Effects of Standard Autogenic Training on Psychophysiological Responses in Elite Bowlers Prior to Competition

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Introduction

Sports and athletics create special opportunities for the study of the feelings of the athletes in various sporting events [3, 5, 22]. Anxiety is a negative emotion that affects perceptions in sport competitions, and this leads to majority of athletes to consider anxiety to be debilitating towards performance, which may result in decreases in performance [18]. Components of anxiety include fear, anger, increased heart and perspiration rate, trembling, and being mentally off balance, which may result in decreases in performance directly involved with the autonomic nervous system creating arousal [27].

Increased recognition of the detrimental effects excessive anxiety can have on athletic performance has prompted the development of a number of anxiety management packages. Autogenic Training is based on passive concentration of bodily perceptions (e.g. heaviness and warmth of arms, legs, and abdomen, rhythm of breath; and heartbeat) and increased feelings of well-being [12]. The Standard Autogenic Training technique, developed by Johannes Schultz [13] consists of six standard exercises:

1. The first exercise aims at muscular relaxation by repetition of a verbal formula, ‘my right arm is heavy’, emphasizing heaviness.
2. Subsequent passive concentration is focused on feeling warm, initiated by the instruction ‘My right arm is warm’.
3. Followed by cardiac activity using the formula ‘My heartbeat is calm and regular’.
4. Then follows passive concentration on the respiratory mechanism with the formula ‘It breathes me’.
5. Then on warmth in the abdominal region with ‘My solar plexus is warm’ and
6. Finally on coolness in the cranial region with ‘My forehead is cool’.

It usually takes 8 weeks to learn the technique, and home practice of the exercises at least three times daily is encouraged [13].

Autogenic Training is frequently applied in group settings. Clinical evidence and evidence from many other controlled studies demonstrates that the group setting is as well appropriate [21]. The effectiveness of Autogenic Training on the stress response is two-fold: Autogenic Training produces a switch from sympathetic (fight/flight) dominance to parasympathetic dominance with increased activity of the rest/digest, relaxation/restorative system [5]. Once the excesses of stress are removed, whatever the cause, the individual is better equipped to address other aspects of themselves.
Biochemical stress reactions evolved for short duration survival. These included increased heart rate, blood pressure, ventilation, and fatty acid metabolism, with vasodilation, decreased gastric movement, alteration in body temperature, and increased muscle strength [20]. Biofeedback measures bodily only responses associated with anxiety, and by feeding back the information via computer, help us become aware of how you are responding to stress; learn to create the physiological conditions that support more positive mental states.

Skin temperature (TEMP) is measured by sensors placed on the ring fingers. The temperature modality indicates the contraction of the smooth muscles surrounding the blood vessels, which determines how much blood reaches the fingertips. When these muscles are contracted (tense), the temperature is cooler because less blood reaches the fingers. Skin Conductance (SCL) is a measure of eccrine (sweat) gland activity. Most people are familiar with having cold, clammy hands under stressful circumstances, such as meeting new people or having to perform before an audience. The coldness comes from constriction of the smooth muscles surrounding the blood vessels (measured by hand temperature), while the dampness is caused by eccrine gland activity. The eccrine glands secrete a salty solution in response to emotional and stress stimuli. Heart Rate (HR) is measured in beats per minute. Faster heart rates are often caused by stress; our hearts may race and pound when we are afraid. Other kinds of stress, such as depression, may result in lower heart rates. To measure heart rate, we place a sensor on a finger to detect each beat of the heart.

Unlike other sport sciences, sport psychology can suffer from the lack of objectively measurable parameters. With technological advances, decreasing costs and equipment size, along with the ease of use of biofeedback devices make the accurate assessment of the effectiveness of special mental skills strategies easier to measure and monitor over time. The physiological response to stress and anxiety, is conceptualized as an individual’s psychological and physiological autonomic system activation varying on a continuum from deep sleep to extreme excitement [10]. Anxiety assessment in research and clinical work are predominantly derived from retrospective self-report. Problems with exclusive use of self-report in the measurement of anxiety have led a number of authors to advocate the utility of physiological measures of anxiety [17, 26]. Physiological measures are recommended because they are objective and, with advances in ambulatory techniques, they can be used continuously in real-world settings [16].

Most psychophysiological research investigating the link between anxiety and physiology has been conducted in the laboratory where it is easier to monitor and induce anxiety with a minimum of confounding variables. The often-cited concern about this laboratory research is its ecological validity and the generalizability of artificially inducing anxiety in an unnatural environment [26]. When anxiety is measured as it occurs naturally in a real-life setting, it is more representative of that experienced by individuals in their day to day lives Wilhelm & Roth [26] especially during sport competition.

The main aim of this study was to investigate the effectiveness of Standard Autogenic Training on psychophysiological responses between pre and post intervention in elite bowlers prior to competition on the training and competition venues, these are the real-life setting for the bowlers, it will be more representatives the nature of anxiety prior to competition.
Methods

Participants
Eight Malaysian elite bowlers (two females and six males), aged 17-20 years, with a mean age of 18.63 (SD= 0.92) years had international experience in international bowling competitions recruited to participate in this study. All participants were under the training program of National Sport Council of Malaysia. They were provided written informed consent to undertake this research and were obtained an institutional ethics committee approved the procedures of this study.

Measurement
The Biofeedback 2000 x-pert Schuhfried, multi-module was employed in this study. The Biofeedback 2000 x-pert Schuhfried Gmbh system provides feedback of physiological parameters. Sensors record the signals non-invasively from the skin surface. In the various radio modules these sensor signals are filtered, amplified, digitalized and transmitted via a cordless Bluetooth connection to a computer. The digitalized data was then processes by the Biofeedback 2000 x-pert software and displayed diagrammatically on the screen. It provides immediate feedback from their biodata or biosignature while undergoing training.

![Figure 1: Biofeedback 2000 x-pert system](image)

Procedure
The nature of this study was explained to the participants, and they were asked to sign an informed-consent form. Baseline measures of physiological measures were obtained on-site during training session 8 weeks prior to official international competition.

The intervention used in this study was the Standard Autogenic Training. It usually takes 8 weeks to learn the technique, and home practice of the exercises is encouraged [13]. All the 8 weeks training sessions were carried out at the meeting room of training venue, and it were assisted by the Sport Psychologist from National Sport Institute of Malaysia. The intervention was carried out twice a week, 30 minutes/session for 8 weeks before their sport skill/technical training. After completion of the 8 weeks Standard Autogenic Training, the participants were assessed again on the physiological measures one day prior to competition at the competition venue.

All data points were screened and epochs containing artefacts were excluded. All data points for Skin Temperature (TEMP), Skin Conductance (SCL) and Heart Rate (HR) were aggregated for each minute. Data were inspected for outliers by the SPSS outlier analysis procedure.
Results

Table 1: Comparison between Pre-Post Interventions on Psychophysiological Measures to Standard Autogenic Training

<table>
<thead>
<tr>
<th>Psychophysiological Measures</th>
<th>Mean Pre Intervention</th>
<th>SD Pre Intervention</th>
<th>Mean Post Intervention</th>
<th>SD Post Intervention</th>
<th>t</th>
<th>Sig. (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Temperature (TEMP)</td>
<td>29.19</td>
<td>2.9032.37</td>
<td>0.96</td>
<td>-4.09</td>
<td>.005</td>
<td></td>
</tr>
<tr>
<td>Heart Rate (HR)</td>
<td>81.16</td>
<td>15.3972.50</td>
<td>12.74</td>
<td>2.97</td>
<td>.021</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

The focus of this study was an investigation of the effects of Standard Autogenic Training on Psychophysiological Measures between baseline and post-intervention prior to competition in Malaysia Elite Bowlers. The findings from the present study indicate that pre-intervention Skin Temperature (TEMP) was significantly lower (M=29.19, SD= 2.90) than the post-intervention (M=32.37, SD=0.96), t(7)= -4.09, p<.05 one day prior to competition at the competition venue. The effectiveness of Standard Autogenic Training intervention was confirmed in this study. Consistent with previous research Tremayne & Barry [24], the present study also found that Autogenic Training was associated with increased finger temperature during the final session of relaxation. More blood reaches the fingers, the temperature is warmer. It showed that the subjects practiced Standard Autogenic Training was able to increased vasodilation, muscle is more relaxed and it caused more blood reached the fingers associated increased of finger temperature.

The significant differences found for the mean scores of Skin Conductance (SCL) between pre-intervention (M=12.43, SD=4.92) and post-intervention (M=9.13, SD=2.83) one day prior to competition, t(7)=4.99, p<.05. Again, in the current study, there were a significant higher of Heart Rate (HR) during pre-intervention (M=81.16, SD=15.39) than the post-intervention (M=72.50, SD=12.74), t(7)=2.97, p<.05. We observed post-intervention decrement in SCL and HR one day prior to competition at the competition venue. Significant lower of SCL during post-intervention one day prior to competition indicates the subjects were managed to control their stress level, caused reduce of the eccrine gland activity which response to emotional and stress stimuli. The findings of this study confirmed that Standard Autogenic Training is a simple, powerful, and effective method which brings about a profound level of relaxation and relief from negative effects of stress [12].

The current findings were consistent with a meta-analysis indicated that Autogenic Training has positive effect on clinical outcomes in patients with anxiety disorders, as well as coronary heart disease [21]. Moreover, it highlighted that in addition to the modulations of mood, cognitive processing, and quality of life, autogenic training has significant physiological effects [21].

Previous studies on elite sportswomen showed lower HR as in another study with men Boutcher et al [2] and higher SCL during and after the task. Elite sportsmen showed lower HR and SCL, which indicates that SCL responses to psychological stressors.
SCL has been used as one of the more widely employed indexes in evaluating psychological processes such as emotion, arousal and attention. Hence, elite sportswomen are more reactive to a psychological stressor and present a worse recuperation from stress than physically active subjects. Their results support the idea that SCL could also be used as a good index to discern the responses to laboratory stressors in women who differ in the way in which practice physical activity.

Current findings similar to previous finding that speech-related anxiety increases in SCL [8]. Giessen & McGlynn [9] and with the view that SCL is an index of autonomic arousal [1, 23, 24, 25]. As arousal is thought to differentially engage emotional over problem-focused processes, this is consistent with research demonstrating that high speech-anxious individuals tend to engage in emotion-focused rather than problem focused information processing [4, 7].

In fact, it seems that all psychophysiological measures in this study were significantly different between pre-intervention and post-intervention one day prior to competition was likely to be due to the athletes’ expertise. Theoretically, the stress level of the athletes should be higher during this time with lower temperature, higher skin conductance and higher heart rate, but the results revealed the opposite. One possible explanation is the elite athletes may have employed other psychological techniques such as a combination of cognitive confidence management strategies [11, 15], including mental rehearsal, thought stopping, and positive self-talk, and arousal-based strategies (e.g., to enhance or diminish arousal intensity), to protect against the potential debilitating effects of stressful situations such as competition. Moreover, these positive subjective interpretations are also possibly due to their experience of sport competition at this level, which is associated with the familiarity/unfamiliarity of the situation to the individual [6, 14].

From the findings of this study, psychophysiological measures have the potential to supplement and eventually replace subjective measures in determining stress and anxiety level of elite athletes. With the advances in equipment over the last decade, the use of various psychophysiological methods, particularly Biofeedback has become more feasible in operational settings. Advances in technology have rapidly moved the use of psychophysiological measurement equipment from the controlled laboratory environment to the chaotic realm of operational reality. Psychophysiological assessment methods can be used to quantify anxiety symptoms in the initial assessment of the problem and to monitor treatment success in terms of the reversal of psychophysiological symptoms [26].

Furthermore, the study of anxiety levels during training periods would be very interesting. Training periods may be extremely stressful for coaches as well as athletes, since coaches experience daily concerns regarding the load and intensity of the training program, the adaptations of the athlete and a number of peripheral issues that affect the athlete’s training and subsequent performance, such as stress and anxiety during training and competition. The contributions of studies such as this are to provide a broader measurement approach in the study of competitive stress. Adopting psychophysiological approaches which are minimally invasive to the sportsperson will ensure that stress responses can be measured more frequently and therefore in close proximity to performance.

Although the present study provides some evidence for psychophysiological measures in the pre-competition period, there are some limitations that need to be addressed. First, this study is concerned with elite bowlers only and so further studies need to be conducted on different competitors and events. For example, this could include the experience level of the elite athlete, influences how individuals interpret competitive emotions [14].

In conclusion, from the results of this study, we state that Standard Autogenic Training appears to be a useful procedure to induce significant physiological changes in elite bowlers prior to competition.

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Practical Application for Coaches

From the results of the current study, we would like to recommend that coaches can utilize the Standard Autogenic Training to control the anxiety level of the athletes prior to competition. Also, the findings of this study suggest that psychophysiological measures have the potential to supplement and eventually replace subjective measures in determining stress and anxiety level of elite athletes.

Aplikasi Praktikal untuk Jurulatih

Hasil dari kajian ini, kami ingin mencadangkan supaya jurulatih mula menggunakan Standard Autogenic Training untuk mengawal tahap kebimbangan atlet sebelum pertandingan. Tambahan pula, hasil kajian ini juga mencadangkan bahawa pengukuran psikofisiologikal ada kemungkinan untuk membantu dan mungkin mengantikan pengukuran subjektif dalam menentukan tahap stres dan kebimbangan untuk atlet elit.

References