anales de psicología
2012, vol. 28, nº 1 (enero), 223-232

ISSN edición impresa: 0212-9728. ISSN edición web (http://revistas.um.es/analesps): 1695-2294

Does the Sensation-Seeking trait differ among participants engaged in sports with different levels of physical risk?

Montserrat Gomà-i-Freixanet[1*], Cécile Martha[2] and Anna Muro[1]

[1] *Department of Health Psychology, Universitat Autònoma de Barcelona (Spain)*
[2] *Institut des Sciences du Mouvement UMR 6233, Aix-Marseille Universités & CNRS, Marseille (France)*

Título: ¿Los practicantes de deportes con diferente nivel de riesgo físico difieren en el rasgo Búsqueda de Sensaciones?
Resumen: El objetivo de dicha revisión consiste en establecer si los practicantes de deportes de diferente nivel de riesgo físico difieren en el rasgo de personalidad Búsqueda de Sensaciones. Una búsqueda sistemática de la literatura obtuvo 36 estudios publicados en revistas indexadas hasta septiembre del año 2010. Los resultados sugieren que puntuaciones elevadas en Búsqueda de Peligro y Aventura parecen características de los practicantes de deportes de riesgo alto y medio, y en menor grado de deportes de bajo riesgo. Puntuaciones elevadas en Búsqueda de Experiencias son características exclusivamente de practicantes de deportes de alto riesgo. Las puntuaciones en Susceptibilidad al Aburrimiento solo difieren cuando se comparan practicantes de deportes de alto riesgo con practicantes de deportes de bajo riesgo. Finalmente, puntuaciones elevadas en Desinhibición y en el Total de la escala parecen ser características de los atletas de todos los niveles de riesgo cuando se comparan con grupos controles, así como de los practicantes de deportes de alto riesgo comparados con los de bajo riesgo. Se concluye que la escala Búsqueda de Sensaciones es un instrumento útil para evaluar e interpretar las diferencias individuales de personalidad existentes entre practicantes de deportes con diferentes niveles de riesgo.
Palabras clave: personalidad; toma de riesgo; deportes; búsqueda de sensaciones; atletas.

Abstract: This paper aims to establish to what extent participants engaged in different levels of physical risk sports differ in levels of Sensation Seeking (SS) trait. A systematic searching of the literature gave 36 peer-reviewed studies published until September 2010. Results suggested that high scores on Thrill and Adventure Seeking seem characteristic of participants engaged in sports with high and medium levels of risk, and to a lesser extent of low risk sports as well. High scores on Experience Seeking seem characteristic only of participants engaged in sports with high levels of risk. Scores on Boredom Susceptibility only differ when comparing participants engaged in high risk with those engaged in low risk sports. Finally, high scores on Disinhibition and high Total score seem characteristic of athletes at any level of risk as compared to controls, and of athletes engaged in high risk sports as compared to those engaged in low risk sports. We conclude that the SS scale is a useful tool to assess and interpret individual differences in personality that exist between sportspersons practicing sports with different levels of risk.
Key words: personality; risk taking; sports participation; sensation seeking; athletes.

Introduction

Our ancestors, when they were organized in hunter-gatherer societies, explored new territories in the pursuit of food and water to have better opportunities for mating behaviour and for the growing of their offspring. This exploratory behaviour entailed gains (like new resources and increased survival of the group) as well as risks that were mainly physical in nature (increased probability of being injured or death). Today, human beings do not have the immediate need of exploring new territories in search of food and water, but they still engage in exploratory behaviour that entails risks. With the complexity of our contemporary societies, these risks are not anymore limited to physical risks, but also entail legal, economic, social, and political risks.

Therefore, the concept of risk is studied in different scientific disciplines, lacking a unitary meaning and interpretation. For example, the field of international relations and politics relies on prospect theory (Levy, 1992, 1997) which states that decision makers accept risks to avoid "losses" but refuse to take risks to make comparable gains. That is, most people are risk averse when facing an opportunity for a gain but are risk acceptant when facing the prospect of a loss. Another theory devoted to risk is that of Weinstein (1980). This author drew attention to what he called the "popular belief" which states that people tend to perceive themselves as invulnerable. This "optimistic bias" holds for a wide range of health and other outcomes, and he coined the term "unrealistic optimism" to define it. In the field of risky sports research, a useful theory is that of reversal theory (Smith & Apter, 1975). Of particular interest for the behavioural analysis of risky sports is the theory's concept of "paradoxical behaviour" which refers to conduct that is inessential for human survival but is "voluntarily undertaken and yet (...) appears to militate against the health, well-being, and even survival of the individual concerned, exposing him or her to gratuitous risk" (Apter & Batler, 1997, p.119-120). Such conduct includes the performance of potentially harmful behaviours (to self and/or others), for instance, participation in dangerous sports.

The three theories described above have in common that they try to describe behaviour related to risk taking. However, none of these theories give much importance to individual differences in personality. This is surprising, given the important influence of psychological processes in risk perception that are propelled by stable personality traits. A personality theory inserted in the trait theory tradition and devoted to the study of individual differences in risk taking is Zuckerman's theory of Sensation Seeking (SS; Zuckerman, 1979, 1994). The Sensation Seeking theory is based on a model that has social, biological and psychophysiological

*** Dirección para correspondencia [Correspondence address]**: Montserrat Gomà-i-Freixanet. Faculty of Psychology, Dept of Health Psychology. Universitat Autònoma de Barcelona. 08193 Bellaterra, Barcelona (Spain). E-mail: montserrat.goma@uab.cat

underpinnings (e.g., Duaux et al., 1998; Fowler, Knorring, & Oreland, 1980; Legrand, Gomà-i-Freixanet, Kaltenbach, & Joly, 2007; Stacy, Newcomb, & Bentler, 1991) that influence behaviour, and the manifestation of attitudes and preferences. The Sensation Seeking trait is defined as "the seeking of varied, novel, complex, and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experience" (Zuckerman, 1994, p. 27).

Zuckerman and colleagues (Zuckerman, Kolin, Price, & Zoob, 1964) developed the Sensation Seeking Scale (SSS) to assess this trait based on the idea that consistent individual differences exist in optimal levels of arousal and stimulation. Research over a period of three decades led to several revisions of the questionnaire from Form I (1964) to VI (1984). Although Form VI of the SSS (Zuckerman, 1984) is the most updated version with only slight modifications from the previous one, Form V (1978) is by far the most widely used. The SSS-V has a total of 40 dichotomized items divided into four 10-item subscales. The Thrill and Adventure Seeking (TAS) scale contains items expressing a desire to engage in sports or other physically risky activities that provide unusual sensations of speed or defiance of gravity, such as parachuting, scuba diving, or skiing. Because most of the activities are not common, the majority of the items are expressed as intentions ("I would like...") rather than reports of experience. An attitude item that summarizes the factor is: "I sometimes like to do things that are a little frightening". The Experience Seeking (ES) scale encompasses items measuring the seeking of novel sensations and experiences through the mind and senses, as in arousing music, art, and travel, and through social nonconformity, as in association with groups on the fringes of conventional society (e.g., artists). The Disinhibition (Dis) scale contains items describing seeking sensation through social activities like parties, social drinking, and sex. The Boredom Susceptibility (BS) scale measures intolerance for repetitive experiences of any kind, including routine work and boring people. A total score (Total) is obtained by summing the four subscales. Finally, in the specific context of sports, an additional TAS-OUT score was computed in some studies (Gomà-i-Freixanet, 1991, 1995, 2001; Jack & Ronan, 1998) by summing all SSS subscales but TAS (thus ES, Dis, and BS). As some of the items from the TAS subscale are concerned with physically risky sports and activities that athletes can actually be participating in, the TAS-OUT scale controls for the possibility of variance in Total SS scores being due solely to sports participation.

One implication of the SS construct in the context of sports is that the particular sport discipline one is more likely to participate in may be associated with whether one is high or low on the SS trait. Of course, additional factors such as physical ability, age, gender, and economic status are important determinants as well but are beyond the scope of this paper. In 1983, Zuckerman published the first paper reviewing the literature on SS and sports. Since then a great deal of new empirical data has accumulated and methodological improvements have been applied that merit a new review of the literature. Therefore, the purpose of this paper consists of reviewing and integrating evidence-based published information on the SS trait in the context of physically risky sports in order to establish whether data show that the SS trait differs among participants engaged in sports with different levels of physical risk.

Method

The editorial on research literature review by Cooper (2003) published in Psychological Bulletin provided guidelines for methods of data collection of this literature survey.

Identification of studies

To identify pertinent studies on the relationship between the SS trait and participation in physically risky sports, a systematic search of published references was executed in the PsycINFO and Web of Knowledge databases from January 1964 until September 2010 inclusive. Two independent investigators did this search to control for possible mistakes and oversights regarding the papers selected for this review. We used the following keywords: "risk(s)", "sport(s)", "sensation(-)seeking", "behaviour(s)", and "personality", to cover the whole range of risky sports and personality.

Inclusion criteria

Only peer-reviewed articles were considered. We did not include neither dissertations and theses, nor conference proceedings or book chapters. Studies were included only if they provided empirical data and compared groups with different levels of physical risky sports (e.g., a control group and a sport one, or comparing different sports). Since there can be confusion concerning the meaning of the term "sport", we must precise that we used such a term to design all physical leisure pursuits, whether or not they are federative or competitive practices. The database searches produced 132 article titles. Of these articles, only 36 met our inclusion criteria.

Method of review

Papers were classified into high- medium- and low-risk sports and presented in three different tables, one for each level of risk. To make a systematic data extraction, we devised a form to describe the general characteristics of the paper. The data extracted from the 36 papers is presented in chronological order and in the following manner: in the first column named "sport" we have placed the kind of physically risky sport; on the second column named "author" the authors and year of publication are stated. At the third column, there is the sport practiced by the experimental group along with the sex and number of participants. At the fourth col-

umn, there is stated the kind of participants, sex and number of them that acted as a control group. The fifth column illustrates the statistical significant differences encountered among the compared groups including the sense of the differences. Finally, the last column "notes", states the version of the questionnaire used and some other observations that can be of interest when interpreting the results obtained in the specific study.

Classification criterion

Furthermore, since few consensuses exist on how to best categorize the different kinds of sports, in the present study we opted to use the same classification Zuckerman used. Thus, sports were grouped into categories with high, medium, and low physical risk according to the associated risks involved. High physical risk sports were those considered with a high probability of serious injury or death as a consequence of practicing such a sport. Sports like climbing, parachuting, speleology or white water kayaking where participants have to struggle with the strong and unpredictable forces of nature are examples of this classification. We identified 27 papers devoted to high physical risky sports embracing different sports. The most studied sports category was parachuting/parasailing/hang-gliding. Medium physical risk sports were those with a higher probability of being injured than encountering death, the arena where the sport takes place is limited and the environment is static. Sports like boxing, karate, rugby or American football are good examples for this category. We found six studies on medium physical risky sports, such as karate and rugby and one category of miscellaneous sports. Finally, low physical risk sports were those with a very low probability of being seriously injured or having a fatal injury occurrence. Sports such as running, gymnastics, bowling or golf fit into this classification. We identified four studies devoted to these sports, including sports like athletes.

Analysis and interpretation of the results

In general, studies compare SS scores either between groups practising sports with similar or different levels of risk, or with control groups. The gender of the athletes, the kind of sports practised, the level of competition, and the classification of individuals (elite versus subelite sportspersons, etc.) vary considerably across the studies. This hardly comes as a surprise taking into account that the first paper meeting inclusion criteria was published in 1974. Some studies differentiate genders while others do not. Some use team sports like rugby while others use individual sports such as parachutism. Some studies differentiate between competition levels (using a host of varying criteria such as expert nominations or membership of a national team) while others do not. Authors also use different criteria to assign individuals to a given level of risk (e.g., number of accidents, level of uncertainty, the dynamics of the sports situation, or international grading systems as in kayaking or climbing). Control groups also vary considerably since sports students, college students, sportsmen with a different level of risk, normative data, participants specifically selected for not practising any risky sport, and the general population are used.

The high heterogeneity encountered in the categorizations used by the different authors along these 36 years of research made us conclude that a mere statistical combination of the results encountered might mask important differences in research findings, and thus might drive us to invalid conclusions (Cooper, 2003). Thus, we opted for a systematic search, followed by an attempt to draw unbiased conclusions as a more valid method to deal with such a diversity of studies. This methodology still falls under the umbrella of a systematic review, given that the literature is searched systematically and the data extracted in a predetermined way.

Results

The reviewed studies are presented in Tables 1, 2 and 3. In order to integrate the empirical data obtained and draw summary statements of this highly heterogeneous data, we adopted the following presentation of results. First, sensation seeking is reviewed in high, medium, and low physically risky sports (individual Tables 1-3). Then, by cross-comparing the three tables, we can further analyse how the distribution of sensation seeking is affected when sports of similar and different physical risk are compared. Finally, SS in sports with different physical risk is compared to controls.

Sensation seeking in high physical risk sports

A total of 27 studies were identified devoted to SS in high physical risk sports (Table 1). These high physical risk sports were compared to sports with similar physical risk, low physical risk, or with controls.

Table 1. Studies relating Sensation Seeking to high-risk sports.

Sport	Author (year)	Experimental (sex, *n)*	Control (sex, *n*)	Group Differences [a]	Notes
Parachuting	Hymbaugh & Garrett (1974)	Sky-divers[1] ♂+♀=21	Non-sky-divers[0] (matched)	TAS 1=0 ES1=0 Dis1=0 BS1=0 Total 1>0	SSS-II
Mountain climbing	Fowler, von Knorring, & Oreland (1980)	Climbers[1] ♂11 , ♀=7 & students interested in climbing= 9	Dental students not interested in climbing[0]	TAS 1>0 ES 1=0 Dis 1=0	SSS-IV

			=32	BS 1=0 Total 1>0	
Hang-gliding Auto-racing	Straub (1982)	Hang-gliders[1] ♂=33 Auto-racers[2] ♂=22	Bowlers[0] ♂=25	TAS 1>0, 2=0 ES 1, 2>0 Dis 1=0, 2>0 BS 1=0, 2>0 Total 1,2>0	SSS-V
Mountain climbing Parachuting Hang-gliding Racing	Zaleski (1984)	Miscellaneous risky sports[1] ♂=60	Controls matched by age[0] ♂=60	TAS 1>0 ES 1=0 Dis 1>0 BS 1=0	
Rock climbing	Robinson (1985)	Elite climbers[1] ♂=30	Normative data[0] ♂=377	TAS 1>0 ES 1>0 Dis 1=0 BS 1=0 Total 1>0	SSS-V
Rock climbing	Levenson (1990)	Rock climbers[1] ♂=18	Norms from college students[0] ♂=686	TAS 1>0 ES 1>0 Dis 1<0 BS 1=0 Total 1>0	SSS-IV No data about significance.
Mountain climbing	Cronin (1991)	Climbers[1] ♂+♀=20	Control[0] ♂+♀=21	TAS 1>0 ES 1>0 Dis 1=0 BS 1=0 Total 1>0	SSS-V College students.
Himalayas expedition	Gomà-i-Freixanet (1991)	Expeditioners[1] ♂=27 Mountain climbers & skiers[2] ♂=72 Sportsmen not related with mountaineering[3] ♂=221	Controls not engaged in any risky sports[0] ♂=54	TAS 1,2,3>0 2>3 ES 1,2,3>0 2>3 Dis 2>0 BS 1,2,3=0 TAS-OUT 2,3>0 Total 1,2,3>0 2>3	SSS-V Controlling for age.
Rodeo Hang-gliding	Rainey, Amunategui, Agocs, & Larick (1992)	Rodeo athletes[1] ♂=19 Hang-gliders[2] ♂=28	Baseball[3] players ♂=39 Wrestlers[4] ♂=29	TAS 1,2=3,4 ES 2>1,3,4 Dis 1>3,4 BS 2>3,4 Total 1>3 2>1,3,4	SSS-V
White-water	Campbell, Tyrrell, & Zingaro (1993)	Canoe & kayak paddlers[1] ♂+♀=54	Norms from general population[0]	TAS 1>0 ES 1=0 Dis 1=0 BS 1=0 Total 1=0	SSS-V
Speleology Alpinism Ski jumping	Rossi & Cereatti (1993)	Speleologists[1]=20 Alpinists[2] =20 Ski-jumpers[3]=7	Controls[0]=20	TAS 1,2,3>0 ES 1,2>0 Dis 1,2,3>0 BS 1,2,3>0 Total 1,2,3>0 1>3	SSS-V Sex not stated. Did not control for age.
Parasailing	Cantón & Mayor (1994)	Parasailers[1] ♂+♀=21	Tennis[0] ♂+♀=30	TAS 1>0 ES 1>0 Dis 1>0 BS 1=0 Total 1>0	SSS-V
Hang-gliding	Wagner & Houlihan (1994)	Hang-gliders[1] ♂+♀=170	Golfers[0] ♂+♀=90	TAS 1>0 ES 1>0 Dis 1>0 BS 1>0 Total 1>0	SSS-V
High risk sports	Gomà-i-Freixanet (1995)	Miscellaneous risky sports[1] ♂=332	Controls not engaged in any risky sports[0] ♂=54	TAS 1>0 ES 1=0 Dis 1=0 BS 1=0 TAS-OUT 1=0 Total 1>0	SSS-V Controlling for age.
Everest expedition	Breivik (1996)	Everest expeditioners[1] ♂=7	Elite climbers[0] ♂=38	TAS 1=0 ES 1=0 Dis 1=0 BS 1>0 Total 1=0	SSS-V
		Everest expeditioners[1]	Sports students[0]	TAS 1>0	

		♂=7	♂=43	ES 1>0 Dis 1=0 BS 1>0 Total 1>0	
Bungee jumping	Michel, Carton, & Jouvent (1997)	Bungee jumpers[1] ♂=51 , ♀=29	General public[0] ♂=50 , ♀=45	TAS 1>0 ES 1=0 Dis 1=0 BS 1=0	SSS-V
Rock climbing Skiing Piloting White-water	Slanger & Rudestam (1997)	Extreme[1] ♂=20 High risk takers[2] ♂=20	Athletes[0] ♂=20	TAS 1=2 Total 1=2 TAS 1+2>0 Total 1+2=0	SSS-V Controlling for age.
Parachuting	Breivik, Roth, & Jorgensen (1998)	Expert[1] ♂=21 Novice parachutists ♂=14	Sports students[0] ♂=43	TAS 1>0 ES 1>0 Dis 1>0 BS 1>0 Total 1>0	SSS-V
		Expert parachutists[1] ♂=21	Novice parachutists[0] ♂=14	TAS 1=0 ES 1>0 Dis 1=0 BS 1=0 Total 1=0	
High risk sports	Jack & Ronan (1998)	High risk sports[1] ♂+♀=93	Low risk sports[0] ♂+♀=73	TAS 1>0 ES 1>0 Dis 1>0 BS 1>0 TAS-OUT 1>0 Total 1>0	SSS-V Controlling for age.
High risk sports	Zarevski, Marusic, Zolotic, Bunjevac, & Vukosav (1998)	High risk sports[1] ♂=94	Low risk sports[0] ♂=94	TAS 1>0 ES 1>0 Dis 1>0 BS 1>0	SSS-V
High risk sports	Gomà-i-Freixanet (2001)	Miscellaneous risky sports[1] ♀=52	Controls not engaged in any risky sports[0] ♀=58	TAS 1>0 ES 1>0 Dis 1>0 BS 1=0 TAS-OUT 1>0 Total 1>0	SSS-V Controlling for age.
Scuba-diving	Bonnet, Pedinielli, Romain, & Rouan (2003)	High-risk taker scuba-divers[1] ♂+♀=25	Low-risk taker scuba-divers[0] ♂+♀=49	TAS 1>0	SSS-V
Paragliding	Franques et al. (2003)	Paragliders[1] ♂+♀=34	School employees[0] ♂+♀=34	TAS 1>0 ES 1=0 Dis 1>0 BS 1>0 Total 1>0	SSS-IV
Surfing	Diehm & Armatas (2004)	Surfers[1] ♂=30+♀=11	Golfers[0] ♂=29 , ♀=15	TAS 1>0 ES 1>0 Dis 1>0	SSS-V
High-risk sports	Lafollie & Le Scanff (2007)	Imprudent high-risk sportsmen [1] ♂=23	Prudent high-risk sportsmen[0] ♂=26	TAS 1=0 Dis 1=0	SSS-V
High-risk sports	Cazenave, Le Scanff, & Woodman (2007)	Leisure high-risk sportswomen [1] ♀=53 Professional high-risk sportwomen [2] ♀=37	Controls engaged in non-risk sports[0] ♀=90	TAS 1>0,2 ES 1>0 Dis 1=0=2 BS 1=0=2 Total 1>2>0	SSS-V
Contemporary and traditional alternative high-risk sports	Rhea & Martin (2010)	Contemporary alternative high-risk sportsmen (wakeboarders, motocrossers, etc.)[1] ♂=50 Traditionnal alternative high-risk sportsmen (Bullriders) [2] ♂=63	Controls engaged in non-risk sports[0] ♂=70	Total 1,2 > 0	SSS-II

Note. Table presentation based on Zuckerman (1983). Studies are ordered by year of publication. If sex, *n* or SSS form are not mentioned, this information is not provided in the reviewed studies. [(a)] Numbers in the Group Differences column refer to the numbers in superscript next to physical risky categories for compact presentation of statistical significant results (e.g., TAS 1>0 indicates that group 1 scored higher on the TAS subscale than group 0). SSS, Sensation Seeking Scale; TAS, Thrill and Adventure Seeking; ES, Experience Seeking; Dis, Disinhibition; BS, Boredom Susceptibility; TAS-OUT, total score minus TAS; Total, total score.

When we compare SS in high risk sports with SS in sports with a similar level of risk, a large majority of studies show that sportspersons do not differ from each other on the SSS, neither on the specific subscales nor on the Total score. Studies such as those of Gomà-i-Freixanet (1991), Rossi and Cereatti (1993), Breivik (1996), Breivik, Roth, and Jorgensen (1998), Lafollie and Le Scanff (2007), and Rhea and Martin (2010) illustrate these findings. These are indeed the results expected when comparing participants practicing sports with similar level of risk. We found only one study (Cazenave, Le Scanff, & Woodman, 2007) showing a difference between a group of sportswomen engaged in high-risk sports for leisure purposes, and one in high-risk sports as professional, since the former scored higher on SSS than did the latter.

Comparing high risk sports versus low risk sports, participants differ on all subscales of the SSS as well as on the Total score (Cantón & Mayor, 1994; Jack & Ronan, 1998; Rainey, Amunategui, Agocs, & Larick 1992; Rhea & Martin, 2010; Wagner & Houlihan, 1994; Zarevski, Marusic, Zolotic, Bunjevac, & Vukosav, 1998). Participants also differed on the variable named TAS-OUT in the studies that included it. That is, high-risk sportspersons score significantly higher on TAS, ES, Dis, BS, Total and TAS-OUT compared to low-risk sportspersons.

When we finally compare high risk sports with controls (either college students, sports students, general population or simply non-athletes), the above described tendency is still maintained with high significant scores on TAS, ES and Total, and even TAS-OUT. They do not differ significantly on BS and on Dis. Regarding Dis however, when we take a closer look at the studies, we can observe that when comparing high risk sportspersons to the general population and controlling for age (Gomà-i-Freixanet, 1991, 1995, 2001; Zaleski, 1984), the former do score significantly higher on Dis, but this effect is less clear when using sports students as a control group and it disappears totally when the contrast group is college students. This is probably due to the fact that these studies did not control for age and, in general, college students are younger than professional sportspersons. It is known that all SS scales scores decline with age (Zuckerman, Eysenck, & Eysenck, 1978). Therefore, the older professionals (in general being in the 30-39 age range), by not differing significantly from college students, actually score higher than their age group. Thus, professional sportspersons actually score higher on Dis as well. All in all, high-risk sportspersons either compared to athletes practicing sports with lower level of risk or to controls (controlling for age) show higher scores on the Total SSS and on all its subscales, except BS when compared to controls.

These results suggest that sportspersons who practise sports with a high level of risk enjoy extreme environments with great opportunities for encountering stimulation through the mind and senses such as height, depth, speed, a great amount of light or darkness, and changes in climatic conditions (wind, temperature); they like new, exciting and unconventional but not necessarily illegal experiences, and they have an intolerance for repetitive and routinely experiences. They do not feel high levels of anxiety that could interfere with the highly skilled performance required at these extreme conditions and they plan these actions very carefully. This is reflected in the planning of expeditions that may last for years since the equipment is very expensive and obtaining permissions is a lengthy process. Although they are unconventional, they follow the social rules and are well socialized. We must not forget that in general high risk sports are practiced in little groups (alpinism, climbing, speleology, parachuting) where one's behaviour can interfere with the group and sometimes one's life relies on the companionship and loyalty of the group.

Sensation seeking in medium physical risk sports

Six studies were identified that studied SS in medium physical risk sports (Table 2). Medium risk sports were either compared to low risk sports, sports students or controls.

When compared to athletes practicing low risk sports, participants engaged in medium risk sports score significantly higher on TAS and Total (Potgieter & Bisschoff, 1990). This pattern was not replicated in the study of Cantón and Mayor (1994) probably due to the sample was constituted by male and female participants and this circumstance could have masked the differences since female participants score lower on SS trait. If we compare medium risk sports to sports students (Davis & Mogk, 1994; Rossi & Cereatti, 1993), only Rossi and Cereatti found a significant difference on the ES subscale. Finally in comparison to controls (Rossi & Cereatti, 1993), athletes score significantly higher on TAS, Dis and Total.

The comparisons seem to indicate that when we compare medium risk sports with either lower risk sports or controls, the former score higher on TAS and Total. When participants in medium risk sports are specifically compared with controls, the Dis subscale appears as significantly different as well. These results probably could be explained by the following reasoning: when we compare medium versus low risk sports, we are still comparing scores between athletes, even though they are practicing different level of risky sports. Thus, both groups as athletes do not necessarily differ on Dis, while by practicing sports with a different risk level it can be expected they do differ on the TAS subscale as this specifically measures thrill seeking. As control participants are not engaged in any sports, the results on the Dis subscale could probably be related to the fact that athletes generally have social habits which are more open than those of non-athletes. In summary, sportspersons practicing medium risk sports compared to low risk sports and controls are thrill and adventure seekers and, specifically, when compared to participants not practicing any given sport they exhibit the general pattern of athletes as being unconventional and open minded.

Table 2. Studies relating Sensation Seeking to medium-risk sports.

Sport	Author (year)	Experimental (sex, *n*)	Control (sex, *n*)	Group Differences [a]	Notes
Rugby	Potgieter & Bisschoff (1990)	Rugby players[1] ♂=35	Marathon runners[0]	TAS 1>0 ES 1=0 Dis 1=0 BS 1=0 Total 1>0	SSS-V
Free-climbing Sports students	Rossi & Cereatti (1993)	Free climbers[1] *n*=20 Sport students[2] *n*=20	Controls[0] *n*=20	TAS 2>0 ES 1>2,0 Dis 1,2>0 BS 1,2=0 Total 1,2> 0	SSS-V Sex not stated. Did not control for age.
Karate	Cantón & Mayor (1994)	Karate[1] ♂+♀=53	Tennis[0] ♂+♀=30	TAS 1=0 ES 1=0 Dis 1=0 BS 1=0 Total 1=0	
Different levels of risky sports	Davis & Mogk (1994)	Elite[1], subelite athletes[2], sports students[3] ♂+♀=30 by group	Non-athlete controls[0] ♂+♀=30	TAS 2,3>0 ES 1,2,3=0 Dis 1,2,3=0 BS 1,2,3=0 Total 1,2,3=0	
Diving	Hinton-Bayre & Hanrahan (1999)	Elite divers[1] ♂=10 ♀=8	Low-risk sportsmen[0] ♂=6 ♀=12	TAS 1>0 ES 1>0 Dis 1>0 BS 1=0	SSS-V
Marathon	Hughes, Case, Stuempfle, & Evans (2003)	Ultramarathon participants ♂+♀=54	Norms from college students[0] ♂+♀=1217	TAS 1=0 ES 1>0 Dis 1<0 BS 1=0 Total 1=0	SSS-V

Note. Table presentation based on Zuckerman (1983). Studies are ordered by year of publication. If sex, *n* or SSS form are not mentioned, this information is not provided in the reviewed studies. [a] Numbers in the Group Differences column refer to the numbers in superscript next to physical risky categories for compact presentation of statistical significant results (e.g., TAS 1>0 indicates that group 1 scored higher on the TAS subscale than group 0). SSS, Sensation Seeking Scale; TAS, Thrill and Adventure Seeking; ES, Experience Seeking; Dis, Disinhibition; BS, Boredom Susceptibility; Total, total score.

Sensation seeking in low physical risk sports

Table 3, summarizes the available empirical data about the relationship between SS and low risk sports.

The results obtained from these three (Gundersheim, 1987; Hartman & Rawson, 1992; Schroth, 1995) highly homogeneous studies merit much credit since: 1) the selected sports were team sports, 2) all participants were college students, 3) the samples consisted of male and female participants and 4) the number of participants was high. Those practicing a low risk sport as compared to those not practicing any sport score significantly higher on Total, TAS and Dis. These results seem to indicate that when we compare athletes practicing low risk sports (in these studies those were all team sports) with non-athletes (controlling for age, sex, type of sport and years of education), the former are sensation seekers, high on thrill and adventure seeking, and more disinhibited. In relation to the Dis scale, as we said before, probably the difference is caused because team sports are related to competitions, and competitions entail frequent travel, meeting new people and celebrating of the winning matches, especially in college settings where parties are so popular and welcome. Therefore, the results suggest that, regardless of gender, college athletes are higher sensation seekers than college non-athletes, although the sports practised entail low levels of risk.

Table 3. Studies relating Sensation Seeking to low-risk sports.

Sport	Author (year)	Experimental (sex, *n*)	Control (sex, *n*)	Group Differences [a]		Notes
Athletes	Gundersheim (1987)	Athletes[1] ♂=123 , ♀=51	Non-athletes[0] ♂=43 , ♀=122	Males TAS 1>0 ES 1=0 Dis 1=0 BS 1>0 Total 1>0	Females Athletes vs Non-athletes Total 1>0	SSS-IV College students
Athletes	Hartman & Rawson (1992)	Athletes[1] ♂+♀=56	Non-athletes[0] ♂+♀=103	TAS 1=0 Dis 1>0 Total 1>0		SSS-VI College students
Athletes	Schroth (1995)	Athletes[1] ♂+♀=152	Non-athletes[0] ♂+♀=146	TAS 1>0 ES 1=0 Dis 1>0 BS 1>0 Total 1>0		SSS-V College students
Physical activities	De Moor, Beem, Stubbe, Boomsma, & De Geus (2006)	Exercisers[1] ♂+♀=4 923	Non-exercisers[0] ♂+♀=14 365	TAS 1>0 Dis 1>0		SSS-V

Note. Table presentation based on Zuckerman (1983). Studies are ordered by year of publication. If sex, *n* or SSS form are not mentioned, this information is not provided in the reviewed studies. [a] Numbers in the Group Differences column refer to the numbers in superscript next to physical risky categories for compact presentation of statistical significant results (e.g., TAS 1>0 indicates that group 1 scored higher on the TAS subscale than group 0). SSS, Sensation Seeking Scale; TAS, Thrill and Adventure Seeking; ES, Experience Seeking; Dis, Disinhibition; BS, Boredom Susceptibility; Total, total score.

Comparing sports with similar level of risk

A large majority of studies showed that when comparing groups engaged in similar levels of risk, there is no significant difference on any of the subscales of the SSS neither on the Total score. This holds regardless if they belong to an elite or subelite group (Davis & Mogk, 1994), if they have made summits at heights higher than 8.000 m. compared to lower altitudes (Breivik, 1996; Gomà-i-Freixanet, 1991), or if they belong to extreme as compared to high risk takers (Slanger & Rudestam, 1997). These results suggest that when sportspersons are at the top or upper level, they do not differ on the sensation seeking trait, i.e., probably all of them are attracted by variation and complexity, intense sensations, risks and adventures. Perhaps the difference between elite and near-elite groups should not be attempted to be explained by the trait level of SS alone, but rather using other variables such as constitutional features (i.e. muscle fiber type) as well. We found only one study (Cazenave et al., 2007) showing a difference between two groups actively engaged in high-risk sports, albeit in different ways; the first group practiced a risk-taking sport for leisure purposes whereas the second had a profession based on a risk-taking sport. Since the professional group was relatively low in both impulsivity and sensation-seeking, the authors conclude that the professional group approach risk-taking sports in a more structured, less impulsive manner.

Comparing sports with different levels of risk

By contrasting different levels of risk in sports, we can distinguish three levels, although comparing both extremes of risk shows the most clear cut image. When comparing high risk sports versus low risk sports, those participating in high-risk sports differ on all subscales as well as on the Total score. This suggests that high risk sportspersons are genuine sensation seekers compared to low risk sportspersons. When comparing SS in high risk versus medium risk levels (Gomà-i-Freixanet, 1991), the difference has reduced to TAS, ES and Total scales. Finally, when comparing SS in medium versus low levels of risk the only difference found is on TAS and Total scale. These results suggest that high risk takers as compared to medium or low risk takers are sensation seekers that like the thrill and adventure, somehow unconventional and like new experiences involved in the practice of high risk sports as parachuting, climbing or motor racing.

Comparing sports with different levels of risk with controls

When sportspersons, either practicing high-, medium-, or low-risk sports, are compared to control groups, a general pattern appears despite the different criteria used to classify the control groups (either college students, sports students, or general population). Compared to control participants, risky sportspersons (either high, medium or low) score high on TAS, Dis and Total score. This indicates that in comparison to control participants, risky sportspersons (either men or women), score high on the Sensation Seeking trait, on TAS and on the Dis subscale (e.g. Gomà-i-Freixanet, 1991, 1995, 2001). Thus athletes, compared to controls, like sports that provide unusual experiences and sensations, the opportunity of frequent travels, meeting new people and the social activity around the participation in sporting activities. In the same way, they would not like sports characterized by routines, long waiting times and slow pace.

Conclusions

Overall, some general findings regarding the Sensation Seeking Scale and its subscales in relation to physically risky sports can be drawn from this review of the literature. High scores on Thrill and Adventure Seeking (TAS) seem characteristic of participants engaged in sports with high and medium levels of risk, and even in low risk sports although to a lesser extent. High scores on Experience Seeking (ES) through the mind and senses (notably cognitive) seem characteristic only of participants engaged in sports with high levels of risk. The Boredom Susceptibility (BS) subscale only differs when comparing participants engaged in extreme levels of risk, that is, high-risk versus low-risk sport practitioners. High Total score and high score on Disinhibition (Dis) seem characteristic of athletes at any level of risk as compared to control groups, and of high-risk sport practitioners as compared to low-risk sport practitioners. Thus, what the Total score measures seems to apply to sportspersons practicing sports with a given level of risk. In relation to Dis we suggest it relates to the liking of social activities around the sport, like meeting new people, celebrating the summit or the winning game, being nonconformist and unconventional. This contrasts with the more "asocial" aspect of the Dis subscale like disregard for social rules and taking drugs and alcohol. Thus, not only the SS scale as a whole but the different subscales themselves are useful to differentiate participants engaged in sports with different levels of physical risk.

These results, in general, match previous findings, but add a new finding in relation to the Dis subscale. Since the last revision by Zuckerman (1983), a great deal of empirical research has been published on sports and especially on high risk sports. Some of the caveats that limited previous research and findings have been improved since the 1990s. For example, the number of participants has been increased as some of the selected sport activities samples had a small (less than 15) number of participants. Second, since that decade most studies use Form-V of the SSS which has been improved and thus the use of the same version facilitates comparisons and generalization of results. Third, with the improvement of statistical analysis, age differences between groups can be controlled for as a covariate. Finally, the refinement of methodology and the increase in the number of participants has allowed separate analyses for males and females, and thus replicate them in both genders.

All in all, the results obtained in the research conducted since the 1990s seem to be more accurate compared to the earlier results and suggest that high scores on TAS are mostly characteristic of participants engaged in sports with high and medium levels of risk; high scores on ES are only characteristic of participants engaged in sports with high levels of risk; BS scores only differ when comparing participants engaged in high risk sports versus those engaged in low risk sports; and high scores on Total and Dis scales seem characteristic of athletes at any level of risk as compared to controls, or athletes engaged in high risk sports as compared to those engaged in low risk sports. From the above, we can conclude that the SS scale is a useful tool to assess and interpret individual differences that exist between sportspersons practising sports with different levels of risk.

The findings obtained from this review have important implications for prevention. If high sensation seekers can be reliably identified, some prevention measures could be implemented to reduce the incidence of their putative high-risk behaviours while practicing high-risk sports. Indeed, the same high-risk sport (e.g., climbing) may be practised in several ways (e.g., soloing, leading, top-roping, etc.), each involving a different degree of risk exposure. High sensation seekers, identified at school, colleges or at university, could be required to complete an educational program focused on deterring them from engaging in risk-taking behaviours while practicing high-risk sports.

References

Apter, M. J., & Batler, R. (1997). Gratuitous risk: a study of parachuting. In S. Svebak & M. J. Apter (Eds.), *Stress and health: A reversal theory perspective* (pp. 119-129). Washington DC: Taylor & Francis.

Bonnet, A, Pedinielli, J. L., Romain, F., & Rouan, G. (2003). Subjective well-being and self-regulation in risk taking behaviors. The case of scuba-diving. *Encephale-Revue de Psychiatrie Clinique Biologique et Therapeutique*, *29*, 488-497.

Breivik, G. (1996). Personality, sensation seeking and risk taking among Everest Climbers. *International Journal of Sport Psychology, 27*, 308-320.

Breivik, G., Roth, W. T., & Jorgensen, P. E. (1998). Personality, psychological states and heart rate in novice and expert parachutists. *Personality and Individual Differences, 25*, 365-380.

Campbell, J. B., Tyrrell, D. J., & Zingaro, M. (1993). Sensation seeking among whitewater canoe and kayak paddlers. *Personality and Individual Differences, 14*, 489-491.

Cantón, E., & Mayor, L. (1994). The sensation of risk and motivational tendencies in sports: An empirical study. *Personality and Individual Differences, 16*, 777-786.

Cazenave, N., Le Scanff, C., & Woodman, T. (2007). Psychological profiles and emotional regulation characteristics of women engaged in risk-taking sports. *Anxiety, Stress and Coping, 20*, 421-435.

Cooper, H. (2003). Editorial. *Psychological Bulletin, 129*, 3-9.

Cronin, C. (1991). Sensation seeking among mountain climbers. *Personality and Individual Differences, 12*, 653-654.

Davis, C., & Mogk, J. P. (1994). Some personality correlates of interest and excellence in sport. *International Journal of Sport Psychology, 25*, 131-143.

De Moor, M. H., Beem, A. L., Stubbe, J. H., Boomsma, D. I., & De Geus, E. J. (2006). Regular exercise, anxiety, depression and personality: A population-based study. *Preventive Medicine*, *42*, 273-279.

Diehm, R., & Armatas, C. (2004). Surfing: An avenue for socially acceptable risk-taking, satisfying needs for sensation seeking and experience seeking. *Personality and Individual Differences, 36,* 663-677.

Duaux, E., Gorwood, P., Griffon, N., Bourdel, M.C., Sautel, F., Sokoloff, P., et al. (1998). Homozygosity at the dopamine D3 receptor gene is associated with opioid dependence. *Molecular Psychiatry, 3*, 333-336.

Fowler, C. J., von Knorring, L., & Oreland, L. (1980). Platelet monoamine oxidase activity in sensation seekers. *Psychiatric Research, 3,* 272-279.

Franques, P., Auriacombe, M., Piquemal, E., Verger, M., Brisseau-Gimenez, S., Grabot, D., et al. (2003). Sensation seeking as a common factor in opioid dependent subjects and high risk sport practicing subjects. A cross sectional study. *Drug and Alcohol Dependence, 69*, 121-126.

Gomà-i-Freixanet, M. (1991). Personality profile of participants engaged in high physical risk sports. *Personality and Individual Differences, 12,* 1087-1093.

Gomà-i-Freixanet, M. (1995). Prosocial and antisocial aspects of personality. *Personality and Individual Differences, 19,* 125-134.

Gomà-i-Freixanet, M. (2001). Prosocial and antisocial aspects of personality in women: A replication study. *Personality and Individual Differences, 30,* 1401-1411.

Gundersheim, J. (1987). Sensation seeking in male and female athletes and nonathletes. *International Journal of Sport Psychology, 18,* 87-99.

Hartman, M., & Rawson, H. E. (1992). Differences in and correlates of sensation seeking in male and female athletes and nonathletes. *Personality and Individual Differences, 13*, 805-812.

Hinton-Bayre, A. D., & Hanrahan, S. J. (1999). Sensation seeking, physical self-concept and attentional style in elite springboard and platform divers. *Journal of Human Movement Studies*, *37*, 183-203.

Hughes, S. L., Case, H. S., Stuempfle, K. J., & Evans, D. S. (2003). Personality profiles of Iditasport Ultra-Marathon participants. *Journal of Applied Sport Psychology, 15,* 256-261.

Hymbaugh, K., & Garrett, J. (1974). Sensation seeking among skydivers. *Perceptual and Motor Skills, 38,* 118.

Jack, S. J., & Ronan, K. R. (1998). Sensation seeking among high- and low-risk sports participants. *Personality and Individual Differences, 25*, 1063-1083.

Lafollie, D., & Le Scanff, C. (2007). Détection des personnalités à risque dans les sports à sensations fortes [Detection of high-risk personalities in risky sports]. *L'Encéphale, 33*, 135-141.

Legrand, F. D., Gomà-i-Freixanet, M., Kaltenbach, M. L., & Joly, P. M. (2007). Does sensation seeking predict binge drinking in college students? Some ecological data collected in "open bar" parties. *Personality and Individual Differences, 43*, 1950-1959.

Levenson, M. R. (1990). Risk taking and personality. *Journal of Personality and Social Psychology, 58*, 1073-1080.

Levy, J. S. (1992). Prospect theory and international relations: Theoretical applications and analytical problems. *Political Psychology, 13,* 283-310.

Levy, J. S. (1997). Prospect theory, rational choice and international relations. *International Studies Quarterly, 41,* 87-112.

Michel, G., Carton, S., & Jouvent, R. (1997). Recherche de sensations et anhédonie dans les conduites de prise de risque. Étude d'une population de sauteurs à l'élastique [Sensation seeking and anhedonia in risk taking behaviours: Study in bengy jumpers]. *L'Encéphale XXIII,* 403-411.

Potgieter, J., & Bisschoff, F. (1990). Sensation seeking among medium and low-risk sports participants. *Perceptual and Motor Skills, 71,* 1203-1206.

Rainey, D. W., Amunategui, F., Agocs, H., & Larick, J. (1992). Sensation Seeking and competitive trait anxiety among college rodeo athletes. *Journal of Sport Behaviour, 15*, 307-317.

Rhea, D. J., & Martin, S. (2010). Personality trait differences of traditional sport athletes, bullriders, and other alternative sport athletes. *International Journal of Sports Science & Coaching, 5*, 75-85.

Robinson, D. W. (1985). Stress seeking: Selected behavioural characteristics of elite rock climbers. *Journal of Sport Psychology, 7,* 400-404.

Rossi, B., & Cereatti, L. (1993). The sensation seeking in mountain athletes as assessed by Zuckerman's Sensation Seeking Scale. *International Journal of Sport Psychology, 24*, 417-431.

Schroth, M. L. (1995). A comparison of sensation seeking among different groups of athletes and nonathletes. *Personality and Individual Differences, 18*, 219-222.

Slanger, E., & Rudestam, K. E. (1997). Motivation and disinhibition in high risk sports: Sensation seeking and self-efficacy. *Journal of Research in Personality, 31,* 355-374.

Smith, K. C. P., & Apter, M. J. (1975). *A theory of psychological reversals*. Wilts: Picton Publishing.

Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1991). Personality, problem drinking, and drunk driving: Mediating, moderating, and direct-effect models. *Journal of Personality and Social Psychology, 60*, 795-811.

Straub, W. F. (1982). Sensation seeking among high and low risk male athletes. *Journal of Sport Psychology, 4,* 246-253.

Wagner, A. M., & Houlihan, D. D. (1994). Sensation seeking and trait anxiety in hang-glider pilots and golfers. *Personality and Individual Differences, 16*, 975-977.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39,* 806-820.

Zaleski, Z. (1984). Sensation seeking and risk taking behaviour. *Personality and Individual Differences, 5,* 607-608.

Zarevski, P., Marusic, I., Zolotic, S., Bunjevac, T., & Vukosav, Z. (1998). Contribution of Arnett's inventory of sensation seeking and Zuckerman's sensation seeking scale to the differentiation of athletes engaged in high risk and low risk sports. *Personality and Individual Differences, 25*, 763-768.

Zuckerman, M. (1979). *Sensation Seeking: Beyond the optimal level of arousal.* Hillsdale, New Jersey: Erlbaum.

Zuckerman, M. (1983). Sensation seeking and sports. *Personality and Individual Differences, 4*, 285-293.

Zuckerman, M. (1984). Experience and Desire: A new format for Sensation Seeking Scales. *Journal of Psychopathology and Behavioral Assessment, 6*, 101-114.

Zuckerman, M. (1994). *Behavioural expressions and biosocial bases of sensation seeking.* New York: Cambridge University Press.

Zuckerman, M., Eysenck, S. B. G., & Eysenck, H. J. (1978). Sensation seeking in England and America: Cross-cultural, age and sex comparisons. *Journal of Consulting and Clinical Psychology, 46,* 139-149.

Zuckerman, M., Kolin, E. A., Price, L., & Zoob, I. (1964). Development of a sensation seeking scale. *Journal of Consulting Psychology, 28,* 477-48.

(Article received: 26-11-2010; reviewed: 14-5-2011; accepted: 14-5-2011)