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· 健康教育与健康促进 ·

园艺活动联合花样跳绳对四年级小学生健康行为的干预效果

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【摘要】 **目的** 探讨校本园艺活动联合花样跳绳对四年级小学生健康行为的干预效果,为儿童健康促进提供参考。**方法** 采用多阶段整群随机抽样方法,于 2023 年 3 月选取长沙市某小学四年级 85 名小学生,随机分为干预组(43 名)和对照组(42 名)。干预组实施 12 周"校本园艺联合花样跳绳"综合干预,每周 1 次,90 min/次,含常规实践(第 1~5,7~11 周;内容为蔬果植物管理、花样跳绳练习理论知识学习等)与亲子活动(第 6,12 周;蔬果沙拉制作、花样跳绳同步竞赛等),对照组维持常规课程。通过加速度计监测四年级小学生中高强度体力活动(MVPA)及睡眠时间,结合问卷评估果蔬摄入和视屏行为,采用广义估计方程分析数据。**结果** 干预后,两组上学日 MVPA 时间(Wald $\chi^2_{组别\times时间}$ 值=8.27)、蔬菜摄入量(Wald $\chi^2_{组别\times时间}$ 值=4.35)和视屏时间(Wald $\chi^2_{组别\times时间}$ 值=13.27)均存在交互效应(P 值均<0.01)。干预后,干预组上学日每日 MVPA 时间从 30.00(20.00,60.00)min 增长至 40.00(30.00,60.00)min;每日蔬菜摄入量从 99.85(33.95,229.48)g 升至 190.15(131.05,279.48)g;视屏时间从每日 225.00(110.00,313.75)min 降至 60.00(30.00,142.50)min(Z 值分别为-4.51,-2.00,-3.84,P 值均<0.05)。两组周末每日 MVPA 时间、水果摄入量及睡眠时间干预前后差异均无统计学意义(Z 值分别为-1.35,-0.85,-0.24,P 值均>0.05)。**结论** 校本园艺活动联合花样跳绳综合干预可显著改善四年级小学生上学日的体力活动、蔬菜摄入及视屏行为,为多维健康促进提供依据。

【关键词】 园艺;运动活动;行为;干预性研究;健康促进;学生

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Intervention effect of school-based horticultural activities combined with fancy rope skipping on the health behaviour of fourth-grade primary school students/*ZHANG Hao**, *CHEN Yi*, *QI Yufei*. **The Sports Department, Central South University, Changsha* (410083), *Hunan Province, China*

【**Abstract**】 **Objective** To explore the intervention effect of school-based horticultural activities combined with fancy rope skipping on the health behaviour of fourth-grade primary school students, so as to provide a reference method for children's health promotion. **Methods** Eighty-five primary school students in grade 4 of a primary school in Changsha City were selected in March 2023 by using multi-stage cluster random sampling method and randomly divided into an intervention group (43 students) and a control group (42 students). The intervention group implemented a 12-week comprehensive intervention of "school-based gardening combined with pattern skipping, once a week 90 min/time including routine practice (weeks 1-5, 7-11; the contents were vegetable and plant management, theoretical knowledge learning of pattern skipping practice, etc.) and parent-child activities (weeks 6 and 12; vegetable salad making, synchronized jumping rope competition, etc.), and the control group maintained the regular curriculum. Moderate to vigorous physical activity (MVPA) and sleep duration were monitored by accelerometers in grade 4 primary school students, combined with questionnaires to assess fruit and vegetable intake and video screen behaviour, and generalised estimating equations were used to analyse the data. **Results** After the intervention, there were interaction effect for school day MVPA time (Wald $\chi^2_{group\times time}$ = 8.27), vegetable intake (Wald $\chi^2_{group\times time}$ = 4.35), and video screen time (Wald $\chi^2_{group\times time}$ = 13.27) in both groups (P<0.01). After the intervention, the MVPA time in the intervention group increased from 30.00 (20.00, 60.00) min to 40.00 (30.00, 60.00) min from school day; vegetable intake increased from 99.85 (33.95, 229.48) g to 190.15 (131.05, 279.48) g; and video screen time increased from 225.00 (110.00, 313.75) min to 60.00 (30.00, 142.50) min (Z=-4.51, -2.00, -3.84, P<0.05). However, there were no statistical differences in MVPA time, fruit intake and sleep time before and after intervention in the intervention group on weekends (Z=-1.35, -0.85, -0.24, P>0.05). **Conclusion** School-based horticultural activities combined with an integrated intervention of fancy rope skipping can significantly improve physical activity, vegetable intake and video screen behaviours on weekdays in grade 4 primary school children, in order to provide a basis for multidimensional health promotion.

【**Keywords**】 Gardening; Motor activity; Behavior; Intervention studies; Health promotion; Students

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随着我国社会经济发展,儿童饮食与运动模式发生显著变化,引发果蔬摄入不足、中高强度体力活动(moderate to high intensity physical activity, MVPA)缺乏及视屏时间延长等问题,导致近视、肥胖等慢性病高发[1-4]。针对这些问题,我国出台了《2019 年全国青少年体育活动促进计划》《健康中国行动(2019—2030 年)》等政策文件[5-6],明确提出"五育并举"的发展战略,充分体现了国家对学生健康行为促进工作的高度重视。校本园艺活动作为劳动与食育融合的干预手段,通过果蔬种植与烹饪实践,可提升营养认知并改善体力活动与视屏行为[7]。花样跳绳以其趣味性和挑战性,对增强儿童 MVPA 水平及身心健康效果显著[8-10]。多项循证研究表明,单一的干预措施对改善学龄儿童包括饮食、体力活动、睡眠质量等多方面健康行为的效果并不明显[11-13],因此,饮食与身体活动的综合干预措施在国内外受到广泛关注[14-17]。

国外已有研究者通过校本园艺活动干预计划与体育干预相结合的方式来改善儿童的饮食和 MVPA 行为[16],并取得较为积极的效果[14,18-19]。本研究将校本园艺活动与花样跳绳结合,旨在构建符合中国国情、可持续的儿童健康行为综合干预模式,为儿童健康促进提供参考。

1　对象与方法

1.1　对象　采用多阶段整群抽样法,于 2023 年 3 月从长沙市 6 个城区整群随机抽取 6 所小学,在每所小学内,以四年级所有班级为研究人群,采用简单随机抽样法抽取 2 个班级。选择四年级学生主要基于其处于学龄中期(9~10 岁),此阶段是健康行为形成的关键窗口期,且身心发育相对稳定,有利于干预效果的客观评估。排除标准:(1)严重脏器疾病或内分泌疾病;(2)药物性肥胖/发育异常;(3)拒绝参与。最终纳入 85 名学龄儿童,采用随机数字表法分为干预组(43 名)和对照组(42 名);干预组年龄(9.79±0.61)岁,对照组(9.86±0.86)岁。两组儿童在性别、民族、居住地、是否独生子女以及主要看护人的文化程度构成及年龄上差异均无统计学意义(χ^2/t 值分别为 0.01, 0.00, 0.01, 0.10, 1.74, 0.45, P 值均>0.05),所有受试者及看护人均签署知情同意书。研究经中南大学湘雅公共卫生学院伦理委员会审查批准(编号:XYGW-2022-44)。

1.2　*方法*

1.2.1　综合干预方案　2023 年 2 月对干预组实施为期 12 周的"校本园艺联合花样跳绳"综合干预,每周 1 次,90 min/次,含常规实践(第 1~5, 7~11 周;内容为蔬果植物管理、花样跳绳练习理论知识学习等)与亲子活动(第 6, 12 周;蔬果沙拉制作、花样跳绳同步竞赛等),本方案严格遵循多阶段循证优化流程[20]。具体干预内容包括:(1)在校内花园种植 6 种季节性蔬果(紫甘蓝、黄瓜、生菜、草莓、圣女果和拇指西瓜等),每周围绕植物生长周期开展松土、除虫、浇水和施肥等实践;(2)讲解不同蔬果生长需求、蔬果营养价值、节气与种植等理论知识;(3)在第 6 和 12 周邀请看护人开展 1 次蔬果沙拉制作与品鉴,并分享 5 种健康食谱;(4)学习 24 种花样跳绳动作,包括个人、双人和集体项目;(5)讲解运动益处、运动损伤处理等理论知识;(6)在第 6 和 12 周邀请小学生看护人开展 1 次亲子花样跳绳竞赛,并颁发奖励。综合干预方案由 2 名具有校本园艺和花样跳绳干预资质的负责人统筹,教师、项目组及志愿者协同(见表 1)。对照组维持常规课程,干预后获赠校本园艺和花样跳绳操作手册。

表 1　校本园艺活动联合花样跳绳干预方案

Table 1　Intervention programme for combining school-based gardening activity and fancy rope skipping

干预类型	干预组成	目标人群	内容、频次与时长
校本园艺活动	园艺实践活动	四年级小学生	种植 6 种蔬果,第 1~5, 7~11 周(每次 35 min)
	园艺亲子互动活动	四年级小学生及看护人	蔬果沙拉制作,第 6, 12 周(每次 45 min)
	营养理论课程	四年级小学生	蔬果相关理论知识,第 1~5, 7~11 周(每次 10 min)
校本花样跳绳活动	花样跳绳实践活动	四年级小学生	24 种跳绳动作学习,第 1~5, 7~11 周(每次 35 min)
	花样跳绳亲子互动活动	四年级小学生及看护人	花样跳绳同步竞赛,第 6, 12 周(每次 45 min)
	运动理论课程	四年级小学生	运动相关理论知识,第 1~5, 7~11 周(每次 10 min)

1.2.2　仪器测量　采用迈欧三轴运动加速度计(型号:MC-780MA)连续监测受试者 MVPA 及睡眠时间。该设备信效度已通过前期研究验证(组内相关系数 ICC = 0.92,与标准多导睡眠监测仪结果一致性 r = 0.88)[21],且具有配戴便捷、抗干扰性强等优势。正式监测前,由经过统一培训的研究人员向受试者演示设备配戴方法,要求受试者于非惯用手连续配戴 4 d(含 2 个上学日及 2 个休息日),每日有效配戴时长≥20 h(若因洗漱、游泳等特殊原因临时摘除需记录原因及时间)。数据通过设备配套软件(MIO Connect 3.0)导出,MVPA 定义为加速度计数≥2 690 counts/min 的累计时间,睡眠时间采用 Cole-Kripke 算法自动分析[22],无效数据(单日配戴时长<10 h 或信号异常)予以剔除。

1.2.3　问卷调查　采用食物频率问卷(Food Frequency Questionnaire, FFQ)评估儿童饮食摄入情况[23]。

涵盖水果、蔬菜、含糖饮料及高能量零食四大类食物。由主要看护人记录小学生在一周内各类食物的摄入天数及具体份量。问卷包含 8 个选项，采用“每周没有或少于 1 d”~“每周 7 d”计分，内容效度(0.58)及信度(Cronbach α 系数为 0.71)良好[24]。视屏时间通过汪君民等[25]编制的问卷测量，内容包括：(1)每日观看电影、电视、录像或录像带的时间；(2)每日使用电脑(含平板电脑)、游戏机及手机的时间。问卷内容效度指数为 1.00，Cronbach α 系数为 0.85，信、效度良好[25]。所有问卷均由主要看护人填写，项目组成员对问卷进行现场核对以确保准确性。

1.3 质量控制 在干预前阶段，采用随机分组，并对研究人员进行统一培训(含干预流程、数据记录规范)及考核。干预期间，严格按标准化手册执行活动，由项目组成员监督实施过程，每 4 周对连续缺席≥2 次者实施家访/电话随访，并开展半结构化访谈(对象：管理者、教师、学生及家长)进行失访风险评估。干预结束后，数据由经培训的项目组成员通过标准化问卷采集，问卷填写过程采用统一指导语并由教师协助维持秩序，确保数据完整性。

1.4 统计学分析 采用 SPSS 27.0 软件进行统计处理，分析前通过 Shapiro-Wilk W 检验和 Levene 检验分别对连续性数据的正态性和方差齐性进行检验。由于数据不符合正态分布，故采用 $M(P_{25}, P_{75})$ 进行统计描述，组间比较采用 Mann-Whitney U 检验；对于重复测量资料采用广义估计方程(generalized estimating equations，GEE)分析，使数据结果更加稳健。检验水准 $\alpha=0.05$。

2 结果

2.1 四年级小学生干预前后 MVPA 时间及果蔬摄入量变化 广义估计方程分析结果显示，两组小学生干预前后在上学日 MVPA 时间和蔬菜摄入量交互效应均有统计学意义(P 值均<0.05)。简单效应分析结果显示，干预前，干预组和对照组学龄儿童在上学日 MVPA 时间、周末平均每日 MVPA 时间、水果摄入量、蔬菜摄入量 4 个方面的差异均无统计学意义(Z 值分别为-0.33，-0.81，-1.05，-0.67，P 值均>0.05)。在干预后，干预组的上学日每日 MVPA 时间和蔬菜摄入量均高于干预前，差异均有统计学意义(Z 值分别为-4.51，-2.00，P 值均<0.05)。两组干预前后在周末平均每日 MVPA 时间和水果摄入量的差异均无统计学意义(干预组 Z 值分别为-1.35，-0.85；对照组 Z 值分别为-1.48，-0.85，P 值均>0.05)。见表 2。

表 2 两组小学生干预前后每日 MVPA 时间与果蔬摄入量比较[$M(P_{25}, P_{75})$]

Table 2 Comparison of MVPA and fruit/vegetable intake between two groups of primary school students pre- and post-intervention[$M(P_{25}, P_{75})$]

组别	干预前后	人数	MVPA/min		果蔬摄入量/g	
			上学日	周末	水果	蔬菜
对照组	干预前	42	30.00(13.00,60.00)	30.00(10.00,40.00)	150.00(64.80,317.90)	178.60(42.90,253.60)
	干预后	42	30.00(20.00,47.47)	25.00(15.00,45.00)	115.00(40.30,235.70)	110.70(65.70,307.90)
干预组	干预前	43	30.00(20.00,60.00)	30.00(20.00,60.00)	130.20(55.88,236.60)	99.85(33.95,229.48)
	干预后	43	40.00(30.00,60.00)	32.50(20.00,60.00)	125.10(46.75,308.40)	190.15(131.05,279.48)
Wald $\chi^2_{组别}$ 值			4.25*	1.98	0.28	5.18*
Wald $\chi^2_{时间}$ 值			0.08	3.89	0.04	1.45
Wald $\chi^2_{组别\times时间}$ 值			8.27**	0.37	0.98	4.35*

注：* P<0.05，** P<0.01。

2.2 四年级小学生干预前后视屏及睡眠时间变化 见表 3。

表 3 两组小学生干预前后视屏时间与睡眠时间比较[$M(P_{25}, P_{75})$]

Table 3 Comparison of screen time and sleep duration between two groups of primary school students pre- and post-intervention[$M(P_{25}, P_{75})$]

组别	干预前后	人数	视屏时间/min		睡眠时间/min	
			上学日	周末	上学日	周末
对照组	干预前	42	160.00(80.00,240.00)	135.00(55.00,270.00)	540.00(540.00,600.00)	600.00(540.00,660.00)
	干预后	42	240.00(60.00,305.00)	150.00(60.00,300.00)	540.00(480.00,600.00)	600.00(480.00,660.00)
干预组	干预前	43	225.00(110.00,313.75)	85.00(51.25,320.00)	540.00(501.00,600.00)	600.00(540.00,619.50)
	干预后	43	60.00(30.00,142.50)	105.00(55.00,315.00)	540.00(487.50,600.00)	540.00(480.00,600.00)
Wald $\chi^2_{组别}$ 值			2.91	1.02	0.71	0.75
Wald $\chi^2_{时间}$ 值			0.01	1.40	0.58	5.48*
Wald $\chi^2_{组别\times时间}$ 值			13.27**	0.48	0.46	0.54

注：* P<0.05，** P<0.01。

广义估计方程分析结果显示，两组小学生干预前后上学日视屏时间交互效应有统计学意义(P<0.01)。

简单效应分析结果显示，干预前，干预组和对照组学龄儿童在上学日视屏时间和睡眠时间，周末平均视屏时间和睡眠时间 4 个方面的差异均无统计学意义（Z 值分别为-1.35，-1.21，-0.32，-1.16，P 值均>0.05）。在干预后，干预组的上学日视屏时间低于干预前，差异有统计学意义（Z=-3.84，P<0.01）。两组干预前后在周末平均视屏时间和上学日睡眠时间的差异均无统计学意义（干预组 Z 值分别为-1.26，-0.24；对照组 Z 值分别为-0.77，-1.11，P 值均>0.05）；周末平均睡眠时间仅时间主效应有统计学意义（P<0.05）。

3　讨论

本研究结果表明，校本园艺活动联合花样跳绳干预可改善四年级小学生健康行为指标。其中，干预组小学生在干预后上学日 WVPA 时间和蔬菜摄入量均高于对照组，视屏时间则低于对照组；而对于周末平均 MVPA 时间、水果摄入量、睡眠时间等指标，干预组与对照组间差异无统计学意义。提示校本园艺活动与花样跳绳的结合干预方案能够促进儿童部分健康行为的改善。

在 MVPA 时间方面，干预组学生在干预后增加了上学日的 MVPA 时长，这一现象与前人的研究结果相似[26-27]。根据自我决定理论，通过花样跳绳等活动的自主选择（动作组合）、能力挑战（难度分级）及社交互动（双人项目），满足了儿童的自主性、胜任力与归属感需求，从而增强参与动机[28]。相较传统体育课的单向训练模式，此类设计更易提升行为依从性[28-32]。其次，蔬菜摄入量的改善也是本研究的发现，印证了“动手学习”对健康饮食行为的促进作用，校本园艺活动通过种植与烹饪实践，不仅提升了儿童营养知识，还可通过成功体验（如培育蔬果）增强其自我效能感，与国际研究揭示的“动手学习”促进行为转化的机制一致[33]。此外，干预组上学日视屏时间下降至 60.00 min/d，可能与身体活动对电子设备使用的行为替代效应[34-35]及同伴规范引导（如集体竞赛）有关[36]。然而，尽管上学日的健康行为有所改善，周末的 MVPA 时间和视屏时间差异并无统计学意义，可能由于学龄儿童在周末的活动模式以及家庭作息时间的影响有关。具体来说，周末通常是家庭休息和社交的时间，许多儿童倾向于参与轻松的家庭活动，而非高强度的体育锻炼；此外，周末的活动可能更多受到家庭习惯的影响，儿童与父母的互动及活动安排与干预活动并未同步，导致周末健康行为改善的效果未能显现。

与此同时，虽然身体活动的增加常伴随水果摄入提升[37]，但本研究干预前后水果摄入量变化无统计学意义，可能与儿童固有口味偏好及干预侧重有关。另外，这种综合性干预对学龄儿童健康行为的改善效果呈现选择性特征。本研究中睡眠时间的改善效果无统计学意义，可能是由于学龄期儿童的睡眠模式在生长发育阶段具有一定的稳定性，且受遗传因素和家族史的影响[38]，表明未来的干预方案可能需要结合多种策略，以更加丰富的干预方式，对水果摄入量和睡眠质量进行教育和引导。

本研究存在一些局限性：（1）样本代表性受限，研究对象仅来源于长沙市 2 所小学四年级学生，且样本量较小，可能限制研究结论的外部效度；（2）干预期较短，未能充分观察干预措施的长期效果；（3）未对家庭饮食习惯、遗传因素等混杂因素进行深度控制，可能对结果产生潜在干扰。今后的研究应考虑更长时间的跟踪调查，并扩大样本范围，探索适合中国学龄儿童健康促进的可持续发展模式。

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