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State anxiety change after a parachute jump and its determinants: gender, experience, and temperament features

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Summary

Study aim: To determine the role of gender and experience level as factors differentiating state anxiety before and after a parachute jump, and to ascertain relationships between state anxiety and temperament features.
Material and methods: The research involved 143 parachutists (98 men and 45 women) aged from 17 to 49 years old, including 73 beginners and 70 advanced parachutists. The following questionnaires were applied: the Formal Characteristics of Behavior-Temperament Inventory by Zawadzki and Strelau, the Sensation Seeking Scale by Zuckerman, and the State-Trait Anxiety Inventory of Spielberger et al.
Results: There was a significant decrease in state anxiety level after a parachute jump (before $M = 32.66$; after $M = 28.57$; $p < 0.001$). Its level is significantly higher in beginners than in experienced skydivers ($p < 0.001$). The level of experience is also a negative predictor of state anxiety level before the jump and its decrease after the jump.
Conclusion: As experience grows, the positive adaptation to stress caused by parachute jump appears, which results with lowering the state anxiety level.

Keywords: Anxiety – Temperament – Sensation seeking – Risk taking – Skydiving

Introduction

Skydiving is a specific discipline in which the element of rivalry during competitions plays a less important role than defeating your own fear and the barriers connected with it. They can be connected with the awareness that even if all procedures before and during a parachute jump are not done well, there is the possibility of serious injury or death. Due to its characteristic, skydiving has been a topic of interest for scientists investigating the psychological side of skydivers.

Seymour Epstein and Walter D. Fenz are seen as the precursors of classic research on skydiving [4]. Their results showed that experienced skydivers felt the highest level of anxiety many hours before a jump. It then lowered gradually until the moment of the jump to increase rapidly again after landing. The situation with beginner skydivers was totally different as a constant growth in anxiety was observed until the moment of the jump was recorded, followed by a decrease in anxiety [5]. According to researchers, advanced skydivers, unlike beginner skydivers, are able to create resistance to a specific type of stress connected with the situation of a jump. Together with gaining experience, they become capable of creating an emotional self-control mechanism, i.e. suppressing anxiety, the gradient of which, closer to the moment of a jump, becomes steeper than the anxiety gradient [4]. According to Epstein, very early activation of anxiety occurs in advanced skydivers, due to which fear seems to be distant.

Price and Bundsen recently obtained similar results [14]. Beginner skydivers experienced an increase in anxiety level as a jump approached; at that time, positive emotions were at a low level. After the jump, the anxiety level decreased significantly and the level of positive emotions increased. Experienced skydivers showed less anxiety and higher levels of happiness before the jump. They tried to minimize the feeling of anxiety by putting emphasis on the positive emotions resulting from having fun, happiness, and pleasure.

According to Polish researchers [19], the experienced skydiver feels a certain anxiety before jumping; however, his/her mood improves as the moment of the jump approaches. The decision to jump is made due to the fact that this is a pleasant experience connected

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with positive emotions. Experienced skydivers, in contrast to beginners, are able to control their own emotions. In beginner skydivers, due to the fear of failure, emotion control is lost. Powell and Verner [13] as well as Sterlini and Bryant [18], who deal with testing anxiety and physiological excitement among beginner skydivers, came to similar conclusions. Their results showed a significant increase in both parameters before the first jump.

The former results did not confirm the research of Schedlowski and Tewes [16] as well as Roth, Breivik, Jørgensen and Hofmann [15], who tested pulse and breathing before, during and after a jump in both beginner skydivers and experienced ones. The curves of physiological parameters presented a similar shape; however, for beginners, significantly higher levels of stimulation were noted than for experienced skydivers. Experienced parachutists showed better awareness of their physiological excitement in comparison to their less experienced colleagues.

Considering issues of changes in state anxiety intensity, it needs to be underlined that anxiety is not an emotion unequivocally unwanted in skydivers' experience. Endler and Kocovski [3] depict the positive effects of anxiety. Anxiety works as a warning signal against approaching danger or harm. Anxiety increases motivation and at a moderate level may play an adapting role. However, great intensity of anxiety leads to disorganization of action, panic, decrease of concentration, and motor coordination [8, 13]. The results showed a negative correlation between the level of anxiety and the sport achievements of skydivers [13].

Why the matter of anxiety change dynamics for beginner and experienced skydivers is worth mentioning and discussing? The research results of Epstein and Fenz [5] suggest that adapting mechanisms lead to a lowering of the anxiety level in advanced skydivers just before a jump, which allows them to maintain a significant effectiveness of activity. It is also possible that the processes of natural selection cause people who are inclined towards reacting with anxiety to resign from this form of activity. Therefore, in the group of advanced skydivers, low level of trait anxiety dominates. This is analogical in other disciplines of sport, especially those containing elements of physical risk. Low anxiety level among experienced sportsmen may be a consequence of them gaining experience [7], or may be an effect of selection – high results are only achieved by people who have a lower tendency towards negative emotional reactions [7, 12]. Such interpretation suggests that a high level of anxiety is something unwanted, lowering the level of performance. However, it cannot be excluded that among people doing skydiving for a very long time, there are individuals who have the need for stimulation. These people may drive towards sustaining a high level of state anxiety, which is wanted as a source of additional stimulation.

None of the previously discussed studies have dealt with gender as a factor differentiating the state anxiety of skydivers. The results of the research on the general population unambiguously confirm that women have higher levels of trait anxiety and stress, and, unlike men, prefer an emotional style of coping, regardless of age. Anxiety indicators in women were also often higher than the ones observed in men [10, 22]. The question arises whether the same is true for anxiety connected with a parachute jump. The results of research [1] suggest that differences between women and men practicing skydiving regarding temperament features (which may condition anxiety state level) are significantly smaller than in the general population. The results obtained from female skydivers diverged significantly from population norms than those obtained from men.

What is also interesting is the level to which anxiety during a parachute jump is dependent on constant psychical properties of the individual. Until now, little research has been conducted on this. The role of trait anxiety is obvious. It does not seem necessary to prove this role through research as it has been shown many times that there are strong correlations between state and trait anxiety, not dependent on age or gender, in situations both neutral and life-threatening [22]. However, it is interesting whether the state of anxiety before and after a jump is determined by temperament features, especially sensation seeking. This problem was tested only rarely in earlier research. Brevik, Roth, and Jørgensen [2] conducted research on personality, the need for stimulation, anxiety level, and pulse in beginner and experienced skydivers. Expert parachutists gained significantly higher results on the scale of psychoticism and sensation seeking than their less experienced colleagues did. Thrill and adventure seeking turned out to be negatively correlated with trait anxiety and positively correlated with measurements of the state of anxiety.

According to Slanger and Rudestam [17], people with a strong need for stimulation are not always qualified with a low level of anxiety, but experience smaller excitement in specific types of situations, e.g. doing risky sports.

From another point of view, Woodman, Huggins, Le Scanff and Cazenave [21] as well as Woodman, Cazenave and Le Scanff [20], observed the problem of anxiety among skydivers. They dealt with the topic of emotion regulation and diversity in anxiety level experienced during skydiving regarding alexithymia.

Alexithymic people may engage themselves in high-risk level activities in order to experience strong feelings of anxiety, which decrease after finishing this activity. The research showed that skydivers with alexithymia experience a significant increase in state anxiety before a jump and a significant decrease after the jump, which may depict that doing high-risk sports helps them to regulate anxiety. According to Woodman et al. [20, 21], skydivers with alexithymia may intentionally engage themselves in situations connected with anxiety, which may be caused by the fact that they have lost the ability to feel pleasure in other ways than through these rather unpleasant emotions. This type of phenomenon is characteristic to anhedonia [9] in which the difference between positive and negative affection is abolished, and the positive effect may be the source of pleasure and the other way round. The results of Franken, Ziijlstra and Muris [6] confirmed that skydivers show more symptoms of anhedonia than people who prefer low-risk level activities, such as canoeing for example.

The aim of the research was to determine the role of gender and experience level as factors differentiating the state anxiety level before and after a parachute jump, and to ascertain relationships between state anxiety and temperament features.

On the basis of the literature, there was a hypothesis made that experienced skydivers show lower anxiety levels before and after a jump than beginners did (first hypothesis). Moreover, it was expected that experienced parachutists would be characterized by "anxiety inhibition", described by Epstein [4, 5] i.e. the anxiety state level after a jump is higher than before the jump (second hypothesis).

Materials and methods

Participants

The research involved 143 parachutists (98 males and 45 females) aged from 17 to 49 years, at different levels of advancement: 73 were beginners, i.e. not having had more than 10 jumps (5 jumps on average); 70 were advanced parachutists, i.e. having had at least 100 jumps (about 550 jumps on average) as well as qualifications enabling them to parachute as an individual without the supervision of an instructor. All the examined parachutists practice parachute jumps as amateurs.

Measures

The X-1 scale of the State-Trait Anxiety Inventory by Spielberger and colleagues in the Polish adaptation by Wrześniewski and colleagues [22], was used for measuring the state of anxiety. The X-1 scale allows for measuring the level of anxiety treated as its actual emotional state. It consists of 20 items describing the actual mood, to which the subject adapts by choosing one of four categorized answers (from strongly no to strongly yes). The possible range of scores for the A-State is 20–80. For the general population, adequate for the examined skydivers age group, low scores are within 20–32 points (for both sexes), average scores are 33–40 (women) and 33–39 (men), and high scores are more than 40 points for women and more than 39 points for men.

The reliability of the Polish version of the scale was valued on the basis of inner consistency (Cronbach's α for appropriate age groups, both men and women = 0.89) and inner stability within the period of four months (for appropriate age groups of men: $r = 0.54$, women: $r = 0.59$). The validity of the scale was estimated by comparing the results gained in a neutral and stressful situation and by correlating the results on the anxiety state scale with different personality dimensions.

In addition, the Formal Characteristic of the Behavior – Temperament Inventory (FCB-TI) [23] was used. This is a tool for diagnosing the basic features of temperament taken into consideration with the Regulative Theory of Temperament by Strelau. It is composed of six scales: briskness (BR) (e.g. "I usually work quickly even if I have a lot of time"); perseverance (PE) (e.g. "Some persistent thoughts often return to my mind"; sensory sensitivity (SS) (e.g. "I can even sense the slight smell of flowers"); emotional reactivity (EM) (e.g. "I lose confidence when someone criticizes me"; endurance (EN) (e.g. "I am able to continue working despite fatigue"); and activity (AC) (e.g. "I often take risks only for the pleasure of risk").

The reliability of the tool is satisfying (Cronbach's α varies from 0.73 for the SS scale to 0.85 for the EN scale); indices of correlation for temporary short-term stability (two weeks) have a value from 0.68 to 0.93; for long-term stability (six months), they range from 0.55 to 0.90. The validity of the questionnaire was confirmed by correlating its results with chosen physiological and psycho-physiological indices of temperament, and indices of other biological dimensions of personality.

The need for stimulation, meaning seeking different, new and intense experiences, and being ready to take risks in order to gain these types of experiences, was tested using the Sensation Seeking Scale (SSS-IV) by M. Zuckerman, in the Polish version by Z. Oleszkiewicz-Zsurzs [11]. It is composed of 68 questions, which use the named scales: thrill and adventure seeking (TAS), experience seeking (ES), disinhibition (Dis), and boredom susceptibility (BS). It is also possible to calculate the index of the general need for stimulation (general, G). The Polish version of the

scale differs from the original in the fewer number of items; moreover, it was complemented with a 7-item sub-scale diagnosing the need for intellectual stimulation (I).

In the original version, the scale is marked with satisfying psychometrical properties [24]. However, the attempt at adapting the tool for Polish conditions is not completely satisfying; hence, caution must be preserved while interpreting the results. Reliability indices (inner stability) vary from 0.77 for the I scale to 0.87 for the ES scale. The diagnostic validity of the tool is not satisfying in the opinion of the author [11].

Results

In order to set the differences in anxiety state change depending on gender and experience, variance analysis with repeatable measurements (gender x experience x measurement) was conducted. Table 1 shows the data. The results show a significant decrease in state anxiety level in skydivers after a parachute jump. There is also a relevant interaction between measurement and the level of experience ($F = 13.63$, $p < 0.001$, $\eta^2 = 0.089$). For beginner skydivers, the state anxiety decrease is bigger than for experienced ones (Figure 1).

We can also observe a significant main effect of experience: in experienced skydivers, the state anxiety level is notably lower. A comparison conducted separately for the state anxiety before and after a jump confirms the relevance of between-group differences in the measurement before the jump ($F = 30.0$, $p < 0.001$), while the difference reaches the tendency level ($F = 3.711$, $p = 0.056$) after the jump. No significant effect of gender or gender and experience interaction was noted.

An indicator of anxiety decrease was also calculated by subtracting the result after landing from the result gained in the X-1 scale before a jump. The positive value of the indicator is evidence of anxiety decrease after a jump. The value of this indicator is greater in beginners ($M = 6.14$, $SD = 6.201$) than in experienced skydivers ($M = 1.94$, $SD = 4.712$); the difference is statistically significant ($F = 13.63$, $p < 0.001$).

On the basis of the indicator of state anxiety decrease, there were two subgroups determined, in which: 1) the anxiety level increased or did not change

Table 1. Differences in anxiety state change depending on gender and experience, ANOVA with repeatable measurements (gender x experience x measurement)

Group	Total		Men		Women		Experienced		Beginners		ANOVA		
											Measurement	Gender	Experience
State anxiety	M	SD	M	SD	M	SD	M	SD	M	SD	$F; p; \eta^2$	$F; p; \eta^2$	$F; p; \eta^2$
Before jump	32.66	6.442	32.49	6.789	33.02	5.667	29.64	5.253	35.55	6.171	67.47; <0.001; 0.327	0.012; 0.912; 0.000	17.638; <0.001; 0.113
After jump	28.57	5.848	28.51	5.888	28.71	5.826	27.70	4.843	29.41	6.597			

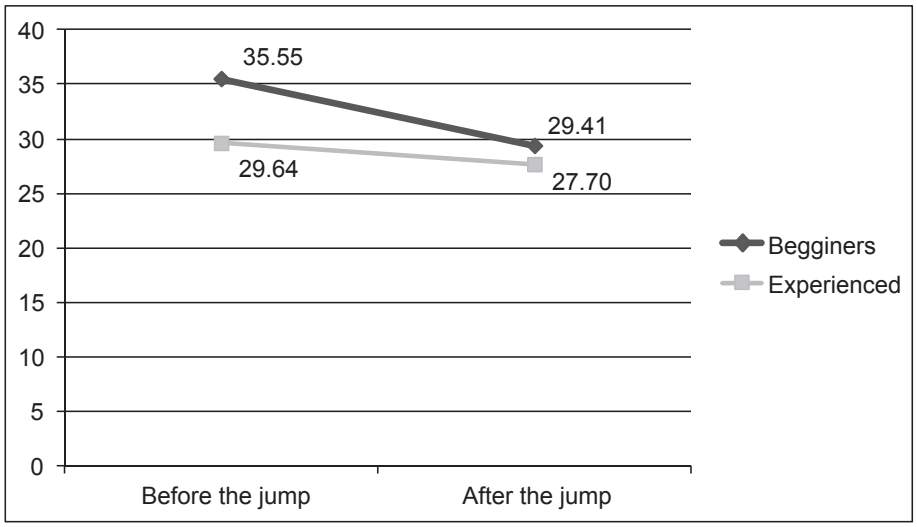


Figure 1. Interaction between state anxiety change and the level of experience among skydivers

(n = 45, indicator of anxiety decrease value ≤ 0); 2) the anxiety level decreased (n = 98, indicator value >0).

The percentage contribution of women and men was compared in these two groups. No relevant differences were noted (χ^2 = 0.702, p = 0.402). The anxiety level decrease appears in 65 (66.3%) men and 33 (73.3%) women. Due to the fact that gender does not differentiate the state anxiety level or its change, further analysis was conducted for men and women together.

Significant differences in the proportion of beginner skydivers and experienced parachutists in the groups were found (χ^2 = 12.90, p < 0.001). Beginners show anxiety decrease after a jump much more often compared to skydivers with greater tenure in this discipline (82.2% and 54.3% respectively). In almost half of the experienced parachutists state anxiety decreases after a jump was not noted.

In order to determine the relationships between the stable psychological properties and state anxiety level, *r*-Pearson correlation coefficients were calculated between potential determinants (temperament features and the need for stimulation) and: state anxiety before and after a jump and the indicator of its decrease.

Among temperament features, significant correlations with state anxiety before a parachute jump were noted in emotional reactivity (r = 0.223, p < 0.01), perseverance (r = 0.195, p < 0.05), and endurance (r = – 0.180, p < 0.05). No relevant correlations were observed between temperament features and: state anxiety after the jump and the indicator of anxiety decrease.

Relationships between all dimensions of sensation seeking and state anxiety indicators were tested. State anxiety after a jump correlates positively with sensation seeking (r = 0.207, p < 0.05) and disinhibition (r = 0.187, p < 0.05). Thrill and adventure seeking (r = –0.196, p < 0.05), sensation seeking (r = –0.188, p < 0.05), disinhibition (r = –0.197, p < 0.05) and the need for intellectual stimulation (r = –0.170, p < 0.05) are negative correlatives of anxiety change. No significant relationships were observed between the need for stimulation and anxiety state before a parachute jump.

In order to determine relationships between state anxiety and temperament features and the need for stimulation, stepwise regression analysis was conducted by inserting the following factors into the equation: gender, experience level, features of temperament, and sensation seeking.

For state anxiety before a jump, the settled predictor in the first step was experience (R^2 = 0.206); in the second, additionally – thrill and adventure seeking; both factors enabled state anxiety before a jump to be foreseen in 23.5%. Table 2 shows the detailed data. High anxiety levels before a jump may be expected in beginner skydivers and skydivers with a low need for physical danger.

The analyses for state anxiety after the jump led to determining two predicators: in the first step – sensation seeking (R^2 = 0.036), in the second step, additionally – endurance (R^2 = 0.058) (Table 2). Skydivers marked with a strong need for psychical sensations and low endurance will probably feel greater anxiety after a jump. However, it must be emphasized that the model explains the lower percentage of variability of state anxiety after a jump than before it.

In the first step of the analysis for the state anxiety decrease, the level of experience turned out to be the predictor, which enabled the state anxiety decrease to be foreseen in 12.1%; in the second step, sensation seeking (R^2 = 0.170) was entered into the regression equation; and in the third step – thrill and adventure seeking (R^2 = 0.191). The results of the last step of the

Table. 2. Results of the Last Step of the Regression Analysis for State Anxiety before and after the Jump and State Anxiety Decrease

Dependant variable /predictors	β	t	p
State anxiety before the jump: R^2 = 0.235, F = 22.85, p < 0.001			
Experience	–0.475	6.455	<0.001
Thrill and adventure seeking	–0.187	2.535	<0.05
State anxiety after the jump: R^2 = 0.058, F = 5.399, p < 0.01			
Sensation seeking	0.230	2.817	<0.01
Endurance	–0.171	2.081	<0.05
State anxiety decrease: R^2 = 0.191, F = 12.19, p < 0.001			
Experience	–0.393	5.164	<0.001
Sensation seeking	–0.182	2.278	<0.05
Thrill and adventure seeking	–0.173	2.175	<0.05

regression analysis are shown in Table 2. One may expect a high state anxiety decrease in beginners and skydivers who show a strong need for psychical and physical stimulation.

The factors considered in the analysis allow better prediction of the state anxiety before a jump, and worse still – after the jump.

Discussion

The results of the research show that in the whole tested group there is a significant decrease in anxiety state level after a parachute jump; its level is significantly higher in beginners than in experienced skydivers. The level of experience is also a negative predictor of state anxiety before a jump and its decrease after the jump. Hence, the obtained results confirm the first hypothesis, according to which experienced skydivers show a lower state anxiety level than beginners before and after a jump.

In among almost half of the tested skydivers with a large amount of experience, the lack of anxiety decrease is noted – the anxiety level is similar to the one observed before a jump and even increases. The obtained results partly confirm the second hypothesis that in experienced skydivers state anxiety after a jump is higher than before the jump. However, this phenomenon does not appear, according to Epstein and Fenz [4, 5], in all experienced skydivers; it also appears, although more seldom, in beginners. It suggests that the phenomenon is more complex and also other factors, not controlled in the research (personality or situational), have an influence on anxiety, apart from the level of experience.

In referring the obtained data to the results of Epstein and Fenz, it is worth remembering that they took place in the 1960s, when the discipline was less accessible and people who wanted to do this sport underwent a much bigger selection in the physical and psychological properties. Training as well as later individual jumps were performed in more difficult conditions than they are today. Now, there are many accessible and mandatory resources that significantly increase the security level of parachute jumps. In the research, skydivers described as experienced were those who had at least 100 jumps. It is worth noting that nowadays doing 100 jumps takes much less time than it did before. There is a possibility that during the times of Epstein and Fenz, by doing this discipline in different conditions, skydivers acquired stress resistance connected with the jump much faster. The benchmark should probably be moved, and skydivers who have more that 500 jumps should be treated as experienced.

The obtained results are consistent with the results of Price and Bundsen [14], where beginner skydivers show higher stress and state anxiety level. However, data on the lack of such differences, obtained by Schedlowski and Tewes [16], Roth et al. [15], is not confirmed. The reason for incoherence in the results may be sought in the state anxiety indicator. Observational indicators and the self-report scale results seem to be less objective than physiological parameters. The moment of measurement is not without meaning. Multiple measuring, as in the research of Epstein and Fenz [5] or Roth et al. [15], enables the dynamics of state anxiety changes to be better determined, and probably increases the chances for discovering their differentiation depending on the experience of skydivers.

The results of the research show that the factor significantly determining the direction of state anxiety change after a jump is the need for stimulation, especially in the dimension of seeking sensation of a psychical nature (sensation seeking) and physical threat (thrill and adventure seeking). These factors enabled the level of state anxiety to be foreseen after a jump and are its negative correlatives. The positive predictor of state anxiety after a jump is seeking psychical sensations. The obtained results are congruent with the results of Brevik et al. [2], in which thrill and sensation seeking was positively correlated with the indicators of state anxiety of skydivers.

The role of the need for stimulation as a determinant of anxiety connected with a parachute jump in the perspective of the obtained results is as follows. Thrill and adventure seeking lowers the intensity of anxiety before a parachute jump. This dimension, together with striving for strong stimulation of psychological nature, increases the probability of obtaining a high state anxiety level after the jump. Temperament features determine, in a wider range, state anxiety before a parachute jump. Its level increases together with increasing emotional reactivity and perseverance and decreasing endurance.

State anxiety after a jump and its decrease is much less connected with temperament. Temperament features seem to mainly determine the state anxiety before a parachute jump, whereas emotional reactivity and perseverance probably increase its level; endurance, however, decreases.

It is also possible that changes in anxiety state level before and after a jump are connected with certain types of disorders, such as alexithymia and anhedonia. According to Woodman et al. [20, 21], as well as Franken et al. [6], some people with these disorders are capable of undertaking risky activities mainly in order to experience a certain type of intense emotions. The fact that in the group of advanced skydivers there were noted lower indices of anxiety state may mean that,

together with gaining experience by them, the "power" of activating emotions through skydiving is lowered and such people simply change the form of activity.

Finally, it is worth mentioning that dependencies connected with gender were not found. Gender does not differentiate state anxiety before and after a jump and the indicator of its decrease. These results stand in contrast to the knowledge on the topic of differences in state anxiety between women and men observed in the general population [22]. It is probably a result of specific psychological properties of the tested women. They obtained more than average results in briskness and endurance; in activity, low results were not noted. Moreover, no tested woman gained high results in emotional reactivity. The majority of women doing this discipline gained average or high results in sub-scales of the Sensation Seeking Scale. These properties may cause the state anxiety to be sustained at a lower level than average in the general population.

Women doing skydiving show a large number of attributes normally connected with the male gender. This may be because of the fact that in the process of undertaking physical activity including risk, both men and women are faced with similar challenges and threats, and only when they show a similar need for intense experiences are they able to accept risk connected with doing extreme sports.

When it comes to further direction of research on skydivers it would be interesting to know the motives for undertaking this type of activity depending on temperament and sensation seeking. For people differentiated by sensation seeking and the readiness to undergo risk, these motives may differ significantly. It would also be worth conducting a deeper analysis of emotional states through conducting multiple measurements on the same people, at different moments, connected and not connected with skydiving. This would help gain additional information on the topic of the dynamics of the change of emotional states, including anxiety, connected with skydiving and its determining factors.

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