructional design was validated through expert review, including input from a licensed physical therapist and a certified dancesport trainer.

Data Collection

Following ethics approval and formal permission from the school administration, data collection was conducted over a two-week period. The researchers coordinated with the dancesport coaches to schedule sessions with the athletes. During these sessions, the Muscle Strain and Discomfort Assessment questionnaire was administered in person, with the researchers providing clarifications as needed to ensure accurate responses. In addition to the surveys, video recordings and structured observations were carried out during selected training sessions to support the biomechanical assessment.

In the second phase, the researchers designed a therapeutic dance exercise routine based on these findings. The routine was reviewed by experts, revised accordingly, and pilot-tested with the participants.

Treatment of Data

The data were analyzed using both qualitative and quantitative approaches. Quantitative data from the Likert-scale assessments were tabulated and analyzed using descriptive statistics to identify common patterns in muscle discomfort. For the qualitative data, thematic analysis was conducted on focus group transcripts and observation notes to extract recurring themes related to the causes of injury and movement-related strain. Video analyses were also employed to evaluate posture, movement mechanics, and potential risks of repetitive strain. Additionally, expert evaluations from a licensed physical therapist and a dancesport professional were incorporated to triangulate the findings and guide the refinement of the training plan, ensuring its relevance and effectiveness.

Ethical Considerations

This study adhered to ethical principles of beneficence, respect for persons, and justice. All participants provided informed assent, and for minors, informed consent was obtained from their guardians. Participation was strictly voluntary, and participants were informed of their right to withdraw at any time. All personal data were anonymized and kept confidential. Ethical clearance was obtained from the University Research Integrity and Compliance Office (RICO) of Mindanao State University – Iligan Institute of Technology.

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RESULTS and DISCUSSION

This chapter presents the findings of the study, emphasizing the assessment and participant feedback on "FlexiPower: Sculpting Strength and Flexibility for DanceSport". The data is organized into sections reflecting respondent feedback during the development phase, their experiences with the program, and expert comments and recommendations. Each part contributes to the study's objectives and provides analysis from multiple perspectives.

Common Muscle Discomforts experienced by Dancesport Athletes

Table 1 shows the result of the needs assessment on the muscle strain and discomfort experience among dancesport athletes.

Table 1. Frequency and Severity of Muscle Strain and Discomfort in Dance Sport Athletes

Aspect	Mean Rating	Frequency Category	Severity Category
1. Frequency of Muscle Strain or Discomfort During Training	2.5	Rarely	Mild Discomfort
2. Severity of Muscle Strain or Discomfort During Training	2.5	Rarely	Slight Discomfort
3. Frequency of Muscle Soreness After Training Sessions	2.5	Rarely	Infrequent Occurrence
4. Severity of Muscle Soreness After Training Sessions	3	Occasionally	Moderate Discomfort
5. Presence of Discomfort During Specific Movements			
5.1 Frequency	2.83	Occasionally	
5.2 Severity	2.33	Mild Discomfort	Slight Discomfort
6. Impact of Muscle Discomfort on Training Performance			
6.1 Frequency	2.83	Occasionally	
6.2 Severity	2.66	Moderate Discomfort	Noticeable Discomfort
7. Frequency of Using Recovery Strategies (Stretching, Massage, Ice/Heat)	2	Rarely	Infrequent Occurrence

Table 1, summarized the frequency and severity of muscle strain and soreness, as reported by the athletes. Overall, results show that muscle discomfort is present at a moderate frequency and mild to moderate intensity. A mean rating of 2.5 to 3.0 indicates that although discomfort does not consistently interrupt training sessions, it remains significant enough to impact physical performance. This is particularly true for soreness after training, where moderate discomfort was more commonly reported. These findings underscore the physical demands of dancesport, characterized by high-intensity, repetitive movements such as jumps, spins, and rapid directional changes, all of which strain the musculoskeletal system. Literature supports these findings, noting the prevalence of delayed-onset muscle soreness (DOMS) and muscular strain in dancers due to repetitive stress and minimal recovery time (Allen et al., 2019) Twitchett et al., 2020). Thus, the development of a training program with controlled intensity and strategic recovery sessions becomes essential in mitigating such discomfort.

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Common Specific Muscles Discomfort affexted by Strain among Dancesport Athletes

Table 2 presents the most common muscle groups that were affected by strain among dancesport athletes.

Table 2. Muscle Groups Most Affected by Strain among Dancesport Athletes

Muscle Group Affected	Frequency of Affected Respondents	Description of Discomfort
1. Neck & Shoulders	All respondents	Commonly affected during posture-maintaining and lifting movements.
2. Upper Back	All respondents	Frequently strained due to improper posture and upper body control during complex movements.
3. Hips & Pelvis	All respondents	Highly susceptible to strain during spins, quick direction changes, and jumps.
4. Thighs	All respondents	Affected due to repetitive flexion, extension, and impact during high-intensity movements.
5. Calves	All respondents	Commonly strained from continuous footwork and pushing off the floor during jumps.
6. Ankles & Feet	All respondents	High strain from quick footwork, pivoting, and constant weight distribution.
7. Core	All respondents	Central to balance and posture during spins, jumps, and rapid direction changes.
8. Lower Back	All respondents	Prone to discomfort from excessive flexion, hyperextension, and improper alignment during dynamic movements.

Table 2 presented self-reported data indicating that all respondents experienced strain in the neck, shoulders, upper and lower back, hips, thighs, calves, ankles, feet, and core. Focusing on the lower extremities, the calves, hips, and thighs emerged as the most commonly affected areas. This correlates with the biomechanical demands of Dancesport, which requires lower-body dominance for explosive and stabilizing movements. The calves, particularly the gastrocnemius and soleus, endure repetitive loading from relevés and jumps, increasing susceptibility to overuse injuries (Quinn & Kline, 2019). The hips, especially the adductors and flexors, are frequently strained during spins and direction changes (Steinberg et al., 2021). Meanwhile, thigh discomfort—primarily affecting the quadriceps and hamstrings—is linked to continuous flexion and extension during rapid footwork. Previous studies have connected these issues to muscle imbalances, insufficient eccentric strength, and inadequate warm-ups (Lopez et al., 2019; Martinez et al., 2019). The findings support the need for targeted exercises in the FlexiPower plan, such as HipFlex Surge and PowerStep Stability Drill, which aim to strengthen and stretch these vulnerable muscle groups.

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Causes and Contributing Factors of Muscle Discomfort

Table 3 shows the beliefs that causes muscle discomfort among dancesport athletes.

Table 3. Beliefs that Causes Muscle Discomfort among Dancesport Athletes

	Cause of Muscle Discomfort	Respondents Reporting Belief
1.	Overtraining	All respondents
2.	Improper Technique	2 out of 6 respondents
3.	Lack of Flexibility	2 out of 6 respondents
4.	Fatigue	All respondents

Table 3 revealed that all respondents identified overtraining and fatigue as major causes, followed with improper technique and lack of flexibility. The literature strongly supports these claims that overtraining leads to cumulative fatigue and reduced muscle recovery, heightening injury risk (Meyers & Narducci, 2019). Fatigue impairs neuromuscular control, increasing the likelihood of poor movement patterns and resulting strain. While fewer athletes identified technique and flexibility as issues, studies emphasize that both are critical in dance injury prevention. Improper technique can cause imbalanced muscle loading and joint misalignment (Chia et al., 2020), and poor flexibility restricts range of motion, raising the risk of muscle pulls—particularly in the calves, hamstrings, and hip flexors (Smith et al., 2021). To address these root causes, the FlexiPower program incorporates a periodized training approach with built-in recovery days, dynamic flexibility routines, and technical reinforcement through core engagement and posture drills.

Common Lower Extremity Discomfort in Dancesport Movements

Table 4 presents the common lower extremity discomfort in dancesport movements.

Table 4. Common Lower Extremity Discomfort in Dancesport Movements

Muscle Group	Common Discomfort	Possible Causes
Calves	**Calf pain**	High stress from movements like relevés, jumps, and quick directional changes. Overuse injuries from repetitive dance steps.
Thighs	**Thigh pain**	Strain from lunges, squats, leg extensions, and rapid directional changes. Muscle imbalances, fatigue, and inadequate eccentric strength in the hamstrings.
Ankles & Feet	**Ankle and foot pain**	Overuse and stress from prolonged standing, footwork, and jumps. Common among various dance genres.

Table 4 shows the most commonly reported lower extremity discomforts in Dancesport athletes, with focus on the calves, thighs, ankles, and feet. These areas bear the greatest load during dance movements such as jumps, pivots, directional changes, and prolonged standing. Calf pain is primarily caused by repeated plantar flexion and limited recovery, leading to microtrauma in the muscle fibers (Quinn & Kline, 2019). Thigh discomfort stems from dynamic motions like lunges and squats that challenge the quadriceps and hamstrings; contributing factors include eccentric weakness and fatigue (Lopez et al., 2019; Davis, 2021). Ankle and foot pain, meanwhile, result from the constant pressure of jumps, balance holds, and intricate footwork (Wong et al., 2022). These findings justify the inclusion of eccentric strengthening exercises, ankle stability drills, and structured recovery practices like foam rolling and static stretching in the training plan. Addressing these areas will help mitigate strain and enhance dancers' physical durability. Overall, the results emphasized the necessity of a training plan that targets the calves, thighs,feet and ankle were the key lower extremity areas commonly affected in Dancesport. With this, the FlexiPower program, guided by empirical findings and expert recommendations, seeks to reduce overuse injuries, promote recovery, and improve overall athlete performance and well-being.

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Dance Exercise Training Plan

Based on the results of the assessment, the dance exercise training plan is to specifically target the areas, using a combination of flexibility training, strength-building exercises, and dance-specific drills. The program will gradually enhance dancers' range of motion, reduce discomfort, and prevent injuries during training and performances.

Table 5 shows the designed dance exercise training plan.

Table 5. FlexiPower: Sculpting Strength and Flexibility for DanceSport

Overview					
Objective:		To enhance flexibility, strength, and endurance in dance sport athletes, while preventing and managing muscle strain and discomfort, particularly in key muscle groups such as the calves, hips, thighs, core, and lower back.			
Duration:		3-4 months (3 sessions per week)			
Frequency:		3 sessions per week			
Time per Session:		1.5 hours			
Intensity:		Moderate to High (with gradual progression to ensure optimal recovery and performance)			
Weekly Schedule					
Week	**Day**	**Activity/Dance Steps**	**Muscle Focus**	**Counting and Repetition**	**Time**
Week 1-2	**Day 1**	**Cardio: DanceFlow** (Zumba-inspired Rumba)	Hips, Core, Calves	5-minute warm-up, 4 sets of 3-minute routines	30 minutes
		Hyflex Surge (Dynamic Stretch for Hips & Quads)	Hips, Thighs, Calves	3 sets of 12 reps each side	15 minutes
	Day 2	**PowerStep Stability Drill** (Lower Body Stability)	Calves, Ankles, Thighs	3 sets of 10 reps per leg	20 minutes
		SpinGuard Core Work (Core Strengthening)	Core, Lower Back	3 sets of 30-second holds	20 minutes
	Day 3	**FlexiStep Circuit** (Strength and Flexibility)	Full Body (Focus on Flexibility)	4 sets of 12 reps for each exercise	30 minutes
		DanceFlow Recovery (Static Stretch and Foam Rolling)	Full Body Recovery	10-minute full body cool-down	15 minutes
Week 3-4	**Day 1**	**Cardio: DanceFlow** (Cha-cha and Samba steps)	Hips, Core, Legs	4 sets of 4-minute routines	30 minutes
		HipFlex Surge (Dynamic Stretch for Flexibility)	Hips, Quads, Hamstrings	3 sets of 12 reps each side	20 minutes
	Day 2	**PowerStep Stability Drill** (Leg and Ankle Strength)	Thighs, Calves, Ankles	3 sets of 15 reps per leg	20 minutes
		SpinGuard Core Work (Spin Stability)	Core, Lower Back	3 sets of 45-second holds	20 minutes
	Day 3	**FlexiStep Circuit** (Full Body Strength & Flexibility)	Hips, Calves, Thighs	4 sets of 15 reps per exercise	30 minutes

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		DanceFlow Recovery (Foam Rolling and Stretching)	Full Body Flexibility	10 minutes of foam rolling	15 minutes
Week 5-6	**Day 1**	**Cardio: DanceFlow** (Cha-cha and Samba with intensity)	Hips, Core, Calves	4 sets of 5-minute routines	30 minutes
		HipFlex Surge (Stretch & Strengthen for Flexibility)	Hips, Quads, Calves	4 sets of 15 reps each side	20 minutes
	Day 2	**PowerStep Stability Drill** (Focused Stability)	Thighs, Glutes, Ankles	4 sets of 15 reps per leg	20 minutes
		SpinGuard Core Work (Advanced Core Stability)	Core, Lower Back	4 sets of 45-second holds	20 minutes
	Day 3	**FlexiStep Circuit** (Strength + Flexibility with Technique)	Full Body (Flexibility & Strength)	4 sets of 15 reps per exercise	30 minutes
		DanceFlow Recovery (Dynamic Cool-down and Stretch)	Full Body Flexibility	10-minute full-body cool-down	15 minutes
Week 7-8	**Day 1**	**Cardio: DanceFlow** (Rumba & Samba with choreography)	Hips, Core, Calves	5 sets of 4-minute routines	30 minutes
		HipFlex Surge (Dynamic Stretch & Strengthening)	Hips, Thighs, Calves	4 sets of 15 reps each side	20 minutes
	Day 2	**PowerStep Stability Drill** (Ankle and Knee Strength)	Calves, Thighs, Glutes	4 sets of 20 reps per leg	20 minutes
		SpinGuard Core Work (Spin and Balance Control)	Core, Lower Back	4 sets of 1-minute holds	20 minutes
	Day 3	**FlexiStep Circuit** (Full Body Training with Dance Focus)	Hips, Thighs, Calves	5 sets of 15 reps per exercise	30 minutes
		DanceFlow Recovery (Recovery with Flexibility and Foam Rolling)	Full Body Flexibility	15-minute full-body cool-down	15 minutes

Table 5 outlines the FlexiPower program, a structured training plan designed to reduce muscle discomfort and enhance strength, flexibility, and endurance among DanceSport athletes. The inclusion of targeted drills like PowerStep Stability and HipFlex Surge supports the lower extremities, addressing areas most prone to strain. This aligns with Koutedakis and Sharp (1999), who emphasized the need for dancer-specific strength and flexibility training to prevent injury. The cardio-based DanceFlow sessions replicate performance intensity, while balance and core exercises enhance control and reduce injury risk, consistent with findings by Emery et al. (2005). Recovery strategies such as foam rolling and stretching are integrated to improve muscle elasticity and reduce soreness, making FlexiPower a practical, evidence-based approach to DanceSport conditioning.

Conclusion

The findings of this study revealed that dancesport athletes commonly experience mild to moderate muscle discomfort, particularly in the calves, thighs, hips, and lower back due to the biomechanical demands of training and

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performance. Factors such as overtraining, fatigue, limited flexibility, and improper technique contribute to these discomforts, potentially impairing performance. The FlexiPower training program, developed in response to these needs, effectively integrates targeted strength, flexibility, and recovery strategies. It addresses high-risk muscle groups and movement patterns, offering a holistic approach that improves physical capacity while supporting injury prevention. Overall, FlexiPower proves to be a practical, culturally grounded, and evidence-informed training model for enhancing athlete well-being and DanceSport performance.

Recommendations

Based on the findings, it is recommended that DanceSport coaches and trainers integrate the FlexiPower program into regular conditioning to address muscle strain and enhance strength, flexibility, and endurance. Emphasis should be placed on incorporating structured recovery techniques such as foam rolling and stretching into each session to reduce fatigue and prevent overuse injuries. Additionally, technical reinforcement should be included to correct improper movement patterns that contribute to discomfort. The program should be continually adapted based on athlete feedback and performance response. Finally, FlexiPower can be scaled and customized for use in other dance disciplines, promoting broader application in dance conditioning and injury prevention programs.

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