The Effects of the 11+ Dance Program on Reducing the Risk of Foot and Ankle Injuries for Collegiate Contemporary Dancers

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BACKGROUND

This study explores the high prevalence of musculoskeletal injuries among contemporary dancers, the realm are often likened to high-performance athletes due to the physically demanding nature of their work. However, lacking adequate medical attention demonstrates that the implementation of the 11+ Dance Neuromuscular Prevention Program significantly enhances balance and ankle strength, reducing injury rates and fostering safer, sustainable dancing careers. (Steinberg et al., 2012; Kolokythas et al., 2022).

Research Gap

While contemporary dancers face injury risks comparable to high-performance athletes, there remains a notable gap in tailored medical support and injury prevention strategies, which this study addresses by evaluating the efficacy of the 11+ Dance Neuromuscular Prevention Program in enhancing the ability of balance and ankle strength on reducing injury risks among dancers.

PURPOSE

1. The study is designed to evaluate how effective the 11+ Dance Program is in enhancing balance and ankle strength among collegiate contemporary dancers.
2. The results aim to contribute valuable insights into the study of effective injury prevention strategies for dancers and healthcare professionals.

METHODOLOGY

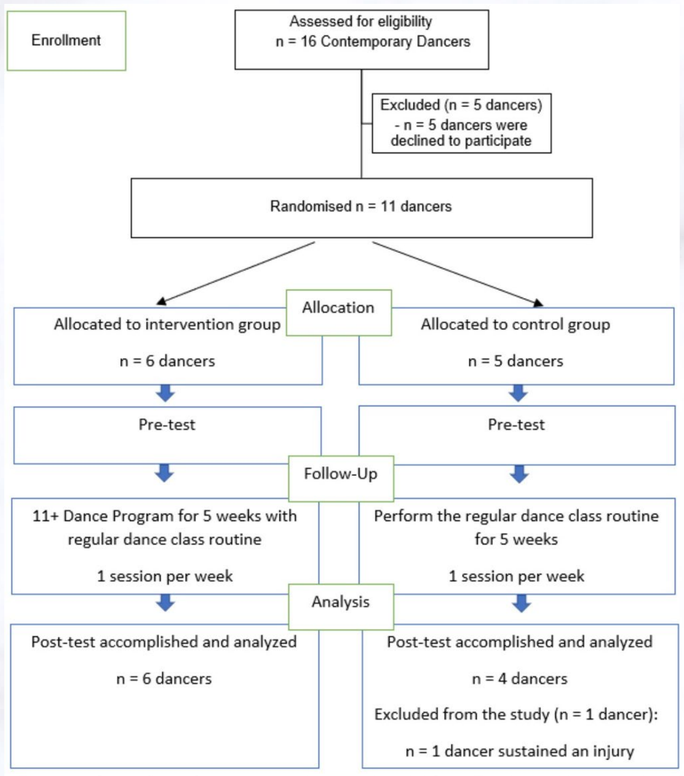
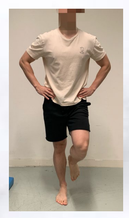


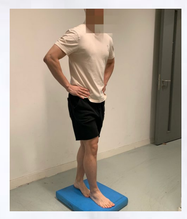
Figure 1. Study flow of participants through the trial from The Hong Kong Academy for Performing Arts

mBESS Test (Kleffelgaard et al., 2017)


Single Leg Stance Test


Tandem Leg Stance Test


Single Leg Stance on Foam Test

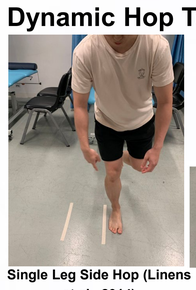

Tandem Leg Stance on Foam Test

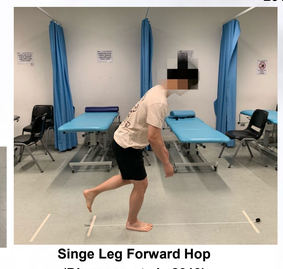
HHD Test

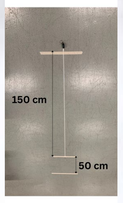

Hip Abduction (Awwad et al., 2017)


Ankle Eversion (Alfuth & Hahm, 2016)

Dynamic Hop Test


Single Leg Side Hop (Linens et al., 2014)


Singe Leg Forward Hop (Dingenen et al., 2019)



11+ Dance Neuromuscular Program (Kolokythas et al., 2022)

- **Participants:** Collegiate contemporary dancers from HKAPA
- **Sampling Method:** Random selection of participants who meet the inclusion criteria
- **Duration:** 5 weeks
- **Intervention:** 11+ Dance Program
- **Frequency:** 30-minute a week for 5 weeks
- **Program Content:** Exercises include strength training, balance workouts, and techniques for refine jumping and landing. Exercises progress in intensity and complexity over the duration of the program.

Data Collection and Analysis

- Pre-Test Data Collection: Before starting the 11+ Dance Program, baseline data on balance and ankle strength of the participants would be collected.
- Post-Test Data Collection: After the completion of the 5-week 11+ Dance Program, the same tests conducted in the pre-test would be repeated to assess any changes in balance and ankle strength.
- Data from pre and post-tests would be analyzed to determine significant improvements or changes in the measures of balance and ankle strength.

RESULTS

Most data were no significant differences ($p>0.05$) in post -test

The post test statistical analy of m-Bess SLS and TLS (errors score)

Test	Adjusted Mean (IG)(SEM)(n=6)	Adjusted Mean (CG)(SEM)(n=4)	Adjusted Mean Difference IG-CG (95%CI)	Sig. (p)	η2	ICC(95%CI)
SLS	-1.417(0.888)	2.125(1.063)	-3.542 (-0.376,-6.708)	0.033	0.454	0.380(-0.280-0.800)
TLS	4.329(0.540)	3.756(0.672)	1.181 (3.420,-1.059)	0.259	0.156	0.800(0.380-0.940)

Note. Abbreviations: SEM - Standard Error of Mean; N-number; IG - Intervention Group; CG - Control Group; ICC - Intraclass Correlation Coefficient; Sig. - P value; η2 - Partial Eta Squared ;CI - Confidence interval ; m-BESS – Modified Balance Error Scoring System; SLS - Single Leg Stand; TLS - Tandem Leg Stand;

Note. Means were adjusted by Quade's Ancova; Negative adjusted means indicate that, after accounting for covariates and rank transformation, the group's mean is lower than expected based on the overall distribution of the data

The post test statistical analy of m-Bess SLSF and TLSF (errors score)

Test	Adjusted Mean (IG)(SEM)(n=6)	Adjusted Mean (CG)(SEM)(n=4)	Adjusted Mean Difference IG-CG (95%CI)	Sig. (p)	η2	ICC(95%CI)
Over ALL	6.037(0.621)	6.570(0.787)	-0.533 (2.025,-3.091)	0.637	0.034	0.600 (0.002-0.884)
SLSF	4.329(0.540)	3.756(0.672)	0.573 (2.684,-1.538)	0.541	0.056	0.380 (0.310-0.940)
TLSF	1.138(0.653)	2.293(0.823)	-1.155 (1.496,-3.806)	0.337	0.132	0.490 (-0.160-0.840)

Note. Abbreviations: SEM - Standard Error of Mean; N-number; IG - Intervention Group; CG - Control Group; ICC - Intraclass Correlation Coefficient; Sig. - P value; η2 - Partial Eta Squared ;CI - Confidence interval ; m-BESS – Modified Balance Error Scoring System; SLSF - Single Leg Stand on Foam; TLSF - Tandem Leg Stand on Foam; Over ALL;Sum of SLS TLS SLSF TLSF

Note. Means were adjusted byAncova test (pre-test as covariate)

The post test statistical analy of HHD Hip ABD and Ankle EV (kilogram)

Test	Group	Adjusted Mean (IG)(SEM)(n=6)	Adjusted Mean (CG)(SEM)(n=4)	Adjusted Mean Difference IG-CG (95%CI)	Sig. (p)	η2	ICC(95%CI)
Hip ABD	D	20.339(1.978)	16.384(2.423)	-3.955 (-3.445,11.354)	1.597	0.247	0.970 (0.910-0.990)
	ND	19.670(2.111)	17.554(2.568)	2.116 (10.015,-5.783)	0.401	0.547	0.910 (0.760-0.970)
Ankle EV	D	12.589(1.818)	14.700(2.245)	1.013 (8.712,-6.686)	0.097	0.765	0.950 (0.850-0.990)
	ND	14.352(2.021)	13.339(2.491)	-2.111 (4.851,-9.074)	0.514	0.497	0.910 (0.770-0.980)

Note. Abbreviations: SEM - Standard Error of Mean; N-number; IG - Intervention Group; CG - Control Group; ICC - Intraclass Correlation Coefficient; Sig. - P value; η2 - Partial Eta Squared ;CI - Confidence interval ; HHD - Handheld Dynamometry; Hip ABD - Hip Abduction; Ankle EV - Ankle Eversion; ND – Non-Dominant leg; D - Dominant leg

Note. Means were adjusted by Ancova test (pre-test as covariate)

The post test statistical analy of SLH (centimeter)

Test	Group	Adjusted Mean (IG)(SEM)(n=6)	Adjusted Mean (CG)(SEM)(n=4)	Adjusted Mean Difference IG-CG (95%CI)	Sig. (p)	η2	ICC(95%CI)
SLH	D	118.882(3,706)	105.010(4.633)	13.872 (28.570,-0.826)	0.468	0.516	0.800(0.530-0.940)
	ND	117.674(5.202)	111.439(6.608)	6.253 (27.780.-15.311)	4.981	0.061	0.880(0.700-0.970)

Note. Abbreviations: SEM - Standard Error of Mean; N-number; IG - Intervention Group; CG - Control Group; ICC - Intraclass Correlation Coefficient; Sig. - P value; η2 - Partial Eta Squared ;CI - Confidence interval ; SLH - Single Leg Hop test; ND – Non-Dominant leg; D - Dominant leg

Note. Means were adjusted by Ancova test (pre-test as covariate)

The post test statistical analy of SLSH (second)

Test	Group	Adjusted Mean (IG)(SEM)(n=6)	Adjusted Mean (CG)(SEM)(n=4)	Adjusted Mean Difference IG-CG (95%CI)	Sig. (p)	η2	ICC(95%CI)
SLSH	D	9.030(0.771)	10.700(0.970)	-1.670 (1.441,-4.782)	3.680	0.103	0.600 (-0.001-0.880)
	ND	9.510(0.258)	9.940(0.361)	-0.429 (0.738,-1.597)	0.756	0.413	0.850 (0.520-0.960)

Note. Abbreviations: SEM - Standard Error of Mean; N-number; IG - Intervention Group; CG - Control Group; ICC - Intraclass Correlation Coefficient; Sig. - P value; η2 - Partial Eta Squared ;CI - Confidence interval ; SLSH - Single Leg Side Hop test; ND – Non-Dominant leg; D - Dominant leg

Note. Means were adjusted by Ancova test (pre-test as covariate)

DISCUSSION

Results and Analysis:

- The study found that while the 11+ dance program slightly improved basic balance abilities, it did not significantly enhance complex balance or strength in dancers, suggesting its duration may be insufficient to meet the demanding physical needs of dance routines.
- The small sample size limits the ability to demonstrate significant differences in this study.

Insights from Recent Studies:

- The study references significant previous research such as Vera et al. (2020), which demonstrated a substantial decrease in injury rates through a targeted intervention in ballet.
- Kaufmann et al. (2022) highlighted the benefits of neuromuscular warm-up routines in reducing overuse injuries in ballet performers.

Conclusions and Implications:

- The findings imply that while the 11+ dance program has potential, its current configuration and duration might be inadequate for achieving significant improvements in balance and strength among dancers.
- The need for further research with larger sample sizes and possibly extended program durations to validate and refine the intervention strategies.

PRACTICAL APPLICATION

- Research like that of Sudds et al. (2023) indicates adaptations in biomechanics and improved jump performance in participants, showcasing the direct benefits of the program.
- The Program is delivered through structured sessions focusing on strength, balance, and refining jumping and landing techniques to adapt the dancer's bodies progressively and safely.
- Recommended to be incorporated during the warm-up phase, the program consists of 20-30 minutes sessions held at least three times a week, tailored to each dancer's training intensity and specific requirements.

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