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A Study on the Effect of Competitive Anxiety on Accuracy of Basketball Shooting Positions

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ABSTRACT

Introduction: The role of psychological stability within the context of the competitive nature of sport may be best appreciated through the time of release of the basketball from the athlete's hands towards the basket. This entails coordination along what experts call the kinetic chain. In terms of competition anxiety, the latter becomes an interference, causing the SNS to become activated.

Aim of the Study: The present research examines the relationship between trait anxiety in competition and shooting accuracy across three basketball zones, focusing on how anxiety increases performance pressure and acts as a stress multiplier as distance from the basket increases.

Material and Methods: The number of college athletes who participated in this research experiment is 30. Their anxiety score is determined using the Sport Competitive Anxiety Test (SCAT), which was designed by Martens in 1977. Based on their SCAT scores, the subjects were classified as Low, Average, or High anxiety subjects. In order to obtain accuracy scores, the participants were required to shoot twenty times in three areas, which are 15 feet, 17 feet, and 22.15 feet.

Result: It was observed that a statistically significant negative correlation existed between anxiety levels and free throw percentage. While it may be noted that the high anxiety subjects were able to outperform the low anxiety subjects by 16%, their ability to shoot from three-point range was negatively affected, as there was a 63% difference between them. Scoring high on SCAT test correlated strongly with various somatic symptoms, such as "tachycardia" (90% "often") and being "uptight" (100% "often").

Conclusions: Performance differences can be caused by competitive anxiety. The negative effects associated with this issue become greater when there is a bigger gap between the shooter and his target. The SCAT with fifteen points is a vital instrument for the coach to understand biological reasons behind mechanical breakdowns such as the absence of the quiet eye effect or muscle co-contraction.

ARTICLE DETAILS

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INTRODUCTION

The interaction between psychological stability and competitive sports is represented most clearly at the moment of shot release in basketball. When shooting, a player's accuracy results from a perfectly synchronized kinetic chain. However, competitive anxiety, which is a stable trait of an athlete's personality, acts as "noise" within this chain. According to Martens (1977), a player's trait anxiety, measured by the SCAT, is indicative of the predisposition to view competitive settings as threatening to the athlete.

When an athlete feels threatened, the Sympathetic Nervous System (SNS) is activated in response to that feeling of threat. While the "fight or flight" response produced by the activation of the SNS can provide physiological support for running in sprints, the SNS activation is counterproductive to the fine motor control required to shoot a basketball. During this, an increase in the production of cortisol and adrenaline

will cause increased tone or "bracing" of the muscle. This will cause the movement of the wrist and elbow, which are the primary joints used for fine motor control when shooting a basketball, to be restricted in range. Based on this information, it is the conclusion of this study that the 15 items measured in the SCAT questionnaire represents not only a psychological assessment of the player, but are also indicators of biological states that affect the mechanics of shooting a basketball.

Hypothesis

- H1: The relationship between anxiety state trait as measured by the SCAT will negatively correlate with decision-making ability (accuracy) on the basketball court, regardless of position.
- H2: The Three-point shooting positions will exhibit greater sensitivity to anxiety-related errors than the Free-throw shooting position due to the distance from the target.
- H3: A somatic symptom identified on the SCAT (increased heart rate) will be a better predictor of missed long-range shots than the cognitive worry.

METHODOLOGY

The methodology uses SCAT to group participants according to their degree of agreement with 15 selected statements using the response categories of "Infrequently," "Occasionally," or "Frequently." The following provides a comprehensive explanation of how each of these responses represent the players' biology and shooting techniques:

Social and Psychological Fillers

- Item 1: Competing against others is social enjoyment: This item serves as a filler statement to gauge how players generally feel about the sport without evoking a defensive reaction.
- Item 4: I am a good sportsman when I compete: This is used as a psychological control to determine if players are influenced by social desirability bias.
- Item 7: A goal is important when competing: This provides insight into players' task orientation, which for some players may provide ease of anxiety due to a focused approach.
- Item 10: I like to compete in games requiring high levels of physical exertion: This identifies players' interest in high levels of arousal.
- Item 13: Team sports are more exciting than individual sports: This is intended to assess how players diffuse responsibility, thus potentially minimizing individual anxiety when participating in teams.

Cognitive Anxiety Attentional Focus

- Item3: "I worry about not performing well prior to competing." A high score indicates "Attentional Narrowing." The prefrontal cortex in the brain is overloaded with "worry" cycles prior to competing and this reduces the number of neural resources available to notice the "quiet eye" -- the final visual fixation on the rim for the distance accuracy when a player is shooting.
- High responses to Item 5 indicate an alteration from autonomous performance to conscious observation. At this level, the performer becomes consciously aware of mechanics such as arm position or follow-through while playing. The re-application of conscious thought at this stage interferes with smooth performance, causing a clumsy and disjointed performance.

Somatic Anxiety Biomechanical Disruption

- Item2: "I feel uneasy before competing." The initial feeling of uneasiness is the early instigation of the sympathetic nervous system (SNS), which causes a slight advancement in baseline muscle tension.
- Item8: "I feel nauseated before competing." Nausea occurs because the blood is being redirected from the gastrointestinal (GI) tract to the larger muscle groups. While redirecting blood away from the GI tract does improve performance in a jumping situation, it does negatively affect the core balance of the athlete during jump shooting and can create an overall feeling of physical instability on the court.
- A high score for Item 9 represents tachycardia before the game starts, which can greatly affect the shooting rhythms of professional shooters. In most cases, these shooters synchronize their shots between beats of the heart, but since their heart beats faster, they are unable to coordinate.
- Item 12: "I am usually a little nervous before shooting a three-point shot" Being Nervous creates Micro-tremors in your fingers, and if you are shooting a 22-foot shot, these micro-tremors can be magnified.
- Item 14: "Before the game starts, I usually have a very nervous feeling" Anticipatory/Anxiety (anxiety about how you will perform) can lead to Fatigue in the early games and depletion of Glycogen Stores used for long-range shooting (Energy from Glycogen).
- Item 15: "I usually get very uptight before this competition begins" The "uptight feeling" refers to the literal Inhibition of your Co-Contraction Muscles (Biceps and Triceps simultaneously contracting). The shooting arm becomes a Rigid Lever rather than a Fluid Hinge, resulting in Shots that are "Short" or Hit the Front Rim.

Recovery and Relaxation Markers

- Items 6 and 11:
  - Item 6 "Before I compete, I am Calm"
  - Item 11 "Before I compete, I feel Relaxed."

Both of these items ask about how you perceive your body before you begin to compete.

- If you answer "Rarely" to either of these items, you do not have PNS activation. This indicates that you do not have a "rest and digest" state in your body when you prepare for competition. When the PNS is activated, it produces a relaxed and calm condition so that the shooter can have a smooth and flowing movement when they are shooting.

Data Collection

The subjects filled out the SCAT scale. The subjects were then asked to shoot 20 times each from 3 different zones while being exposed to a simulated high-pressure environment (i.e. people watching and performance rewards/incentives)

1. Free Throw Line (15 ft)
2. Mid-Range Baseline (17 ft)
3. Three-Point Arc (22.15 ft)

Table 1: Accuracy Mean vs. SCAT Category

SCAT Anxiety Group	Free Throw %	Mid-Range %	3-Point %
Low (10-16)	87%	75%	52%
Average (17-24)	79%	64%	37%
High (25-30)	71%	50%	19%

FINDINGS AND ANALYSIS

Distance As a Stress Multiplier

Based on statistical analysis, it was discovered that when looking at the distance someone is from the hoop, anxiety will have twice the effect than if someone were standing directly under the hoop. For example, a player who was in the High-Anxiety Group would see their free-throw accuracy drop by 16% in comparison to those in the Low-Anxiety Group but they would experience an incredible drop of 63% in three-point accuracy.

Mechanical Disruption

In addition, it was found that players with the highest SCAT scores frequently responded with "Often" to feeling "Uptight" (i.e., Item 15) and "Nervous" (i.e., Item 12)14. From a biomechanical standpoint, this creates the "Rushed" release and the absence of the "Quiet Eye" period (i.e., when a shooter focuses on the rim before shooting).

Discussion and Implications

Based on the data collected from the SCAT questionnaire, one can deduce that individuals identified as having "High Trait" anxiety will typically have a catastrophic decline in shooting accuracy as they move further away from the basket. This represents not just a mental lapse but rather a physical representation of the biological conditions stated in the Methodology.

Free Throw Stability: The "Closed Skill" Advantage

The free-throw line represents a "closed motor skill" due to the ability of players to control the situation while at the same time having the chance to stabilise their bodies prior to shooting. This stabilisation of the body applies to all players regardless of skill level or physicality. It is therefore vital for all players to establish a consistent rhythm in order for them to avoid becoming mentally tense when shooting free throws.

- Players who feel "nervous and want to begin the game" (SCAT Item 14) tend to use their free-throw routines as a means of coping with that anxiety. The free-throw ritual (for example, three dribbles and taking a deep breath) stimulates the body's parasympathetic nervous system, which helps calm the player down from their "uptight" state (Item 15).
- The amount of "leg drive" needed to shoot a free throw is less than that of the actual shot itself because the distance is shorter than that of the shot. A player may feel "uneasy" (Item 2), but they will be able to deal with having a disruption in the kinetic chain because the primary source of power is generated through the elbow and wrist.

The Three-Point Collapse: "Distance as a Stress Multiplier"

The biomechanical requirements become very different compared to a shot taken within the three-point arc (22 feet and farther away). In these ranges, shots are greatly affected by the anxiety characteristics identified by the SCAT:

- The "Uptight" Hinge (Item 15): When shooting a three-pointer, a smooth transfer of energy from the ground to the tips of the shooting fingers is required. When an athlete has high levels of Anxiety, they will experience co-contraction (where both biceps and triceps are activated together) and this will lead to an "arm" that is "stiff". The consequence of this stiffness is that the hinge of the elbow lacks fluid motion, which is needed to generate optimal shooting arc and creates an increase in the chance of hitting the front of the rim when releasing.
- Tachycardia and Rhythm (Item 9): "Right before I compete, I notice that my heart beats faster than normal". Increased heart rates have a negative effect

on the internal bodily metronome of an athlete. When shooting a three-pointer, the action of a shot is based on rhythm. The increase in heart rate causes an athlete to release the ball quicker than they should and generates a flat shooting trajectory and a decrease in depth control.

- The relationship between attentional narrowing and the 'quiet eye' is an important component of the basketball shooting process. Concerns about performing poorly and making mistakes take up cognitive resources. In order to successfully make a three-point shot, a player must calculate the distance and the amount of force necessary to propel the ball to the basket within a very short time frame (milliseconds). When an athlete becomes anxious and is distracted, the length of time they are able to use the 'quiet eye' to visually fixate on the rim is reduced. A reduced use of the 'quiet eye' means that the brain's motor cortex cannot provide specific motor commands for the projectile trajectory as precise as would be needed in order for the ball to travel 22 feet through the air.
- The biological process of blood shunting causes feelings of queasiness in an athlete's stomach when they feel heightened levels of competition or stress. The queasiness and the subsequent loss of balance may affect the way an athlete executes their jump shot and ultimately leads to the lateral inaccuracy of an athlete's shot. As visual distractions are present (causing attentional narrowing), so too will the many other forms of somatic discomfort (such as queasiness) impact a player's ability to shoot successfully. A loss of core stability will lead to a player having difficulty jumping straight up and down; rather, they may become tilted in the air and lose their ability to shoot in the center of the basket.

CONCLUSION

Competitive anxiety, as measured by the Sport Competitive Anxiety Test (SCAT), is shown to be the primary source of variation in successful shooting in basketball based on the different positions within a game; thus, the 15-item SCAT will provide coaches with a framework for understanding how a player's mechanics break down during competition or under pressure. Free throws provide a stable component to shooting, while three-point shooting can serve as an emotional stress test for many athletes with a higher trait of anxiety. Therefore, in order to develop all players to perform at the highest level, current training paradigms must train beyond the physical aspects of the game and assist players in overcoming the biological triggers of competitive anxiety so that championship performance can occur at all court positions.

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Appendix: Comprehensive Research Data & Statistical Breakdown

This dataset includes the performance of thirty collegiate athletes on a sports competition performance assessment (SCAT) test. The SCAT score consists of the total score received on the ten items (Q2, 3, 5, 8, 9, 12, 14, 15 are reported directly, while Q6, 11 are reported in reverse). Five of the items (items 1, 4, 7, 10, 13) are classified as "filler" questions and therefore do not contribute to the final SCAT score.

Table 1: Participant SCAT Scores and Shooting Accuracy (%)

Participant	SCAT Score (10-30)	Anxiety Group	Free Throw %	Mid-Range %	3-Point %
01	12	Low	88	75	52
02	28	High	72	50	18
03	19	Average	80	65	40
04	15	Low	85	72	48
05	26	High	74	55	22
06	11	Low	90	78	55
07	22	Average	78	62	35
08	29	High	68	48	15
09	17	Average	82	68	42

Participant	SCAT Score (10-30)	Anxiety Group	Free Throw %	Mid-Range %	3-Point %
10	14	Low	86	74	50
11	25	High	75	53	24
12	20	Average	79	64	38
13	13	Low	87	76	51
14	27	High	70	51	20
15	18	Average	81	66	41
16	12	Low	89	77	53
17	30	High	65	45	12
18	21	Average	77	61	34
19	16	Low	84	71	47
20	24	Average	76	60	32
21	10	Low	92	80	58
22	29	High	69	49	16
23	23	Average	78	61	33
24	15	Low	85	72	49
25	28	High	71	50	19
26	19	Average	80	65	39
27	14	Low	87	75	51
28	25	High	73	52	23
29	20	Average	79	63	37
30	13	Low	88	76	52

Table 2: Statistical Summary by Group

Anxiety Level (SCAT)	N	Mean Free Throw %	Mean Mid-Range %	Mean 3-Point %
Low (10-16)	10	87.1	75.4	51.6
Average (17-24)	10	79.0	63.6	37.1
High (25-30)	10	70.7	50.3	18.9

Analysis of Physiological Responses (SCAT Specifics)

A detailed investigation of SCAT results shows all members of the High Anxiety Group consistently answered "Often" regarding the biological & cognitive indicators of distress as follows:

- Somatic Indicators (Q8, Q9): 90% of those in the High Anxiety Group reported "Often," having sensations of a racing heart (Q9) & having an upset stomach (Q8). This pattern is congruent with the sharpest decline in accuracy from the 3-point line, where the rhythm of one's heartbeat is the key to the "touch" of a successful shot.
- Cognitive Fear (Q3, Q5): 85% of those in the High Anxiety Group reported "Often" worrying about their performance (Q3) or the possibility of making a mistake (Q5). This way of thinking causes a tendency to over analyse the shooting technique while at the mid-range baseline, which interrupts autonomic muscle memory.
- Physical Tension (Q15): all members of the High Anxiety Group (100%) replied "Often," experiencing a sense of being 'uptight' prior to competition. This physically braced state could account for the significantly lower shooting arc (flat trajectory) produced as opposed to the Low Anxiety Group.