Personality and Individual Differences xxx (2017) xxx-xxx

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com

Short Communication

Understanding performance in risky sport: The role of self-efficacy beliefs and sensation seeking in competitive freediving

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ARTICLE INFO

Article history:
Received 5 April 2017
Received in revised form 2 June 2017
Accepted 5 June 2017
Available online xxx

Keywords:
Risky sport
Competitive freediving
Sport performance
Sensation seeking
Self-efficacy

ABSTRACT

Sensation seeking and self-efficacy beliefs have been shown to be associated with participation and risk taking in risky sport. Little attention, however, has been given to their role in relation to performance. The purpose of the study was to investigate whether and how self-efficacy and sensation seeking predict sport performance in lower- and higher-risk freediving disciplines. A sample of 129 freedivers practising a lower-risk freediving discipline ($N = 86$) and a higher-risk freediving discipline ($N = 43$) completed a self-report questionnaire assessing socio-demographics, freediving experience and performance, sensation seeking, and freediving self-efficacy. The results provided evidence that the performance in the lower-risk discipline was predicted by freediving experience and freediving self-efficacy, while the performance in the higher-risk discipline was predicted by freediving self-efficacy and sensation seeking. The results suggested that sensation seeking and self-efficacy represent two different predictors of the performance in the higher-risk freediving discipline. Further research is needed to verify whether current findings may be extended to other risky, competitive sports.

1. Introduction

High-risk sports have become ever more popular since they started to gain public fame in the 1990s with the establishment of extreme sport competitions, commercial advertising, specific TV channels and video sharing websites (Breivik, 2010). Breivik (1995) defined a risky sport as any sport in which one must accept the possibility of severe injury or death as an inherent aspect of the activity. This definition relies on two basic components. First, any risky sport is a sport: it means that the participants must possess considerable skills and abilities (physical, technical, and psychological) to acceptably execute specific physical activities according to the rules. Second, risky sports are characterized by extreme features and significant elements of danger associated with practicing the sport. The participation and risk taking in risky sport have been found to be associated with sensation seeking (Jack & Ronan, 1998; Zuckerman, 1983) and self-efficacy beliefs (Llewellyn & Sanchez, 2008; Llewellyn, Sanchez, Asghar, & Jones, 2008; Slanger & Rudestam, 1997). Taken together, previous findings have suggested that participants in higher-risk sport generally had significantly higher levels of sensation seeking than participants in lower-risk sport, participants in non-risky sport or control groups. Additionally, it was shown that risky sport participants who have high self-efficacy tend to take more calculated risks, due to their confidence that they will successfully perform specific risky activities.

Although the determinants of the participation and risk taking in risky sport have been widely studied, rather little attention has been paid to the performance in risky sport. So far the investigation of the sport performance has addressed various types of sports but without specifically considering the risky ones. Concerning that, in sport psychology research, there is a general consensus about the importance of self-efficacy in predicting the sport performance. Previous research has consistently highlighted a positive correlation between self-efficacy and performance (Moritz, Feltz, Fahrbach, & Mack, 2000) and provided evidence that self-efficacy is a significant predictor of sport performance (Bandura, 1997; Feltz, Short, & Sullivan, 2008).

The present study integrated previous findings concerning the determinants of the participation and risk taking in risky sport with the psychological literature regarding sport performance in order to investigate the psychological factors that may explain performance in risky sport. The study focused on a never-before-investigated risky sport: competitive freediving. The term freediving designates a sport event in which athletes hold their breath while keeping their faces below the surface of the water. Specifically, the current study considered two disciplines of competitive freediving:

- Dynamic freediving (DYN) – athletes aim to cover the maximal horizontal distance by swimming in apnoea with or without fins. The event is usually conducted in a swimming pool, and the risks

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http://dx.doi.org/10.1016/j.paid.2017.06.006
0191-8869/

related to dynamic freediving are surface blackout and shallow-water blackout.[1]

- Constant weight freediving (CWT) – athletes must cover the vertical distance in apnoea down to the declared depth without any change in their weight during the whole performance with or without fins. The event usually occurs in open water (i.e., sea or lake), and the risks related to constant weight freediving are surface blackout, deepwater blackout, pulmonary and middle-ear barotrauma, pulmonary edema and, in the worst case, death.

In light of the different risks associated with these disciplines, the DYN was considered a lower-risk discipline while the CWT was considered a higher-risk discipline.

On the basis of previous findings, the following main hypotheses were developed:

1- Since self-efficacy has been shown to predict sport performance in various sporting populations, freediving self-efficacy was expected to predict the freediving performance in both the lower- (DYN) and the higher-risk (CWT) freediving discipline, regardless of the level of risk that characterizes each discipline.
2- Since the CWT discipline is characterized by greater risks, it was expected that sensation seeking would influence performance in the higher-risk discipline (CWT) but not in the lower-risk discipline (DYN).

The effect of the socio-demographic (i.e., sex and age) and sport-related (i.e., years of freediving experience) variables having a significant relationship with the outcome variable was kept under control in the model.

2. Materials and methods

2.1. Participants

The participants ($N = 129$; 86 men, 43 women; mean age = 39.76, sd = 9.28) were Italian freedivers who competed at the elite level in the DYN or CWT discipline. Athletes who took part exclusively in elite DYN competitions ($N = 86$; 54 men, 32 women) were included in the lower-risk group, while athletes who competed only in elite CWT contests ($N = 6$; 3 men, 3 women) or who participated in both DYN and CWT competitions ($N = 37$; 29 men, 8 women) were considered higher-risk athletes, since taking part in higher-risk competitions was the necessary and sufficient condition to be included in the higher-risk group. To sum up, the lower-risk group was made up of 86 athletes (mean age = 39.36, sd = 8.69; mean freediving experience = 4.26 years, sd = 3.10), while the higher-risk group was made up of 43 athletes (mean age = 40.56, sd = 10.43; mean freediving experience = 5.58 years, sd = 3.51).

2.2. Procedure

2.2.1. Sampling procedures

Freediving athletes were contacted during sporting competitions or via mail in the period between May 2014 and October 2016. Athletes who were contacted during competitions filled out a paper-and-pencil self-administered questionnaire, while those who were contacted via mail filled out an online version of the same questionnaire. The athletes were asked to read and accept the informed consent form, individually complete the measures, and then return the questionnaires to the researcher. The participants received no incentive for their participation.

2.2.2. Measures

Freediving performance was measured in the following ways, according to each specific discipline:

- DYN performance was measured in metres and referred to the maximum diving length reached by the athletes during an official competition (mean = 141.76; sd = 30.38; min = 75; MAX = 240).
- CWT performance was measured in metres and referred to the maximum diving depth reached by the athletes during an official competition (mean = 53.33; sd = 16.63; min = 26; MAX = 100).

Sensation seeking was measured using the Italian version (Primi, Narducci, Benedetti, Donati, & Chiesi, 2011) of the Brief Sensation Seeking Scale (BSSS; Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002).

Freediving self-efficacy was assessed with two ad hoc developed self-efficacy scales (one for each of the freediving disciplines) since an up-to-date, validated measure of self-efficacy specific to the domain of freediving was not available in the literature. To develop the self-efficacy scales, the major variables comprising the perception of technical efficacy in DYN and CWT freediving were identified inductively by semi-structured interviews with active recreational freedivers ($N = 5$), freediving instructors and coaches ($N = 2$) and academic specialists in the areas of social cognitive theory ($N = 2$) and sport psychology ($N = 3$). The DYN self-efficacy scale (DYNSES) consists of 9 items that refer to the specific technical skills required in DYN competitive freediving, while the CWT self-efficacy scale (CWTSES) consists of 8 items that refer to the specific technical skills required in CWT competitive freediving (see Appendix). Both the DYNSES and the CWTSES were aimed at measuring a unique dimension of domain-specific technical self-efficacy labelled dynamic self-efficacy and constant weight self-efficacy. According to Hu and Bentler's guidelines (Hu & Bentler, 1999), the confirmatory factor analysis (CFA) confirmed the single-factor structure for both the DYNSES ($\chi^2 = 41$, df = 26, $p < 0.05$; CFI = 0.96; RMSEA = 0.08, pRMSEA > 0.05; SRMR = 0.05.) and the CWTSES ($\chi^2 = 20$, df = 18, $p > 0.05$; CFI = 0.98; RMSEA = 0.05, pRMSEA > 0.05; SRMR = 0.07). Both the scales showed a good internal consistency: DYNSES $\alpha = 0.86$; CWTSES $\alpha = 0.84$.

2.2.3. Statistical analysis

Pearson correlation was carried out to explore associations among the demographic, psychological, and sport-related variables in DYN and CWT. Two multiple regression analyses, one for each discipline, were performed: CWT and DYN performance were entered as dependent variables while self-efficacy and sensation seeking were entered as predictors. Sex, age and freediving experience were included in the regression analyses in order to take into account their potential effect on freediving performance.

3. Results and discussion

3.1. Results

3.1.1. Correlations among demographic, sport-related and psychological variables

The first preliminary correlations included the whole freediving sample and indicated a negative association ($r = -0.32$, $p < 0.001$) between age and sensation seeking, a non-significant correlation ($r = -0.14$, $p > 0.05$) between sex and sensation seeking and a posi-

[1] Blackout (once incorrectly known as syncope) is a loss of consciousness caused by cerebral hypoxia towards the end of a breath-hold dive.

tive correlation between age and freediving experience ($r = 0.20$, $p < 0.05$). The discipline-specific correlations among the demographic, sport-related and psychological variables are shown in Table 1. The results showed different association patterns for each specific discipline. A negative relationship was found between sex and DYN performance, indicating that male freedivers perform better than their female counterparts. Freediving experience was positively associated with DYN performance but no association emerged between freediving experience and CWT performance. On the other hand, freediving experience was positively associated with CWT self-efficacy but not with DYN self-efficacy. DYN and CWT self-efficacy were positively related to DYN and CWT performance, respectively. Sensation seeking was correlated with DYN self-efficacy but not with CWT self-efficacy. Finally, sensation seeking was positively associated only with CWT performance.

3.1.2. Multiple regression analysis for the prediction of freediving performance

Freediving experience and DYN self-efficacy proved to be significant predictors of DYN performance. Differently, sensation seeking and the other controlling variables did not predict the performance in DYN. The overall model accounted for 27% of the variance of the DYN performance (adjusted R^2; $F = 7.18$, $p < 0.001$) (see Table 2).

CWT self-efficacy served as a significant predictor of CWT performance, as well as sensation seeking. None of the controlling variables proved to predict CWT performance. The overall model accounted for 26% of the variance of the CWT performance (adjusted R^2; $F = 3.94$, $p < 0.01$) (see Table 2).

3.2. Discussion

The purpose of the present study was to investigate the association among self-efficacy, sensation seeking, and freediving performance in lower- and higher-risk freediving disciplines.

In line with previous literature (Jack & Ronan, 1998), the preliminary correlation analysis suggested a negative association between age and sensation seeking in the whole sample. Furthermore, the correlation values between self-efficacy and sport performance are similar to the average one found in a previous meta-analytical study (Moritz et al., 2000).

In line with the hypotheses, multiple regression analyses indicated that freediving self-efficacy predicted the freediving performance in both the DYN and the CWT discipline. This first result supported the idea that domain-specific self-efficacy, regardless of the level of risk related to the sport, is a significant predictor of sport performance (Bandura, 1997; Feltz et al., 2008). Differently, sensation seeking emerged as a significant predictor only of CWT performance, suggesting that, in addition to being associated with the participation and risk taking in risky sport, it may constitute an appropriate predictor of performance in risky sport. On the basis of this finding it seems plausible to hypothesize that the performance variance explained by sensation seeking may be associated with the risk taking component that characterizes the performance in the higher-risk discipline. The overall results confirmed the current hypotheses and underlined that sensation seeking and self-efficacy constitute two separate, not overlapping predictors of performance in risky sport. Finally, it is interesting to note that freediving experience predicted DYN performance, but it was not a predictor of CWT performance. This difference between the disciplines is probably due to the fact that there are not as many occasions to train for CWT (due to logistic and safety difficulties) as for DYN, hence CWT performance is less influenced by experience. These results suggested that sensation seeking, rather than experience, has an influence on the performance in the higher-risk discipline.

4. Conclusions

The main contribution of the present research was to investigate the association among self-efficacy, sensation seeking and freediving performance. While previous research mainly focused on explaining participation and risk taking in risky sport or performance in non-risky sport, the current research tried to integrate these different perspectives in order to address the question about what determines performance in risky sport. For this purpose, the study targeted a never-before-investigated risky sport – competitive freediving – that has become ever more popular in the last two decades with the organization of national and international official freediving competitions. Even though the current research focused on such a specific risky sport, it provided some interesting insights that deserve to be tested in other contexts.

Some limitations of the study should also be noted. First, the current study adopted a cross-sectional design, so it is suitable to adopt some caution in generalizing the present findings. This is particularly relevant in reference to the association between self-efficacy and performance. Self-efficacy influences performance as well as performance influences self-efficacy (Bandura, 1997), and in the study, the reported best freediving performance occurred before the self-efficacy assessment. The current research, however, involved elite freedivers with substantial experience, hence it seemed reasonable to hypothesize that their freediving self-efficacy, although estimated from a post-performance measure, would be consistent over time since it was the result of several years of training and competitions. Finally, the DYN and the CWT freediving groups are not equivalent in terms of sample size. Even though this discrepancy represents the percent-

Table 1
Correlations between age, freediving experience, freediving self-efficacy, sensation seeking and best individual performance referring to each specific discipline.

DYN ($N = 86$)				CWT ($N = 43$)			
	DYN self-efficacy	SS	DYN performance		CWT self-efficacy	SS	CWT performance
Age	− 0.13	− 0.36**	− 0.02	Age	0.14	− 0.26	− 0.14
Sex	− 0.09	− 0.15	− 0.23*	Sex	− 0.14	− 0.10	− 0.03
Freediving experience	0.13	− 0.04	0.41***	Freediving experience	0.33*	− 0.16	0.23
DYN self-efficacy	1	0.22*	0.37***	CWT self-efficacy	1	− 0.06	0.41**
SS	0.22*	1	0.15	SS	− 0.06	1	0.34*

Note: SS = sensation seeking.
In sex coefficients, positive values corresponded to higher values for male freedivers.

* < 0.05 (two tailed)

** < 0.01 (two tailed)

*** < 0.001 (two tailed)

Table 2
Multiple regression analysis for variables predicting sport performance in DYN and CWT freediving.

DYN ($N = 86$)			CWT ($N = 43$)		
	DYN performance			CWT performance	
Variable	B (95% CI)	β	Variable	B (95% CI)	β
DYN self-efficacy	16.20 (5.51, 26.89)	0.29**	CWT self-efficacy	12.04 (3.22, 20.85)	0.39**
Sensation seeking	3.20 (− 6.17, 12.56)	0.07	Sensation seeking	8.90 (1.84, 15.67)	0.36*
Age	− 0.07 (− 0.85, 0.71)	− 0.02	Age	− 0.24 (− 0.70, 0.23)	− 0.15
Sex	− 12.40 (− 25.41, 0.61)	− 0.18	Sex	0.96 (− 9.55, 11.48)	0.03
Freediving experience	4.04 (1.97, 6.11)	0.37***	Freediving experience	0.92 (− 0.49, 2.33)	0.19
R^2	0.31		R^2	0.35	
Adjusted R^2	0.27		Adjusted R^2	0.26	

Note: unstandardized (B) and standardized (β) coefficients are reported. CI = confidence interval.
In sex coefficients, positive values corresponded to higher performances for male freedivers.

* < 0.05 (two tailed).

** < 0.01 (two tailed).

*** < 0.001 (two tailed).

age of DYN and CWT freedivers within the elite population, the smaller CWT sample size may have influenced the possibility to identify small to medium effect sizes.

In order to overcome these issues, future research should involve larger samples and focus on longitudinal studies with a repeated measure of both the behavioural and the psychological variables. Furthermore, as with most sports, the explanation of the performance in freediving obviously involves additional factors beyond those investigated by the present study. Thus, it would be interesting to investigate the factors (i.e., equalization skills, hypoxic tolerance, breathing abilities, relaxation) and the respective self-efficacy beliefs that may contribute to depicting a more comprehensive representation of the determinants of freediving performance. Finally, further research is needed to verify the generalizability of current findings to other risky, competitive sports characterized by larger groups of practitioners (e.g., motorcycle racing, alpine skiing or high diving).

Appendix A

A.1. Dynamic self-efficacy scale (DYNSES)

Instructions: The following questions are about a series of typical situations and actions that characterized your dynamic free diving performance. We ask you to carefully read each question and indicate how well you feel you can do each thing.

For each question, think about the "ideal freediver", that is, a freediver who is capable of doing each thing perfectly.

Use the following scale for your answers:

NOT AT ALL	NOT VERY WELL	MODERATELY WELL	VERY WELL	PERFECTLY
1	2	3	4	5

Remember that "NOT AT ALL" means that you cannot do that thing and that "PERFECTLY" means that you can do it as well as the ideal player.

HOW WELL CAN YOU:

Dyn1. Take in enough air on your last breath to optimally perform a dynamic apnea?	**1**	**2**	**3**	**4**	**5**
Dyn2. Do a push-off start from the side of the pool so as to go as far as possible.	1	2	3	4	5
Dyn3. Correctly use ballast to keep an efficient and appropriate balance throughout the dive regardless of the depth of the pool.	1	2	3	4	5
Dyn4. Control the breadth and rhythm of fin kicks or arm strokes/frog kicks throughout your dive?	1	2	3	4	5
Dyn5. Keep your strokes and kicks symmetrical despite fatigue?	1	2	3	4	5
Dyn6. When you get to the end of the pool, turn and get the breadth and rhythm of your strokes and kicks back without increasing the energy you spend in movement?	1	2	3	4	5
Dyn7. Efficiently alternate between engaging muscles for propulsive action and relaxing them during rest.	1	2	3	4	5
Dyn8. Synchronize propulsion movements with diaphragm contractions to keep your mind and body relaxed?	1	2	3	4	5
Dyn9. At the end of the dive, find a foothold and do the exit protocol even if you are fatigued?	1	2	3	4	5

A.2. Constant Weight self-efficacy scales (CWTSES)

Instructions: The following questions are about a series of typical situations and actions that characterized your constant weight free diving performance. We ask you to carefully read each question and indicate how well you feel you can do each thing.

For each question, think about the "ideal freediver", that is, a freediver who is capable of doing each thing perfectly.

Use the following scale for your answers:

NOT AT ALL	NOT VERY WELL	MODERATELY WELL	VERY WELL	PERFECTLY
1	2	3	4	5

Remember that "NOT AT ALL" means that you cannot do that thing and that "PERFECTLY" means that you can do it as well as the ideal player.

HOW WELL CAN YOU:

Cwt1. Fill your lungs with enough air on your last breath to achieve the longest dive you can?	**1**	**2**	**3**	**4**	**5**
Cwt2. Adapt to the marine weather conditions on the surface before your dive?	1	2	3	4	5
Cwt3. Take advantage of the push-off to plunge and maintain the right position in front of the rope?	1	2	3	4	5
Cwt4. Save energy when descending and ascending by keeping your force proportionate to your balance and the depth?	1	2	3	4	5
Cwt5. Stay close to the rope and maintain the same position when descending and ascending regardless of the strength or direction of the current?	1	2	3	4	5
Cwt6. Keep propulsion movements symmetrical despite changes in balance due to depth?	1	2	3	4	5
Cwt7. Maintain a state of physical relaxation at the greatest depths?	1	2	3	4	5
Cwt8. After your ascent, control how you float and manage the exit protocol even when you are fatigued?	1	2	3	4	5

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