Title:

Improving Design Characteristic to Estimate Load for Future Rock Climbing Studies

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Abstract

Rock climbing is an increasingly popular physical activity with indoor competition climbing accepted for inclusion at the summer 2020 Olympic Games in Tokyo. The International Olympic Committee consensus statement recommends the accurate monitoring of training load to reduce injury risk in athletes (Soligard, et al., 2016). Differences in acute/chronic training loads have been found to be predictive of injury occurrence (Gabbett, 2016). In published climbing literature to date, differences in injury terminology, data collection procedures, calculation of exposure and operational measures of performance used by authorship teams impedes comparison. At present, there is no consensus on design characteristics for use in epidemiological cohort studies in rock climbing. The aim of this article is to report a critical appraisal of methodologies used to estimate load and recommends an amendment to the IRCRA comparative grading scale to include British adjectival grade and design characteristics for future studies.

Key Words: Exposure; load; grade; incidence

Résumé

L'escalade est une activité physique de plus en plus populaire avec l'escalade de compétition en salle acceptée pour les Jeux Olympiques d'été 2020 à Tokyo. La déclaration de consensus du Comité international olympique recommande un suivi précis de la charge d'entraînement afin de réduire le risque de blessures chez les athlètes (Soligard, et al., 2016). Les différences dans les charges d'entraînement aiguë / chronique ont été jugées prédictives d'une occurrence de blessure (Gabbett, 2016). Dans la littérature sur l'escalade publiée à ce jour, les différences dans la terminologie des blessures, les procédures de collecte des données, le calcul de l'exposition et les mesures opérationnelles de performance utilisées par les équipes d'auteurs empêchent la comparaison de l'exposition. À l'heure actuelle, il n'y a pas de consensus sur les caractéristiques de conception à utiliser dans les études épidémiologiques en escalade. Le but de cet article est de présenter une évaluation critique des méthodologies utilisées pour estimer la charge et de recommander un amendement à l'échelle de notation comparative de l'IRCRA afin d'inclure les caractéristiques adjectivales britanniques et les caractéristiques de conception pour les études futures.

Mots clés: Exposition ; charge ; teneur ; incidence

Introduction

The International Olympic Committee consensus statement recommends the accurate monitoring of training load to reduce injury risk in athletes (Soligard, et al., 2016). Inconsistencies in the calculation of exposure is likely contribute to large variances in the reported incidence of injury in rock climbing (Jones & Johnson, 2016). Accurate estimates of exposure and operational standards of performance are required to calculate and precisely monitor training load. The aim of this article is to critically report current methodologies used to estimate load in rock climbing and recommend an amendment to the IRCRA comparative grading. A secondary aim is to recommend design characteristics for future studies.

Exposure

The International climbing and Mountaineering Federation Medical Commission recommends that the incidence of injury in climbing to be expressed as injuries per 1000 hours to control for variation in exposure, especially between different types of climbing activity (Schoffl, et al., 2011). However, reporting injuries per 1000 hours of exposure is an imprecise measure because it may not account for non-climbing activities such as preparation, rest periods between attempts, belaying a fellow climber and non-climbing training. The Medical Commission further recommends that studies that do not measure the hours of exposure should record: four hours for sport climbing outdoors and traditional climbing (outdoor bouldering was not considered) and two hours for any indoor climbing activity per day. Clearly, by calculating climbing exposure using such methods it is likely to introduce significant error into estimates. Further errors are likely to arise in reviews that have performed secondary analysis of primary climbing data using such methods. The heterogeneity of the contained studies means that the resultant statistics are likely to be erroneous.

Perhaps a better way to report participant exposure in climbing is to control for performance standard as this is a potential confounder in the calculation of risk. Climbers would be asked to provide information detail regarding their performance standard, as well as estimates of the frequency and nature of their ascents to capture individual climbing exposure. This would enable prediction of risk of injury to be based on an individual climber's profile of climbing behaviours.

Operational Measure of Performance Standard

A variety of different grading systems exist worldwide to report the operational standard of climbing performance but inconsistencies in the conversion of climbing grades for the purpose of data analysis exist (Draper et al., 2015). As a consequence the International Rock Climbing Research Association (IRCRA) produced a positional statement and a comparative grading scale (Draper, et al., 2015). The reporting scale was

designed to standardise the conversion of climbing performance, regardless of behaviour, in to a numerical value for analysis. The authors acknowledged a limitation of the proposed scale was the use of the British technical grade for traditional climbing only. Traditional climbing in Britain is graded using a combined system that assigns both an adjectival and technical grade, for example Very Severe 4c. The adjectival grade provides essential information about the level of difficulty, overall seriousness and potential risks to the climber. The corresponding technical grade provides information about the hardest technical movement required to complete the climb. The comparative grading scale proposed by Draper et al. (2015) shows considerable overlap between the British technical grade and the recommended reporting value, for example British technical grade 6a may be recorded as 13, 14, 15 16 or 17. Therefore, the use of the IRCRA scale in its current form may introduce significant measurement error when applied to sample populations of British traditional climbers.

We propose an amendment to the IRCRA comparative grading scale to include both the British adjectival grade and technical grade in such a way as to reduce overlap and allow more accurate comparisons to be made (Table 1). To achieve this, we initially cross-referenced key traditional anchor grades within the current scale. The anchor grades selected were: VD, VS 4c, HVS 5a, E1 5b, E2 5c and E3 6a. We contacted Professor Draper the lead author of the positional statement for comment. Professor Draper confirmed his agreement of the anchor positions and subsequently the remaining grades were populated. Additionally, we extended the sport grade within the scale to 9c to account for a confirmed recent ascent at this standard. Furthermore, the hardest traditional climb in Britain was confirmed to be E11 7a, therefore all values greater than this within the British adjectival and technical column of the amended scale are theoretical. The completed amended scale was presented for further consideration to 4 industry professionals (2 Mountaineering Guides, 1 Climbing Guidebook Consultant and 1 member of the Board of the National Mountain Centre for England and Wales). No additional changes were made.

Summary

Current methodologies used to calculate load in climbing populations are likely to introduce significant measurement error. Detailed information regarding performance standard, the frequency and nature of ascents would enable training load ratios to be calculated. In addition, future design characteristics are recommended (see Table 2).

References

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Table 1: Amendment to IRCRA comparative grading scale (Draper et al., 2015)

IRCRA Reporting Scale	British Adjectival & technical grade	French Sport
1	M	1
2	D	2
3	VD	2+
4	S	3-
5	HS / VS 4a	3
6	VS 4b	3+
7	VS 4c	4
8	VS 5a / HVS 4c	4+
9	HVS 5a	5
10	HVS 5b / E1 5a	5+
11	E1 5b	6a
12	E1 5c / E2 5b	6a+
13	E2 5c	6b
14	E3 5c	6b+
15	E3 6a	6c
16	E4 6a	6c+
17	E4 6b	7a
18	E5 6b	7a+
19	E6 6b	7b
20	E6 6c	7b+
21	E7 6c	7c
22	E7 7a	7c+
23	E8 6c	8a
24	E8 7a	8a+
25	E9 6c	8b
26	E9 7a	8b+
27	E9 7b/E10 7a	8c
28	E11 7a	8c+
29	E11 7b	9a
30	E11 7c	9a+
31	E12 7b	9b
32	E12 7c	9b+
33	E13 8a	9c

Table 2: Future design characteristics for rock climbing studies

Domain	Criterion	Explanation
Survey method	Prospective cohort studies	Data captured over a minimum period of 1 year.
	Retrospective cohort studies	Data captured in the preceding year
Terminology definitions	Specific details of the population at risk	Recommend use of taxonomy of rock climbing
	Clear definition of injury	To account for injuries requiring medical attention and injuries resulting in time-loss but not medical attention
Operational measures	Aetiology of Injury	Classified according to mechanism: acute impact, acute non-impact & chronic overuse,
	Injury location and severity of injury	Self-reported studies identify anatomical site and approximate time-loss. Studies involving health professional assessment report injury detail i.e. identify discreet anatomical structure and severity of injury
	Injury, multiple injuries and the recurrence of injuries	Account for first injury occurrence and subsequent injury occurrence per participant.
	Exposure	Record actual time and/or frequency spent in the activity of climbing and climbing related training (not actual climbing)
		Prospective studies to account for illness.
		Record climbing behaviour, practice and grade standard.
Data Analysis	Data processing	Use IRCRA reporting scale
	Measures of disease/injury	Calculate incidence and prevalence.
	Measures of risk	Acute & chronic load, odds ratio, relative risk.