ORIGINAL ARTICLE
INNOVATIONS IN RESEARCH METHODOLOGY

The ability to use firearms in stressful conditions as an important criterion for survival

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
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Abstract

Background & Study Aim: Survival competence is one of the basic areas of utilitarian human skills. Among many, the ability to shoot occupies a special place, especially from the perspective of using weapons in stressful situations (a special case of necessary defence). Factors modifying performance may be age, stress level, emotions, motivation, etc. Of interest is the question of whether the results of so-called static shooting are correlated with the results of simulated shooting situations as a necessity for the use of firearms in necessary defence. The main objective of the research is to know how competent the participants of the shooting instructor course are in the use of firearms in extreme situations (competition based on static shooting standards and dynamic duel "one against one" under safe simulation conditions).

Material & Methods: Twelve participants of a shooting instructor course aged 26-55 years were studied. All subjects were competent in the use of firearms. None of the subjects declared experience in defensive shooting or previous use of weapons with Simunition FX (non-lethal training ammunition). The test subjects first participated in a static shooting competition and then in dynamic duels with another person (simunition weapons and ammunition were used). Stress level was measured by heart rate values (HR Index: difference in heart rate after and before the competition). Motivation to compete was measured on a 10-degree scale (1 minimum motivation, 10 maximum). The use of special ammunition provided simulated conditions of imminent threat to health or life during real-life defensive combat with firearms. This methodological procedure allowed not only the competence of the test subjects in the use of firearms under stressful conditions to be assessed, but also the ability to act with precision during the effort. The opponent during the duel was an independent shooter (the same for all participants). The test ("shooting duel") took place over a distance of 10 m at the signal of the judge. During the duel, competitors were allowed to take any shooting stance they wished, without reducing the distance to the opponent. Each shooter had 10 rounds of ammunition (5 rounds in each of two magazines).

Results: A high level of shooting skills was found in the static subjects: mean score of 39.9 (out of a possible 50) with a mean motivation of 9.1. The age of the subjects was not significantly related to performance, nor was stress level. In the static competition, the mean HR before the competition was 86.3 BPM just after the competition 87.4 BPM. The mean HR Index was 1.1 BPM (in some cases it had negative values). There was a highly significant correlation (r = 0.715) of motivation with competition performance. In contrast, duel results showed no statistically significant correlation with shooting performance under static conditions. The stressful situation manifested itself in an apparent increase in the participants' heart rate: the average HR before the duel was 92.4 BPM, just after the competition 111.3 BPM; the average HR Index was 18.9 BPM. There was no significant correlation (r = 0.261) between duel motivation (mean 9.5) and shooting performance (mean 1.8 hits).

Conclusions: The shooting instructor candidates surveyed demonstrated high competence in the use of firearms under static conditions, while this was not confirmed by the results of shooting under simulated conditions of necessary defence. Thus, the ability to use firearms in self-defence, as an important element of survival competence, requires specialised training under conditions that are close to a real threat. The results of this research extend the empirical evidence of the need to introduce simulated direct threat situations into the training of defensive shooting educators. Such innovations will meet the methodological criteria of training precision action during exertion and stress as core survival competencies.

Keywords: education for safety • shooting simulation • survival awareness

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INTRODUCTION

Survival competencies are one of the most elementary areas of practical human skills. This unique combination of knowledge, skills, attitude and motivation allows us not only to survive but, most of all, becomes a basis for constructing many individual and socially useful competences [1, 2]. Being able to shoot a firearm is of particular importance, primarily from the perspective of using it in stressful situations (a special case of necessary self-defence). This skill is one of the key competences in many professions (police, military, other uniformed services, security) [3, 4]. In sports activities (e.g. practical shooting) it is a decisive factor for the final outcome of competition. An ability to use a firearm effectively (to hit a target) is a combination of many specific psychomotor skills. Effectiveness can be modified by: age, stress, emotions, motivation, etc. Stress experienced by a shooter is the most significant indicator in case of self-defence [5, 6]. Unsurprisingly, becoming aware of a threat to one's own health or life or effects of one's actions towards an opponent during a duel differs significantly from a situation that requires a precise action only (shooting to target). A real threat is simulated in numerous ways in so-called practical-defensive shooting, with Simunition FX weapons and ammunition (non-lethal training ammunition) being the most sophisticated form of this simulation [7]. A situation involving attention being focused on one's own precise actions, combined with the awareness of being a target for an opponent, requires special, automatic, learned skills that are somewhat different from those used during static shooting. The types of target at which the shot is fired are also different. In static shooting, the target is a circle with a dot not much larger than the calibre of the ammunition, while in practical shooting the highest scoring area includes sensitive areas of human body (Alpha, Beta, etc.), the hitting of which may be potentially dangerous (lethal) to an opponent in a real situation (torso, head, neck).

This study explores whether the results of so-called static shooting are correlated with the results of simulated shooting situations as the need to use firearms in necessary self-defence.

The main objective of the research is to know how competent the participants of the shooting instructor course are in the use of firearms in extreme situations (competition based on static shooting standards and dynamic duel "one against one" under safe simulation conditions).

MATERIAL AND METHODS

Twelve participants of a shooting instructor training course aged 26-55 were studied. All subjects were competent in the use of firearms. None of the subjects declared experience in defensive shooting or previous use of weapons with Simunition FX ammunition (non-lethal training ammunition). The trainees participated first in a static shooting competition (10 shots, 25m, target type TS-2, ISSF25/50) and then in dynamic duels with another person (simunition weapons and ammunition were used). Stress levels were measured by the heart rate value (HR Index: a difference in heart rate after and before the competition). Motivation to compete was measured on a 10-point scale (1 being the lowest and 10 being the highest motivation).

Target type TS-2 (ISSF 25/50) – 25m Precision and 50m Pistol Target (for the 50m Pistol and 25m Standard Pistol events and the precision stage of the 25m Centre Fire and the 25m Pistol events). Inner ten: 25mm, black from 7 to 10 rings, paper size 520mm x 550mm.

BPM – *abbreviation* beats per minute [26].

Self-defence – *noun* fighting techniques used for defending oneself against physical attack, especially unarmed combat techniques such as those used in many of the martial arts [26].

Special ammunition ensured stimulated conditions of imminent threat to health or life, during a real-life defensive struggle with a firearm. This methodological procedure made it possible not only to assess the competence of the subjects in the use of firearms in stressful conditions, but also to evaluate the ability to act with precision during physical effort. An independent shooter was an opponent during a duel (the same in case of all participants). The test ("shooting duel") took place over a distance of 10 m at the referee's signal. The competitors could take any shooting stance they wished, without reducing the distance to their opponent. Each shooter had 10 rounds of ammunition (5 rounds in each of the two clips). A hit to the body or head was considered effective.

Statistical analysis

Basic elements of descriptive statistics were used to analyse the collected data: average; standard deviation (SD); minimum (Min); maximum (Max). The relationships between the variables was tested using the Pearson correlation coefficient. In the studies, the level of at least $p<0.05$ and higher was shown as statistically significant differences.

RESULTS

A high level of the subjects' shooting skills was found under static conditions (Table 1): mean result 39.9 points (out of 50 possible) with mean motivation 9.1 (on a scale of 1 to 10). In the static competition, the mean HR was 86.3 BPM before the competition and 87.4 BPM after the competition. Mean range of HR Index was 1.1 BPM (it took negative values in some cases).

In contrast, duel scores did not show a statistically significant relationship with shooting performance under static conditions (Table 2). A stressful situation manifested with an apparent increase in the participants' heart rates; the mean HR was 92.4 BPM before a combat, 111.3 BPM immediately after the competition, with the mean range HR Index of 18.9 BPM.

Table 1. Static shooting competition (SC) – ordering variable: age.

Shooter (code)	Age (years)	Shooting competition (SC)		HR-SC_1 before (BPM)	HR-SC_2 after (BPM)	SC-HR Index ($SC_2 - SC_1$)
		SC-Motivation (scale 1 to10)	SC-results (points/50)			
S1	55	7	**39**	86	92	6
S2	44	10	**37**	94	92	–2
S3	42	10	**38**	92	90	–2
S4	36	10	**42**	82	88	6
S5	34	10	**37**	88	89	1
S6	33	10	**47**	99	91	–8
S7	32	10	**48**	88	85	–3
S8	31	10	**39**	82	83	1
S9	30	10	**48**	85	83	–2
S10	28	7	**29**	82	86	4
S11	28	10	**46**	77	82	5
S12	26	5	**29**	81	88	7
Average:	34.9	9.1	39.9	86.3	87.4	1.1
SD	8.0	1.7	6.3	6.0	3.4	4.4
Min:	26.0	5.0	29.0	77.0	82.0	–8.0
Max:	55.0	10.0	48.0	99.0	92.0	7.0

Table 2. Dynamic shooting duel (SDu) – ordering variable: age.

Shooter (code)	Age (years)	Shooting duel (SDu)		HR-SDu$_1$ before (BPM)	HR-SDu$_2$ after (BPM)	SDu-HR Index (SDu$_2$ – SDu$_1$)
		SDu-motivation (scale 1 to10)	SDu-results (hits/10)			
S1	55	10	**0**	102	135	33
S2	44	10	**0**	100	128	28
S3	42	10	**2**	112	122	10
S4	36	10	**2**	88	91	3
S5	34	10	**2**	89	108	19
S6	33	10	**5**	99	112	13
S7	32	10	**3**	100	114	14
S8	31	6	**1**	82	100	18
S9	30	10	**2**	89	98	9
S10	28	10	**1**	85	102	17
S11	28	10	**3**	78	108	30
S12	26	8	**1**	85	118	33
Average:	34.9	9.5	1.8	92.4	111.3	18.9
SD:	8.0	1.2	1.3	9.6	12.4	9.6
Min:	26.0	6.0	0.0	78.0	91.0	3.0
Max:	55.0	10.0	5.0	112.0	135.0	33.0

A highly significant correlation (r = 0.715, p<0.01) was found between motivation and static competition performance (Table 3). No significant correlation (r = 0.261) was demonstrated between motivation (mean 9.5 on a scale of 1 to 10) and shooting performance (mean 1.8 hits out of 10 possible). Neither age of the participants nor stress was significantly related to the scores.

The majority of shooters (7 persons) tried to be in motion (dynamic behaviour) during a combat, whereas others preferred to be static. The opponent of the shooters preferred dynamic behaviour and their average hit score was higher (mean 2.3).

In contrast, a highly significant relationship links static shooting skills with dynamic shooting skills

Table 3. Linear correlation results.

Relationships of variables	Shooting competition	Shooting duel
Motivation ÷ Results	**0.714****	0.261
Age ÷ Results	0.006	–0.421
HR Index ÷ Results	–0.516	–0.449
SC Results ÷ SDu Results	**0.644***	

*p<0.05, **p<0.01

Table 4. Shooters efficiency.

Shooting competition	Shooting duel
79.8%	18.0%
39.9 pts / 50 pts	1.8 hits /10

in individual shooters (r = 0.644, p<0.05), demonstrating that a good static shooter is potentially a good dynamic shooter. However, the effectiveness (hitting the target) of shooters under static conditions is significantly higher (79.8%) than during dynamic shooting (18%) (Table 4).

DISCUSSION

The use of firearms, as a highly sophisticated tool of necessary self-defence, requires a high level of specialised psychomotor competence in this area. Our study revealed that there are no grounds to claim that persons proficient in the use of weapons in target shooting transfer these skills to the area of self-defence (or, more broadly, a fight for survival). A stress situation accompanying the activity is a decisive factor. The stress level, as measured by the heart rate value (HR Index), clearly reflected the differences between static (HR Index = 1.1) and dynamic shooting (HR Index = 18.9). A direct, dynamic confrontation with a visible and active opponent is a factor significant enough to be considered as modifying the skills already possessed in the negative sense. The highly significant difference in the effectiveness of static shooting (79.8%) and dynamic shooting (18%) by experienced shooters (instructor candidates) suggests that dynamic elements with simulation techniques should be included in basic shooting training, at an appropriate (preferably final) stages of training. In addition, the highly significant correlation (r = 0.644, p<0.05) between static and dynamic shooting scores of individuals proves that effectiveness in dynamic shooting is rooted in high competence in static shooting (and this principle of methodical improvement of shooting skills should be respected).

As far as mental preparation is concerned, motivation combined with necessary shooting skills plays an important role. Very high motivation for static shooting (9.1 on a scale of 1 to 10) was reflected in scores (mean score of 39.9/50 points), but this did not translate, with equally high motivation, into a score in dynamic shooting (nominally higher motivation: 9.5; mean shooting score 1.8/10 points).

There is evidence in scientific publications that training under simulated stressful conditions has measurable effects, such as a marked improvement in firearms handling performance in extreme situations [8, 5, 9, 6]. Highly sophisticated stress shooting training programmes have also been successfully implemented, primarily for specialised police and military units [10, 11]. The ability to use special weapons and ammunition that reflect all shooting aspects (firearms loaded with dye) and safety (personal protective equipment) provides extremely effective training tools.

As far as training in shooting sports (Olympic disciplines and disciplines of the International Shooting Sport Federation) is concerned, the main emphasis in the mental sphere is placed on stress management and relaxation techniques. Simulated stress training is not and probably will not be adequate in this case. Nevertheless, such training seems necessary in the increasingly popular types of shooting that involves practical use of firearms for self-defence. As mentioned, this requires that defensive shooting instructors acquire separate competences, with the simplest way being simulated direct threat situations.

In a broader sense, such innovations should meet the methodological criteria of training precision action during physical effort and stress [12-15, 4, 16-18] as core competencies for survival. In simplified forms, these competencies can be stimulated through the use of, for example, tennis balls thrown into a container, at a fixed interval, during increasing physical exertion [19, 20]. A repeated effort based on the Burpee test is attractive and most of all highly selective [21, 22]. In a sense, paradoxically, exercises that involve avoiding collision with an object in motion recommended by experts in innovative agonology [23-25] may be relevant in preparation for a shooting duel.

CONCLUSIONS

1. The shooting instructor candidates surveyed demonstrated high competence in the use of firearms under static conditions, while this

was not confirmed by the results of shooting under simulated conditions of necessary defence. Thus, the ability to use firearms in self-defence, as an important element of survival competence, requires specialised training under conditions that are close to a real threat.

2. The results of this research extend the empirical evidence of the need to introduce simulated direct threat situations into the training of defensive shooting educators. Such innovations will meet the methodological criteria of training precision action during exertion and stress as core survival competencies.

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