Reporting climbing grades and grouping categories for rock climbing

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Abstract. Rock climbing is an increasingly popular adventure sport with a growing research base. To date the growth of research and reporting styles has been somewhat haphazard and as a consequence comparison between studies can be problematic. The aim of this paper was to make suggestions about a number of changes that could be made to improve the consistency in reporting between studies. Included with this paper are two new tables, one each for male and female climbers. These provide comparative grading scales for use in reporting for future studies. These tables also provide a suggested framework for grouping climbers according to their ability. Using the tables researchers could group the climbers in their study by a category name (lower grade, intermediate, advanced, elite or higher elite climber) or by a number (level 1–5). In addition, the authors make recommendations about climber characteristics that could usefully be reported in future to assist comparison between studies. It would be helpful to readers if the self-reported, highest lead climbs (on-sight and redpoint) could be reported for a climbing group, along with the types of climbing regularly undertaken.

Keywords: Rock climbing, grade tables, climbing grades, Ewbank scale, Yosemite decimal scale, sport climbing

1. Introduction

Commonly known as rock climbing, the sport actually comprises a number of different disciplines that require individual research attention to develop a more complete understanding of the performance dynamics for each strand. Perhaps the oldest discipline, which grew from mountaineering, is that of traditional or “trad” climbing. Trad climbers ascend routes using a rope and carry all protection with them as they ascend the route [1]. At various points on the route a climber will stop to place anchors (wires, camming devices and slings) into/around appropriate points on the rockface and clip these to the rope to protect against a possi-

bly fatal ground fall. One of the most commonly pursued disciplines is that of sport rock climbing which is also one of the safest forms of the sport. As such it has become one of the main disciplines researchers have concentrated upon when investigating the physiological, psychological and technical aspects of the sport. Climbers ascend routes, again protected against a ground fall by a rope, but instead of placing their own protection anchors the climbers clip the rope to anchors that have been pre-drilled and set into the rock [2]. Virtually all indoor climbing with ropes uses this method and it forms the predominant version of the sport for outdoor climbing in Europe. Indeed most competition climbing takes place using this modality. These descriptions of trad and sport climbing are known as lead climbing ascents. Lead climbing involves the climber wearing a harness to which a rope is attached. As the climber ascends the route they clip it to the anchors while being belayed from the ground [3,4].

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Another popular climbing discipline is bouldering which usually takes place on shorter (less height gain) routes without the use of rope, but with a mattress (bouldering mat) placed beneath the climber to protect against injury in the event of a ground fall [5]. Bouldering is increasing in popularity, perhaps due to the purity (the climber ascends the route without having to stop to place gear or wearing harness/trailing a rope) and speed at which you can move between routes. There are an increasing number of research papers that focus on this discipline within the sport [6,7].

As well as the different disciplines within rock climbing, the style of lead climb ascent of a specific route can also be described differentially to clarify the way in which it was made. To claim completion of a climbing route an ascent would have to be as a lead climb without weighting the rope (resting hanging on the rope) during the climb. An on-sight ascent would be a climb completed without the climber having any information about how to complete the route [8–11]. This style is widely used in competition climbing. If on the other hand, a climb was made first time, but having watched a previous climber ascend the route or having gained information about the route prior to ascent the term “flash” is commonly used to describe the ascent. Finally if a route is completed after practicing the route before a clean ascent the term “redpoint” is used to describe the achievement. To practice a route a climber may either lead climb or top-rope the route. Top-roping is where the climber is belayed by a rope anchored from the top of the route and so they do not have to place protection as they make the ascent [3,4,9].

The increasing popularity of the sport and the development of competition formats have perhaps been the major stimuli for the rapid increase in rock climbing research in recent years [12,13]. There have now been over 250 original research papers published in the field and the past decade has seen a rapid increase in research interest worldwide [14]. Early studies in the field of rock climbing tended to focus on the anthropometry of climbers, the incidence and types of injuries associated with the sport and the underlying physiological components of climbing [15–28]. More recently researchers have begun to examine factors that affect performance and to identify climbing specific training methods [2, 29]. Associated with this work has been a move to investigate the interaction of the key performance variables and the development of sport specific assessment tools for climbing [1,12,13,30].

Researchers in the field have tended to concentrate upon their specific research interests and as such the

development of knowledge in the field has been somewhat haphazard. In addition, the fragmented nature of the sport's research development has meant that the reporting methods have differed between studies which has made comparison between studies more problematic. As a consequence, the aims of this paper are to; (a) recommend a standardised method for reporting the characteristics of participants in future climbing studies, (b) to propose two ability classification tables for males and females which could be used in future studies to report on participant climbing ability levels and (c) to suggest the use of a comparison grading scale (that could be used in addition to the country/region scale where the data were collected) that would be helpful for statistical analysis.

2. Reporting climber characteristics

In the participants or subjects section of the method researchers to date have used a variety of measures for reporting the characteristics of their climbers. This variation and often lack of information, particularly in papers published before 2000, means the reader is often left with further questions about the participant group. This inconsistency also adds to the difficulties of making comparisons between studies. The situation is changing and a number of recently published papers have added points that could be adopted for all studies. Clearly studies should present basic biographical data such as age, height, mass, body fat percentage and aerobic capacity. In addition key climbing specific factors include the climbing ability of the group, years of experience in climbing, days of training and hours of training per week and the main types or disciplines followed. Recent papers by MacLeod et al. [31], Schöffl et al. [32], España Romero et al. [33] and Sherk et al. [34] have provided more informed details about the climbing ability of their participants, including their self-reported highest current on-sight and redpoint lead climbs. This type of information is very helpful to the reader and given the findings of Draper et al. [35] self report climbing grades appear to be a valid and reliable indicator of climbing ability. The main disciplines or types of climbing undertaken by climbers also merit reporting in the participants section as this provides additional information about the training status of the recruited climbers. For instance Schuster et al. [36] provided an excellent breakdown of the main types of climbing undertaken by their participants (tradition climbing, sport, mostly sport some traditional,

gym climber etc.) and this system might usefully be adopted for reporting participant characteristics in future climbing studies.

There is additional information that could also be added to the procedures section for comparative purposes. It would be very useful to the reader if researchers made clear the venue where the climbing took place, the nature of the protection available, the safety rope protocol (lead or top-rope) and amount of practice on and/or knowledge of the route climbers had prior to completion of the data collection.

3. Ability classification tables for male and female climbers

There are times in rock climbing research when it is helpful to describe the ability of the study group or groups within a study. The nomenclature used by researchers to describe individual climber and group abilities has varied widely between studies. Common examples include the use of the term “recreational” climber or group which has been used across studies to describe a wide variety of climber ability groups from beginner to elite level climbers. In the context of climbing this term is perhaps particularly unhelpful as anyone who is not a full-time professional climber is by definition recreational [37,38]. As a consequence, this group could include climbers just starting out in the sport or those who have been climbing for many years at 8a (sport) and above ability levels. As such this term might not be particularly useful for future studies and we would advocate the non-continuation of the use of this term to describe climber groups in future studies. Another example of confusion that can be created through a lack of agreement in the meaning of terminology is the use of terms “elite” or “expert” to describe an ability group. For this example the ability of the climber necessary to be classified as elite or expert has varied greatly between studies [37–41]. Common agreement between researchers as to what constitutes and elite or expert level climber would be very helpful for comparative purposes.

In 2009 Draper et al. [42] published a table that had been developed for a study regarding the assessment of the validity and reliability of a series of novel, sport specific measures of flexibility for rock climbing. This table consisted of a number of grading scales (Sport grade, British technical grade and Fontainebleau bouldering grade) that had been tabulated in order to make comparison between scales. Divisions were created in

the tables in order to classify the climbers in the study into one of four groups (novice, intermediate, advanced or elite climber). This type of table could be very useful for climbing research, however, there were a number of problems with this iteration that could be improved upon.

Firstly the use of the term “novice” is fraught with the same problems associated with term “recreational”. In this context the term could apply to someone just starting out in the sport, but could equally refer to a recreational climber who is unconcerned with climbing high grades routes, but wishes merely to be out climbing. As such this latter type of climber might have many years of experience, have a past on-sight or redpoint grade that was much higher but would be termed incorrectly as a novice climber. Secondly the divisions for each ability grouping were agreed by a small group of expert climbers ($n = 3$). A wider consultation process would perhaps have led to the development of different division points for the classification of each ability group. Thirdly, the table was designed as appropriate for classifying male and female climbers, rather than separate tables being created for each gender. Fourthly, the climbers did not state, especially in the case of sport climbing, whether the highest recorded route was for an indoor (artificial climbing wall) or outdoor natural rock climb. Finally, the authors neglected to state that the highest climb that was recorded for each climber was their redpoint ability rather than on-sight.

Our paper presents two adapted versions of the table presented by Draper et al. [42]. These were developed using the Delphi technique in consultation with over 40 expert climbers and researchers worldwide [43,44]. The classifications are presented separately for females (Table 1) and males (Table 2) as the overwhelming feeling amongst respondents was that such a classification system should be developed as two separate tables. As can be seen from the tables, for lower grade climbers the bounds for the division are the same for males and females, however, for all other categories the suggested boundary grades differ by gender. These divisions were agreed upon through consultation with the expert climbers and researchers involved in the development of the tables. The divisions are intended to reflect, as well as possible, natural breaks climber ability levels. The expert respondents believed there were differences in the climbing abilities for each of these groupings. We recognise that, as with the grading of climbs themselves, there is a relative degree of subjectivity in making these ability grouping distinctions, but we have tried to remain as object as possible in this process by

Table 1
Climbing grade and climbing group divisions comparison table for female climbers

Ability group	USA	French/sport	British Trad Adj	British Trad Tech	BRZ	Aus/NZ	UIAA	UIAA metric	Watts
Lower Grade (Level 1)	5.1	1	D	1	I sup	9	I		
	5.2	2	VD	2	II	10	II		
	5.3	2+	HVD	3a	II sup	11	III		
	5.4	3-	S	3b	III	12	IV		
	5.5	3	HS	4a	4	13	IV+		
	5.6	3+	VS	4b	5	14	V		0.00
	5.7	4	VS	4c	5	15	V+		0.25
	5.8	4+	HVS	5a	5 sup	16	VI-	5.66	0.50
	5.9	5	E1	5b	6	17	VI	6	0.75
Intermediate (Level 2)	5.10a	5+	E1	5b	6 sup	18	VI+	6.33	1.00
	5.10b	6a	E2	5c	6 sup	19	VII-	6.66	1.25
	5.10c	6a+	E2	5c	6 sup	20	VII	7	1.50
	5.10d	6b	E3	6a	6 sup	21	VII	7	1.75
	5.11a	6b+	E3	6a	7a	22	VII+	7.33	2.00
Advanced (Level 3)	5.11b	6c	E4	6b	7b	22	VIII-	7.66	2.25
	5.11c	6c+	E4	6b	7b	23	VIII-	7.66	2.25
	5.11d	7a	E4	6b	7c	23	VIII	8	2.50
	5.12a	7a+	E5	6b	8a	24	VIII+	8.33	2.75
	5.12b	7b	E5	6c	8b	25	IX-	8.66	3.00
	5.12c	7b+	E6	6c	8c	26	IX-	8.66	3.25
	5.12d	7c	E6	6c	9a	27	IX	9	3.50
	5.13a	7c+	E7	7a	9b	28	IX+	9.33	3.75
Elite (Level 4)	5.13b	8a	E7	7a	9c	29	X-	9.66	4.00
	5.13c	8a+	E7	7a	10a	30	X-	9.66	4.25
	5.13d	8b	E8	7a	10b	31	X	10	4.50
	5.14a	8b+	E8	7a	10c	32	X+	10.33	4.75
Higher Elite (Level 5)	5.14b	8c	E9	7a	11a	33	XI-	10.66	5.00
	5.14c	8c+	E9	7b	11b	34	XI	11	5.25
	5.14d	9a	E10	7b	11c	35	XI+	11.33	5.50
	5.15a	9a+	E10	7b	12a	36	XI+	11.33	5.75
	5.15b	9b	E11	7b	12b	37	XII-	11.66	6.00
	5.15c	9b+	E11	7b	12c	38	XII	12	6.25

N.B. USA system is the Yosemite Decimal System (YDS). The French/European system is also known as the "Sport Grade System". The Ewbank System is generally common to Australia, New Zealand and South Africa (with some minor differences).

consulting a wide number of expert respondents before finalising each boundary. There will obviously be some overlap in abilities between those very close to a climbing ability boundary, the respondents however, indicated that in their opinion there were different ability groupings across the climber ability continuum. These tables are an attempt to establish such groups to assist with future research.

The number of grading systems has been increased from the table created by Draper et al. [42] to provide a wider range for comparative purposes. The Fontainebleau bouldering grading system was removed, however, as respondent feedback suggested that separate bouldering specific tables would be more appropriate. Given the increasing popularity of bouldering, the number of bouldering specialists the sport now has and the number of grading systems for bouldering it would perhaps be beneficial for similar tables (male

and female) across grading scales to be developed for this discipline of climbing.

The descriptors for the ability grouping have also been modified from Draper et al. [42] in light of consultation feedback. As described above respondents indicated that the term novice be replaced due to its lack of accuracy. The classifier "lower grade" climber has been created as this can encompass both climbers who are new to the sport and those more experienced climbers who climb by choice or ability level at lower grade. The elite climber group, again after feedback from respondents, was sub-divided into two levels as the climbers consulted believe there are two clear sub-group that exists even at the elite level with regard to the ability of higher elite climbers in comparison to elite climbers. Several respondents also suggested that a number system might be added rather than named categories and so we have added this as an alternative for reporting purposes in future studies. As can be seen

Table 2
Climbing grade and climbing group divisions comparison table for male climbers

Climbing group	USA	French/sport	British Trad Adj	British Trad Tech	BRZ	Ewbank	UIAA	UIAA metric	Watts
Lower Grade (Level 1)	5.1	I	D	I	I sup	9	I		
	5.2	2	VD	2	II	10	II		
	5.3	2+	HVD	3a	II sup	11	III		
	5.4	3-	S	3b	III	12	IV		
	5.5	3	HS	4a	4	13	IV+		
	5.6	3+	VS	4b	5	14	V		0.00
	5.7	4	VS	4c	5	15	V+		0.25
	5.8	4+	HVS	5a	5sup	16	VI-	5.66	0.50
	5.9	5	E1	5b	6	17	VI	6	0.75
Intermediate (Level 2)	5.10a	5+	E1	5b	6sup	18	VI+	6.33	1.00
	5.10b	6a	E2	5c	6sup	19	VII-	6.66	1.25
	5.10c	6a+	E2	5c	6sup	20	VII	7	1.50
	5.10d	6b	E3	6a	6sup	21	VII	7	1.75
	5.11a	6b+	E3	6a	7a	22	VII+	7.33	2.00
	5.11b	6c	E4	6b	7b	23	VIII-	7.66	2.25
	5.11c	6c+	E4	6b	7b	23	VIII-	7.66	2.25
	5.11d	7a	E4	6b	7c	23	VIII	8	2.50
	5.12a	7a+	E5	6b	8a	24	VIII+	8.33	2.75
Advanced (Level 3)	5.12b	7b	E5	6c	8b	25	IX-	8.66	3.00
	5.12c	7b+	E6	6c	8c	26	IX-	8.66	3.25
	5.12d	7c	E6	6c	9a	27	IX	9	3.50
	5.13a	7c+	E7	7a	9b	28	IX+	9.33	3.75
	5.13b	8a	E7	7a	9c	29	X-	9.66	4.00
Elite (Level 4)	5.13c	8a+	E7	7a	10a	30	X-	9.66	4.25
	5.13d	8b	E8	7a	10b	31	X	10	4.50
	5.14a	8b+	E8	7a	10c	32	X+	10.33	4.75
	5.14b	8c	E9	7a	11a	33	XI-	10.66	5.00
	5.14c	8c+	E9	7b	11b	34	XI	11	5.25
Higher Elite (Level 5)	5.14d	9a	E10	7b	11c	35	XI+	11.33	5.50
	5.15a	9a+	E10	7b	12a	36	XI+	11.33	5.75
	5.15b	9b	E11	7b	12b	37	XII-	11.66	6.00
	5.15c	9b+	E11	7b	12c	38	XII	12	6.25

N.B. USA system is the Yosemite Decimal System (YDS). The French/European system is also known as the "Sport Grade System". The Ewbank System is generally common to Australia, New Zealand and South Africa (with some minor differences).

in the tables the scale ranges from level 1 to 5 for males and females with increasing score representing higher climbing ability. It is our recommendation that the two tables presented here be adopted in climbing research for reporting climbing abilities in future studies.

4. A comparison grading scale for reporting climbing ability

A particular problem for climbing research resulting from the mixed number and letters systems used in many grading systems (for example USA, British technical and French/Sport) occurs with any statistical analysis that involves grades using these systems. To get around these problems researchers have developed their own study scales using numbers only and converted actual climbing grades to their study scale. The first to do this was Watts et al. [45] and so this scale has been

added to the comparison tables for males and females. Other who have created such scales include Schweizer et al. [46] who developed a scale from 1–24, Padrenosso et al. [47] with a scale from 0.75–5.25, Llewellyn and Sanchez [48] with scale from 1–16, Michailov et al. [7] who used a scale from 2.50 to 5.50, and Draper et al. [42] whose scale was from 1–14. In addition, Schöffel et al. [49] in a publication for the International Mountaineering and Climbing Federation (UIAA) recently published a metric version of the UIAA grading scale (ranging from 5.66 to 12.00) and this has been included in Table 1 and 2 for comparative purposes.

Not only are there a wide range of grading scales for rating actual climbs around the world (a number of which are shown in Tables 1 and 2), but on top of this researchers have developed a whole series of their own study scales. Clearly, given the need to complete statistical analyses of research data, it is necessary to have a number only grading scale for climbing studies,

but the inconsistencies between studies make comparison between studies even more problematic. A sensible approach to avoiding this problem was adopted by España-Romero et al. [50] who completed their analysis using the already existing scale created by Watts et al. [45]. Perhaps an even simpler solution though, has been missed by researchers to date and that would be to use the Ewbank system. Not only is this grading system used in three popular climbing destinations, but it is an existing climbing scale that is based on numbers only and as such would be ideal for statistical analysis. It would therefore be our recommendation that all future studies conduct their statistical analyses using either the Watts et al. [45] scale as the original researcher based system or the Ewbank system as a whole number climbing grading scale.

5. Areas for future research

The aim of this paper was to suggest a number of points that might be considered by researchers presenting findings for rock climbing studies in the future. With regard to future research there are a large number of studies that could be conducted to improve our understanding of the sport. Rock climbing is a multifaceted sport with a number of major disciplines each of which require further investigation to examine the similarities and differences between other forms of climbing. To date, the majority of papers presented have focused on sport climbing and used top-roping, perhaps for safety reasons, to protect the climbers during ascent. Research by Hodgson et al. [51] and Draper et al. [42] provided evidence that there are significant psychological and physiological differences between lead climbing and top-roping. As a consequence, it would be useful for future studies to further examine the differences between lead climbing and top-roping and to investigate lead climbing and the specific demands it places on the climber. Furthermore, the majority of studies published to date have reported findings based on research conducted on indoor artificial climbing walls. Accordingly, the differences between indoor and outdoor climbing along with research to improve our understanding of the psychophysiological and environmental effects of climbing outdoors on natural rock merit further investigation.

With regard to improving performance, a notable concern for many climbers and particularly competition climbers, Goddard and Neumann [52] identified six key factors that impact upon the development of a

Table 3
Factors that affect climbing performance

Physical fitness
External conditions
Co-ordination and technique
Psychological aspects
Background conditions
Tactical aspects

N.B. Adapted from Goddard and Neumann 1993, p. 12.

climber's ability. The factors are shown in Table 3 and each requires further investigation to improve our understanding both of the demands of climbing and also the best methods for improving performance in each aspect.

With regard to the key physical fitness components for climbing, these were summarised in a table by Draper et al. [42]. The key aspects, agreed upon by many leading climbers and coaches include strength, power, power endurance and flexibility. To monitor improvements in fitness sport specific measures of these aspects of fitness are required for climbing. To date researchers have identified sport specific tests of strength, power and flexibility [14,42,53,54]. Further research could also usefully address the measurement of power endurance and the development of a sport specific test of this aspect of climbing fitness. The completion of this research would mean that it was then possible to measure each of the key components of fitness for climbing.

The aim of this paper was to make suggestions about reporting climber characteristics, scales to use for statistical analysis and to provide gender specific tables that can be used to classify climber ability groups. Within the methods section future research studies could usefully report age, height, mass, body fat percentage, aerobic capacity, climbing ability, years of experience in climbing, days and hours of training per week and the main disciplines pursued. It would be our recommendation also that for statistical purposes, where necessary, researchers use either the Watts et al. [45] or Ewbank grading scales with which to make comparison between studies easier in future. Finally we suggest that Tables 1 and 2 from this paper could be used to classify climber groups in future research papers.

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