论著·军事医学

运动功能障碍纠正对新兵新训期间军事训练伤预防效果的随机对照研究

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[摘要] **目的** 为应对新兵军事训练伤高发现状,依据军人身体关节功能筛查技术发现的运动功能障碍,进行针对性纠正训练,探索该模式对新兵入伍训练期间军事训练伤的预防效果。**方法** 在联勤保障部队某新兵训练基地开展军人身体关节功能筛查,依据筛查得分将单个动作为1分且总分<10分的新兵作为纠正训练对象,通过整群抽样的方法,随机将新兵分为试验组(n=223)和对照组(n=223)。对照组新兵按照常规训练计划实施;试验组新兵在完成其既定训练任务同时,辅助开展为期2个月的运动功能障碍纠正训练,纠正训练全程由经过相关业务培训的组训骨干负责实施,同时记录整个新训期间的受伤情况,受伤情况来源于试验单位医疗保障部门的就诊记录。关节功能筛查得分采用独立样本t检验分析;训练伤发生率采用χ^2检验或Fisher精确检验法分析。**结果** 纠正训练后试验组关节功能筛查得分高于训练前(15.12±2.13 *vs* 10.58±2.83);纠正训练后试验组关节功能筛查得分显著高于对照组(15.12±2.13 *vs* 14.19±1.97,P<0.05)。新训期间试验组发生训练伤的人数比例为12.5%,显著低于对照组的34.5%(χ^2=5.469,P=0.001)。仅针对在新训期间受伤的人群,试验组测试得分<10分者11人(39.2%),显著低于对照组的49人(63.6%)(χ^2=4.972,P=0.026)。**结论** 基于军人身体关节功能筛查结果制定的纠正训练能够有效降低新兵军事训练伤发生率,该模式能够起到良好的预防效果。

[关键词] 新兵;入伍训练;军事训练伤;军人身体关节功能筛查;运动功能障碍;纠正训练;预防策略
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Prevention effectiveness of motor dysfunction correction against training injuries in new recruits during recruit basic training: a randomized controlled study

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[**Abstract**] **Objective** To explore the prevention effectiveness of a mode, conducting targeted corrective training based on motor dysfunction detected by military joint function screening, on military training injuries in new recruits during recruit basic training in order to cope with the high incidence of military training injuries among them. **Method** A military personnel joint function screening was conducted on the new recruits in a training base of Joint Logistics Support Force. Based on the results of screening, the

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new recruits with a single action score of 1 and a total score of <10 were subjected and served as corrective training participants. Through cluster sampling, the new recruits were randomly divided into an experimental group (*n*=223) and a control group (*n*=223). The control group were trained according to the regular training plan, while the experimental group completed their designated training tasks and a 2-month corrective training for motor dysfunction at the same time. The entire corrective training process was carried out by our key personnel who had received relevant training. Medical records of the medical security department of the experimental unit were collected and evaluated for the injury situation. The score of joint function screening was analyzed using independent sample *t* test. The incidence of training injuries was analyzed using *Chi*-square test or Fisher's exact test. **Result** After corrective training, the score of joint function was higher in the experimental group than the score before training (15.12±2.13 *vs* 10.58±2.83), and the score was also higher than that of the control group (15.12±2.13 *vs* 14.19±1.97, *P*<0.05). During the recruit basic training period, the incidence of training injuries was notably lower in the experimental group than the control group (12.5% *vs* 34.5%, *Chi*-square=5.469, *P*=0.001). Only for those who were injured during the training, 11 people (39.2%) in the experimental group scored less than 10, which was obviously lower than the 49 people (63.6%) in the control group (*Chi*-square=4.972, *P*=0.026). **Conclusion** Our mode, corrective training based on the results of military personnel joint function screening, can effectively reduce the incidence of military training injuries in new recruits during recruit basic training, and exerts a good preventive effect against military training injuries.

[**Key words**] new recruits; recruit basic training; military training injuries; military personnel joint function screening; movement dysfunction; corrective training; preventive strategies

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入伍训练是新兵从普通青年向合格军人转变的必经之路,军事训练作为增强新兵身体素质、打牢新兵"四个基础"的重要手段,一直是新兵入伍训练的核心内容。研究发现,由于新兵的身体素质、运动技能和心理适应能力均处于发展初期,在突然承受高强度军事训练时更容易发生训练损伤[1]。新兵军事训练伤的发生具有明显的特征性表现:从运动功能层面看,新兵普遍存在关节灵活性与稳定性不足、呼吸模式低效、动作模式不规范等问题;从训练层面看,训练强度骤增、肌肉力量薄弱、热身放松不足等因素是主要诱因;从环境层面看,训练场地条件、装备适配性等因素也具有重要影响[2-4]。

已有研究表明,运动功能障碍引发的慢性损伤是导致训练伤高发的核心因素[5-6],目前,纠正训练作为一种针对运动功能障碍的主动干预手段,在竞技体育和康复医学领域展现出显著效果[7-8]。因此,及时发现新兵存在的运动功能障碍并实施针对性纠正训练,已成为预防新兵训练伤发生的关键措施。

本研究立足于新兵入伍军事训练的实际需求,旨在构建一套科学有效的运动功能障碍纠正训练体系。采用"评估-干预-验证"的研究范式,基于军人身体关节功能筛查结果,识别存在运动功能障碍的易伤人群,对试验组新兵分组、分层、分阶段地实施针对性的纠正训练,并通过随机对照试验验证干预效果,为新兵新训期间军事训练伤预防提供新的范式与实践参考。

1 对象与方法

1.1 研究对象

采用整群抽样的方式,随机抽取联勤保障部队某新兵训练基地新兵446人,并分为试验组和对照组。样本量计算依据:要求双侧检验,α为0.05(Z_α=1.96),2组样本量比值1∶1(即2组病例数相等),β=0.1,把握度(检验效能)1-β=90。n代表每组样本量。β为单侧,把握度(检验效能)为0.9(Z_β=1.28)。根据前期查阅的相关训练伤预防对照试验研究[9-10],发现纠正干预组训练伤发生率约为15%(p_1=0.15),对照组约为35%(p_2=0.35),$\bar{p}$代表p_1和p_2的均值,$\bar{q}$代表1-p_1和1-p_2的均值,样本量计算公式如下:

$$n = \frac{2 \times \bar{p} \times \bar{q} \times (Z_\alpha + Z_\beta)^2}{(p_1 - p_2)^2}$$

n=2×0.275*0.725 $(1.96+1.28)^2/(0.20-0.35)^2$=186。即2组各需要186例研究对象,共需372例研究对象。考虑到20%的数据丢失或无效等其他情况,最终纳入446例研究对象(每组223例)

纳入标准:①男性新兵;②无既往伤病史或手术史;③自愿参与研究并签署知情同意书。排除标准:①有心脏病、高血压、呼吸系统以及神经类等基础疾病;②近期接受过手术尚在恢复期;③其他经审批无法参与新训的人员。本研究已通过陆军军医大学医学伦理委员会审查(2025第1-03号)。

1.2 *研究方法*

1.2.1 身体关节功能筛查 军人身体关节功能筛查包括足踝背屈、直膝抬腿、单腿平衡、胸椎旋转、肩部回旋、俯卧推起和四足抗旋7个动作,分别针对身体各主要关节的灵活性与稳定性以及核心的抗旋能力进行有效筛查。动作评分按照3、2、1、0分共4个等级评定,其中1分表示存在运动功能障碍。整套筛查动作总分21分,10分为及格分数。国外研究表明,功能性运动筛查评分能有效评估个体的运动模式和受伤风险[11],并识别存在运动功能障碍的高风险人群,以便采取预防措施[9,12]。国内研究也显示,该评分技术可用于发现军人身体运动功能缺陷、预测训练损伤风险,并为纠正性训练提供依据。一项针对新兵的防伤试验进一步证实,该评分对预测军事训练伤发生风险具有显著效果[10]。

本研究具体实施流程如下:①准备阶段,本研究团队赴试验单位完成技术宣讲及组训骨干标准化培训,包括筛查操作规范、纠正训练方案实施要点等。②训前筛查评估阶段,由经过培训的组训骨干使用标准化工具对试验组和对照组的446名新兵完成首次筛查评估。③训后筛查评估阶段,2个月新训结束后,再次由相同的组训骨干对2组新兵实施第二次身体关节功能筛查评估。

1.2.2 运动功能障碍纠正训练 纠正训练是指当身体存在功能障碍,动作限制或不对称的时候,能够帮助身体达到一个基本功能状态的训练。因此,纠正性训练是为了改善目前较差的动作质量的训练。纠正性训练这个概念最开始是出现在物理治疗领域,旨在帮助病人提升或者恢复自身的功能,后来由Gray Cook把这个理念引入到运动训练界。Gray Cook认为纠正性训练应该是有顺序的,每一个步骤重点不一样。纠正性训练的第一个重点是灵活性,目的是使基本的身体活动不受限制;第二个重点是稳定性,也就是要让身体能有更好的运动控制;第三个重点是动作模式的整合训练,这是把重点放在功能动作模式上,目的是让身体能够更好地运用自身的灵活性和稳定性。因此,纠正训练的顺序应该遵循先灵活、后稳定、再习得的原则[13-15]。

本研究查询了大量国内外文献并收集整理了基层部队官兵意见,严格遵循生物力学、生理学、解剖学、神经发育学和人体动作系统功能性原则,为新训补差制定了包括放松、重置、准备、强化、整合5个阶段内容的阶段训练法(表1),实时追踪效果反馈,并遵循损伤预防规律的逐步进阶(适应、强化、巩固)运动功能障碍纠正训练方案(表2)。该方案提供了一个简单易学的系统性训练过程,以帮助新兵改善关节功能障碍,最大限度地减少损伤并提升训练成绩。

1.2.2.1 纠正训练分组排序原则 根据关节功能筛查测试结果,首先应对受试者的筛查分数进行排序,以确定存在障碍的功能动作的纠正性训练分组和顺序,排序原则包括“得分排序原则”和“动作排序原则”[16-18]。

得分排序原则根据试验组新兵身体关节功能筛查测试得分进行排序分组,本研究主要解决单项得分1分的新兵(1分表示身体存在较严重的运动功能障碍),并依次解决得分为1~3、1~2、1分的动作。

动作排序原则按照灵活性优先,稳定性其次,综合动作模式最后的原则来进行排序。主灵活性的动作如果产生了问题,会影响主稳定性的动作,更会影响整体动作。这个顺序也指引了筛查后的纠正性训练,即先进行灵活性训练,再进行功能稳定性训练,包括静态稳定性到动态稳定性的过程,最后进行整体动作模式的训练,这种训练的顺序往往最有效且更容易带来更持久的效果。对应到本筛查技术中,应该依次解决足踝背屈、直膝抬腿、胸椎旋转、肩部回旋、单腿平衡、俯卧推起、四足抗旋动作中筛查出来的关节功能障碍。

一般而言,先按照得分排序原则进行排序分组,再通过动作排序原则进行补充,除0分外(阳性,建议就医),例如得分为1分的动作首先应该得到解决,如果直膝抬腿和肩部回旋得分均为1分,那么仅仅按照得分排序原则就无法确定首先应该解决哪个动作中的问题,因此参考动作排序原则,就可确定先解决直膝抬腿的问题,再解决肩部回旋的问题。

1.2.2.2 纠正训练方案 根据身体关节功能筛查

表1 阶段训练法

Table 1 Staged training protocol

Phase	Name	Utilize Primary Techniques	Training Goals
One	Relaxation	Muscle fascia relaxation, muscle traction	Tension release and activity reduction of overactive myofascial tissue in the body
Two	Reset	Respiratory techniques, dynamic neural stabilization	Restore the body's original movement ability, solve communication barriers between nerves and the body, and enhance the nervous system's perception and control over the body
Three	Preparation	Techniques such as dynamic movement, joint traction, and voodoo belt compression	Improve joint flexibility and align joints with lines
Four	Reinforcement	Techniques such as static stability, dynamic stability, and reactive neuromuscular training	Activate local stable muscle groups to achieve joint co-axiality
Five	Integration	Functional training on different motion planes	Enhance muscle strength and neuromuscular control, restore basic movement patterns, and integrate the effects and abilities obtained from the first 4 stages of correction into the basic movement patterns, achieving optimal coordination between breathing, stability, and flexibility during movements

表2 进阶训练法

Table 2 Advanced training protocol

Period	Phase	Training Content	Training Goals
Adaptation period (Sep. 23—Octo. 7)	Relaxation, reset, preparation	Muscle fascia relaxation technique, muscle traction technique, breathing technique, dynamic neural stabilization technique, dynamic activity, joint traction technique	Establish the basic perception ability of the body, relieve tension and compensatory patterns, improve joint mobility, restore correct movement patterns, enhance joint co-axiality and core control ability
Strengthening period (Octo. 8—Nov. 3)	Relaxation, reset, preparation, strengthening	Muscle fascial relaxation technique, muscle traction technique, breathing technique, dynamic neural stabilization technique, dynamic activity, joint traction, static stability, dynamic stability, and reactive neuromuscular training	Enhance the strength and endurance of weak links, while consolidating correct movement patterns, improving power imbalance, and transforming isolated strengthening abilities into compound movement abilities
Consolidation phase (Nov. 4—Nov. 25)	Relaxation, reset, preparation, strengthening, integration	Muscle fascia relaxation technique, muscle traction technique, breathing technique, dynamic neural stabilization technique, dynamic activity, joint traction static stability, dynamic stability and reactive neuromuscular training, functional training	Improve movement efficiency, continue to strengthen neuromuscular control, ensure dynamic balance between strength and flexibility, form long-term stable correct movement habits, achieve automation and generalization of body functions, and ultimately complete the transition from "correction" to "prevention"

结果,进行身体各关节功能的专项纠正训练。对试验组单个动作得分1分且总分<10分的的新兵实施针对性纠正训练。既往研究表明[11-12],军人身体关节功能筛查得分总分<10分且单个动作得分为1分的新兵其训练伤发生率远高于总分≥10分且单个动作得分为2~3分的新兵,本次纠正训练的对象为训练伤易高发人群,因此,选取单个动作为1分且总分<10分的新兵为纠正训练对象。本次纠正训练按照7个筛查动作的侧重点分为上肢、核心和下肢3个训练组,参与纠正训练的新兵在完成训练基地既定计划任务的基础上,由试验单位取得体能训练教练员资格认证的教员牵头,并纳入经过针对性培训、富有多年组训经验的带教骨干进入团队进行组训,每周进行3次60 min运动功能障碍纠正训练,共计24次。并根据纠正训练效果按照初级(适应期)、中级(强化期)、高级(巩固期)3个阶段逐步进阶。

1.3 统计学分析

采用SPSS 26.0软件对数据进行统计分析。数据结果以$\bar{x}\pm s$表示,关节功能筛查得分采用独立样本t检验分析;训练伤发生率采用χ^2检验或Fisher精确检

验法分析,$P<0.05$表示差异具有统计学意义。

2 结果

2.1 2组人员特征比较分析

对照组与试验组在年龄、身高、体质量、以及体质指数(body mass index,BMI)方面差异均无统计学差异(表3)。

表3 2组人员基本特征对比 ($\bar{x}\pm s$)

Table 3 Comparison of basic characteristics between the 2 groups ($\bar{x}\pm s$)

Group	Average Age/Years	Average Height/m	Average Weight/kg	Average BMI/(kg/m^2)
Experimental group (n=223)	21.23±1.58	1.74±6.12	70.02±9.21	23.01±2.56
Control group (n=223)	21.49±1.40	1.73±6.02	69.08±9.31	22.94±2.63
t	1.868	1.622	1.074	0.267
P	0.062	0.105	0.283	0.789

BMI: Body mass index

2.2 2组人员训练前后关节功能筛查得分比较分析

在新训开始前,试验组筛查测试总分(10.58±2.83)与对照组筛查测试总分(10.92±1.91)无显著性差异(P=0.137),2组人员各单项平均分也均无显著性差异(表4)。在接受2个月运动功能障碍纠正训练之后,试验组筛查总分显著高于对照组(15.12±2.13 *vs* 14.19±1.97,$P<0.05$),试验组7个测试单项评分中足踝背屈(2.12±0.53 *vs* 2.00±0.53)、直膝抬腿(2.20±0.45 *vs* 1.86±0.58)、单腿平衡(2.17±0.57 *vs* 1.74±0.61)、四足抗旋(2.00±0.45 *vs* 1.89±0.41)均显著高于对照组($P<0.05$),而胸椎旋转(2.36±0.61 *vs* 2.27±0.62)、肩部回旋(2.41±0.57 *vs* 2.52±0.56)和俯卧推起(1.87±0.68 *vs* 1.92±0.75)无显著性差异(表4)。

2.3 2组人员训练前后关节功能筛查得分差值比较分析

经过2个月运动功能障碍纠正训练后,采用关节功能筛查技术对受试者进行训练后测试评估,将各组受试者训练后筛查得分与训练前初始基线值进行差值计算。试验组筛查总分差值为(4.53±2.95)分,显著高于对照组(3.27±2.11)分($P<0.05$),试验组7个测试单项的评分差值中足踝背屈(0.72±0.83 *vs* 0.56±0.72)、直膝抬腿(0.78±0.73 *vs* 0.39±0.75)、单腿平衡(0.71±0.72 *vs* 0.26±0.62)、胸椎旋转(0.47±0.72 *vs* 0.28±0.53)、四足抗旋(0.62±0.63 *vs* 0.49±0.61)均显著高于对照组($P<0.05$),而肩部回旋(0.59±0.71 *vs* 0.65±0.81)和俯卧推起(0.62±0.74 *vs* 0.62±0.91)差异无统计学意义(表5)

2.4 2组人员新训期间发生训练伤情况比较分析

试验组在2个月训练周期内累计发生训练伤28例(12.5%),经χ^2检验证实其损伤发生率显著低于对照组(34.5%;χ^2=5.469,P=0.001,),提示纠正训练方案在训练伤预防方面具有显著效果(表6)。观察2组人

表4 2组人员训练前后筛查得分对比 ($\bar{x}\pm s$)

Table 4 Comparison of screening scores between 2 groups before and after training ($\bar{x}\pm s$)

Test action	Test time	Experimental group(n=223)	Control group(n=223)	t	P
Ankle dorsiflexion	Before training	1.39±0.73	1.44±0.67	0.608	0.543
	After training	2.12±0.53	2.00±0.53	2.403	0.016
Straight knees and raised legs	Before training	1.42±0.60	1.46±0.66	0.748	0.454
	After training	2.20±0.45	1.86±0.58	7.033	0.001
Single leg balance	Before training	1.46±0.61	1.48±0.68	0.366	0.714
	After training	2.17±0.57	1.74±0.61	7.644	0.001
Thoracic rotation	Before training	1.89±0.81	1.98±0.57	1.490	0.147
	After training	2.36±0.61	2.27±0.62	1.543	0.123
Shoulder rotation	Before training	1.82±0.89	1.86±0.74	0.638	0.523
	After training	2.41±0.57	2.52±0.56	1.914	0.056
Prone and push up	Before training	1.25±0.54	1.29±0.61	0.816	0.415
	After training	1.87±0.68	1.92±0.75	0.792	0.428
Four legged anti rotation	Before training	1.37±0.57	1.40±0.50	0.530	0.596
	After training	2.00±0.45	1.89±0.41	2.654	0.008
total score	Before training	10.58±2.83	10.92±1.91	1.490	0.137
	After training	15.12±2.13	14.19±1.97	4.753	0.001

表5 2组人员训练前后筛查得分差值对比($\bar{x}\pm s$)

Table 5 Comparison of screening score difference between 2 groups after training ($\bar{x}\pm s$)

Test Action	Experimental Group(n=223)	Control Group(n=223)	t	P
Ankle dorsiflexion	0.72±0.83	0.56±0.72	2.173	0.030
Straight knees and raised legs	0.78±0.73	0.39±0.75	5.524	0.001
Single leg balance	0.71±0.72	0.26±0.62	7.003	0.001
Thoracic rotation	0.47±0.72	0.28±0.53	3.117	0.002
Shoulder rotation	0.59±0.71	0.65±0.81	0.739	0.462
Prone and push up	0.62±0.74	0.62±0.91	0.113	0.909
Four legged anti rotation	0.62±0.63	0.49±0.61	2.297	0.022
Total score	4.53±2.95	3.27±2.11	5.209	0.001

员军事训练伤的类别,发现膝关节损伤最为常见,占比29.29%,膝关节作为人体重要的承重关节之一,在军事训练中承受着巨大的压力,因此容易受到损伤。紧随其后的是下肢水肿疼痛(23.23%)、足踝部损伤(17.17%)、腰部损伤(16.16%)、髋关节损伤(8.08%)及肩关节损伤(6.07%)。

表6 2组人员新训期间训练伤发生情况

Table 6 The occurrence of training injuries during the new training period for groups

Group	Number of Training Injuries/case	Incidence of Training Injuries/%
Experimental group(n=223)	28	12.5
Control group(n=223)	77	34.5
χ^2	-	5.469
P	-	0.001

仅针对在新训期间受伤的人群,采用χ^2检验对2组测试得分<10分人数进行比较分析。结果显示,试验组测试得分<10分者11人(39.2%),显著低于对照组的49人(63.6%),差异具有统计学意义(χ^2=4.972,P=0.026)。这一结果表明,纠正训练干预对降低<10分者的训练伤发生风险有积极作用(表7)。

表7 训练前筛查得分<10分与≥10分的人员训练伤发生情况比较(n=105)

Table 7 Comparison of training injury occurrence between personnel with pre-training screening scores <10 and ≥10 (n=105)

Group	Number of Training Injuries/case		χ^2	P
	<10	≥10		
Experimental group	11	17	4.972	0.026
Control group	49	28		

3 讨论

3.1 军人关节功能筛查技术

人体动作系统由肌肉系统、骨骼系统和神经系统组成,虽然它们各自独立,但每个系统及其组成部分必须相互协作、相互依存,在功能上是无法分割的统一体,构成了复杂的"人体动力链"系统[9,19-20]。身体关节是构成每一个训练动作的"基础",人体完成的每一个动作都是由多个关节协调配合完成的,关节是组成动作的基础单位,关节功能是衡量身体运动能力的关键指标[21-22]。如果"人体动力链"上的任意环节出现问题,都会表现出关节功能障碍,导致肌肉的长度与张力关系改变,使得建立在这种功能不良之上的一切都会受到损害、削弱或处于危险状态,进而引发整个链条的功能失衡,导致运动损伤几率增加和运动效率低下[23-24]。例如,膝关节负荷分布异常致使长期战术动作(如匍匐、跳跃)加剧膝关节半月板磨损和踝关节韧带损伤;肩关节稳定性下降(如肩关节盂唇损伤)会进一步引发代偿性动作,增加肩袖肌群拉伤风险。而运用关节功能筛查技术可以提前筛查身体关节功能,并通过干预训练纠正关节功能障碍,降低训练损伤几率和提高训练成绩。本研究数据表明,基于军人身体关节功能筛查得分而进行的纠正干预训练能够有效降低新兵军事训练伤的发生率,这一发现与王刚等[9]、雷恩宇等[10]关于关节功能筛查风险评估的研究结果具有一致性。基于前期研究[9]的受试者工作特征曲线(receiver operating characteristic curve,ROC),该筛查技术表现出良好的预测效能[曲线下面积(area under the curve,AUC)=0.875,敏感度75.0%,特异度80.6%],提示其可作为新兵军事训练伤的评估和预测工具。值得注意的是,筛查评分<10分的受试者中,对

照组与试验组训练伤发生人群占比呈现显著差异(63.6% *vs* 39.2%,χ^2=4.972,*P*=0.026),该阈值与王刚等[9]建议的8.5分临界值存在差异。经分析,此差异可能源于测试者培训不同,对动作评分主观性判断出现差异所致。综上所述,本研究采用这套关节功能筛查技术来甄别新兵存在的运动功能障碍具有有效性,可为接下来的针对性纠正训练提供科学的分组及训练依据。

3.2 纠正训练后新兵新训期间军事训练伤预防效果讨论

3.2.1 关节功能筛查总得分 本研究结果显示,新训结束后,试验组与对照组的关节功能筛查总得分均较训练前提升。针对对照组组内训练前后出现的差异,本研究认为:①首次筛查测试产生的测试重复效应,受试者在初次接触关节功能筛查的标准化动作评估后,会通过神经肌肉系统的学习适应形成更高效的动作代偿,进而在后续测试中有意识地优化动作完成度以追求更高的评分表现,从而从整体提高关节功能筛查总得分;②部队常规新训计划中包含的体能训练内容能一定程度上提高新兵的各项运动能力,这种系统性训练的收益会导致身体关节灵活性和稳定性改善,关节功能评估总得分有所提高。值得注意的是,经过为期2个月的针对性纠正训练干预后,试验组的筛查总得分显著优于对照组(15.12±2.13 *vs* 14.19±1.97,*P*<0.05),这一结果证实本研究设计的纠正训练方案能有效改善新兵的身体关节功能,其干预效果显著优于常规基础训练。

3.2.2 关节功能筛查差值得分 本研究结果表明,进行为期2个月的纠正训练干预后,试验组部分差值得分(足踝背屈、直膝抬腿、单腿平衡、胸椎旋转、四足抗旋)较对照组呈现显著性提升(*P*<0.05)。然而,肩部回旋和俯卧推起2项得分在组间未呈现统计学显著性差异。此现象可能源于以下原因:①俯卧推起动作在生物力学特征上与俯卧撑具有高度相似性[25]。尽管试验组在训练期间接受了针对核心和肩胛稳定性的专项纠正训练,但新训过程中高强度的俯卧撑训练可能对2组受试者均产生了显著的训练适应效应,从而削弱了干预措施在组间差异上的显著性表现。②肩部回旋测试主要评估双侧肩关节活动度。新训期间大量进行的吊杠和引体向上训练可能通过被动拉伸促进了受试者肩关节灵活性的同步提升[26]。这种训练效应的普遍性可能是导致组间差异未达显著水平的主要原因。

本研究结果表明,在军事训练背景下,基础体能训练可能对特定关节功能指标产生普遍性影响,从而在一定程度上掩盖专项纠正训练的效果。未来研究可考虑通过调整训练变量或采用更敏感的评估方法来进一步验证干预措施的有效性。

3.2.3 新兵训练伤发生率 本研究通过为期2个月的纠正训练干预,系统评估了纠正训练干预对受试者关节功能筛查及训练伤预防效果的影响。研究结果显示,试验组在干预后关节功能筛查总分显著高于对照组(15.12±2.13 *vs* 14.19±1.97,*t*=4.753,*P*<0.01),且训练伤发生率显著降低(12.5% *vs* 34.5%,χ^2=5.469,*P*<0.01)。这些发现与王刚等[9]和雷恩宇等[10]的研究结果具有一致性,进一步证实了纠正训练在运动损伤预防领域的应用价值。

在训练伤发生人群的基线特征分析中,试验组筛查得分<10分的受试者占比显著低于对照组(39.2% *vs* 63.6%,χ^2=4.972,*P*<0.05)。这一发现表明,尽管2组受试者在基线筛查得分上无显著差异(10.58±2.83 *vs* 10.92±1.91,*P*>0.05),但纠正训练显著降低了低分受试者的训练伤发生率。试验组中大部分筛查得分较低且存在运动功能障碍的受试者在新兵训练期间避免了训练伤的发生,而对照组中,存在运动功能障碍的受试者则出现了大量训练伤。这一结果提示,纠正训练对运动功能存在缺陷的高风险人群具有显著的保护效应,这一效应不仅体现在降低了新兵训练伤的发生率,更提示了纠正训练在预防训练伤方面,对于高风险人群的干预价值,为后续制定更为科学有效的训练伤预防策略提供了重要的实践依据和理论支撑。

本研究的发现为新训期间训练的安全性和有效性提供了实证依据,特别是在预防训练相关损伤方面具有重要的实践指导意义。建议在常规训练计划中整合系统性的纠正训练干预,特别是针对筛查测试评分<10分的高风险人群,以最大程度地降低训练伤发生率,提高训练效果。

本研究所构建的纠正训练体系具有一定的科学性与实践价值。建议将筛查纠正训练体系纳入军事训练方案,通过建立预防性训练机制,实现训练伤防控的“关口前移”。这种以“预防为先,防重于治”为核心理念的主动干预策略,不仅符合现代军事训练科学化发展的需求,更有助于构建系统化、规范化的训练伤预防体系,从而有效降低军事训练伤的发生率。

利益冲突 本文所有作者声明不存在利益冲突

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