

The Effects of 11+ Dance Exercise Training Program in Reducing the Risk of Lateral Ankle Sprain for Contemporary Dancers

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Background

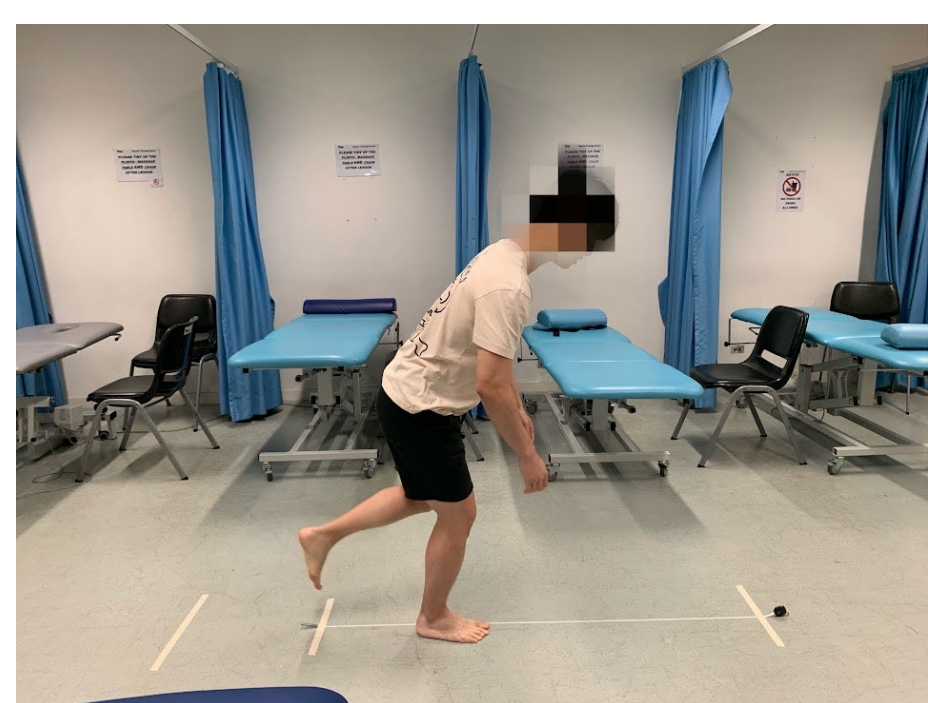
- Contemporary dance, which is modern dance. It is unique because it consists of complex movements (Shah, et al. 2012)
- Their training needs to perform repetitive movement beyond anatomical limitations such as arching and turnout (Van Winden, et al. 2019)
- These actions or requirements will increase the risk of injury to contemporary dancers. The highest injury rate is the ankle (18%) (van Seters et al., 2020; Shah et al., 2012)
- The 11+ Dance Program is a neuromuscular training program for injury prevention in dancers. The program focuses on muscle endurance and muscular activation of the upper and lower body, and also on ankle, knee, hip alignment, balance and coordination (Kolokythas, et al. 2022)

Purpose

- Explore the effects of the 11+ Dance Exercise Training Program in improving the strength, balance and stability of the lower limbs to reduce the risk of lateral ankle sprains for contemporary dancers.

Methods

- A total of 10 contemporary dancers, aged 18-40 years old from the Hong Kong Academy for Performing Arts (HKAPA) were recruited.
- CG (4): pre-test and post-test
- IG (6): pre-test, post-test and 11+ Dance Program (5 weeks)
- Tests: (1) Single leg forward hop test (SLH), (2) Isolated strength test (HHD), (3) Modified balance error scoring system test (M-BESS), (4) Side hop test (SLSH)



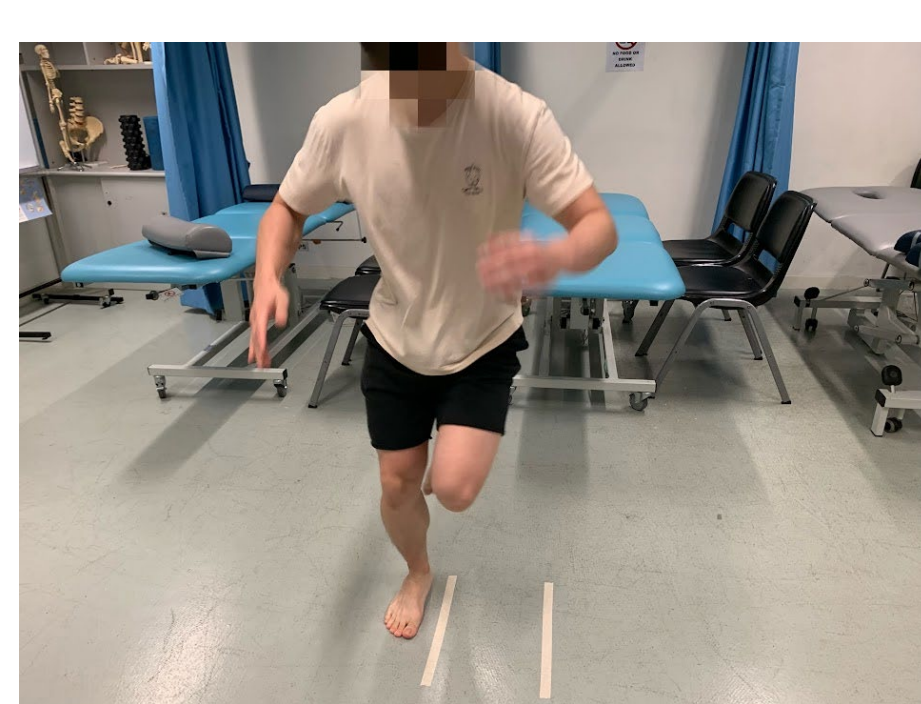
Single leg forward hop test



Isolated strength test (HHD)



Modified balance error scoring system test (M-BESS)



Side hop test



11+ Dance Program

Results

The statistical analysis of m-BESS SLS and TLS (errors scores)

Test	Adjusted Mean (IG)(SEM)(n=6)	Adjusted Mean (CG)(SEM)(n=4)	Adjusted Mean Difference IG-CG (95%CI)	Sig. (p)	η^2	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; η^2 - 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 statistical analysis of m-BESS SLSF and TLSF (errors scores)

Test	Adjusted Mean (IG)(SEM)(n=6)	Adjusted Mean (CG)(SEM)(n=4)	Adjusted Mean Difference IG-CG (95%CI)	Sig. (p)	η^2	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; η^2 - 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 by Ancova test (pre-test as covariate)

The statistical analysis 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)	η^2	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; η^2 - 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 statistical analysis 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)	η^2	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)	6.233 (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; η^2 - 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 statistical analysis 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)	η^2	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; η^2 - 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

- Most of the data showed **no significant difference**
- For the strength: The 11+ dance is a bodyweight exercise, more focused on muscle activation, muscular endurance, balance and the technique of takeoff and landing (Sudds et al., 2023), and might not necessarily improve or increase the lower limb explosive power
- For the balance: The 11+ Dance program performs many single-leg stance movements and balances, such as single balance with hip rotation, so they may have better balance in the single-leg stance on firm surfaces test. Moreover, as contemporary and ballet dancers dance on hard surfaces, they may not improve their balance on a foam surface
- For the stability: May be limited by the setting of the level of the 11+ Dance program, as the article shows that the level of the parameters is very important for increasing the muscle strength, balance and stability of lower the limb (Kolokythas et al., 2022)
- Conclusion: As all data has low statistical power, the effect of the 11+ Dance program on reducing the risk of lateral ankle sprain was not able to be confirmed

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