Do You Feel What I Feel? The Developmental Psychobiosocial States in Competitive Badminton

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ABSTRACT

Emotions affect the way elite athletes respond to competition and distractions during competitive play. Elite athletes who can identify and regulate emotion during completion increase their chances of consistently high quality of play.

Coaches can benefit from knowing how their players respond emotionally during a match. This study examines the extent to which psychobiosocial states of elite badminton players vary by age. Thirty elite badminton players in three age group (lower juniors, upper juniors, and adults) will reflect on their psychobiosocial states, rating their feelings on eight components of psychobiosocial states (Bortoli et al., 2008) during their self-identified best and worst performances during competitive tournaments. Descriptive statistics will examine the strength of emotions on each item, and linear regression will test differences between the three groups. The result indicated the theoretical implications from both ZOF model and developmental psychology. Not all psychobiosocial states were perceived similarly across all age players. Developmental differences were found in the perception of the psychobiosocial states in competitive badminton matches. The goal of the study is assisting coaches in understanding athlete's developmental proper zone of optimal function (ZOF) to help them cope with changing psychobiosocial states during matches.

LITERATURE REVIEW

Emotion plays a significant role in athletic competitions, particularly for elite athletes (Deci, 1980). There are high profile examples that provide a rare glimpse into the impact of emotions on temper and the level of play. One only needs to recall John McEnroe in the 1970's or Serena Williams in the contemporary era to bear witness to how emotions can positively or negatively impact competitive play. The power of emotions in sports was well defined by Deci (1980),

> *An emotion is a reaction to a stimulus event (either actual or imagined). It involves a change in the viscera and musculature if the person is experiencing subjectively in characteristics ways, is expressed through such means as facial changes and action tendencies, and may mediate and energize subsequent behaviors (p.85).*

Performance in competitive settings is not only a product of long training sessions, natural proclivities but also influenced by split-second responses of mental status. For the past three decades, sports psychologists have explored relationships between anxiety and performance, emotions and performance. More recently, the relationship between multiple components has emerged under a single concept. The numerous complicated components of mental status include eight psychobiosocial states: Emotion, motivation, Bodily reaction, Operation, communication, Volition, motor behavior and cognition (Bortoli, Bertollo & Robazza 2009). At the same time, there are developmental differences in all of these psychobiosocial states. Split-second mental status is influenced by the psychobiosocial states. However, the effect and interaction within and

among the states depend on the development of the athlete, typically in age ranges. For example, junior athletes are more likely to perceive and react differently from their adult counterparts.

Psychobiosocial States

In 2000, Hanin defined the Individual Zone of Optimal Function (IZOF) as "a focus on describing, predicting, explaining, and regulating performance-related psychobiosocial states affecting individual and team activity" (p.66). He stated that the eight psychobiosocial states presented as either positive or negative could have the optimal or dysfunctional influence on performance. It is the relative intensity that the athlete experiences in Psychobiosocial states that creates a personalized IZOF. Understanding players IZOF can predict future performance and coaches can assist players in regulating components to optimize future performance. If coaches and players can better regulate mental status, it is hypothesized that they can improve their performance. Failure to regulate mental status can result in persistent under-performance in highly competitive matches.

Extended from the in-depth individual zone of optimal function (IZOF) profiles (Hanin, 2000; Hanin & Ekkikakis, 2014), researchers developed a standardized tool to assess athletes' states during competitions. Eight psychobiosocial states are contributing to athletes' performances in various sports contexts: cognitive, emotional, motivational, operational, bodily, volitional, motor behavioral, and communicative (Bortoli, Bertollo, & Robazza, 2009 ; Bortoli, Bertollo, Comani, & Robazza, 2011; Robazza, Bertollo, Ruiz, & Bortoli, 2016).

The specific definitions for each of the psychobiosocial states include (Middleton, 2016; p.10)

Cognitive: the attentional processing component of the state. Included in this is an athlete's ability to concentrate, be alert and the ability to allocate the necessary attention and mental effort to relevant stimuli within the situation.

Emotional: within this conceptualization, is seen as an organized psychosociological experience which reflects the past, ongoing, and/or anticipation of future person-environment interactions. These interactions can occur through the predominance of a person over the environment, a balance between the person and environment, or the predominance of the environment over the person.

Motivational: the goal-setting phase of the motivational state which comes before any action conducted towards the goal. This component reflects people's appraisal of a situation, its benefits and drawbacks, and all process which occur before taking action.

Operational: an athlete's perception of how effective their actions or task execution is at that moment in time.

Bodily: biological and/or psychophysiological components of one's state which are often related to emotion. This may be reflected in general feelings such as tension, relaxation, and/or feelings associated with specific body parts.

Volitional: the second component of the motivational process. This component of the state is reflected in a person's actions towards attaining a goal, including any self-regulation involved in initiating and maintaining actions until the goal has been attained.

Motor behavioral: this component refers to an athlete's perception of their coordination and movement.

Communicative: reflected in interactions between the athlete and those around them in relation to the execution of a task. (p.10)

Developmental differences in 8 Psychobiosocial states

The impact of Psychobiosocial-performance happens in real time and can change in a mere matter of seconds during competition. For athletes to effectively regulate their multiple states, they have to quickly identify the states they are trying to regulate. This ability differs by age and by psychobiosocial component. All eight psychobiosocial states are developmental significant.

Cognition:

According to Piaget, there are three different stages of human development -- childhood: concrete operational; adolescent: formal operational; adulthood: post-formal operational. Children and adolescent's attention spans and strategies used to reason and make sense of the world differ from adults. They move from very concrete thinking toward abstract thinking, and

eventually, most adults proceed toward more dialectic thinking strategies. These differences are partially explained by the unique ways in which the different developmental groups process various stimuli presenting to them. McMorris recommended that coaches should consider Piagetian stages when teaching decision making and problem-solving in sports training (McMorris, 1999; McMorris et al., 2006). With more advanced stage in cognitive development, older adolescents exhibited more efficient strategies comparing to their younger counterparts in multiple sports competition settings (Micklewright et al., 2012; French & McPherson, 1999).

Emotion:

Emotional changes experience in childhood generally differs from emotions in adolescence and adulthood. As children get older and have more experiences to deal with, s/he can make a more effective prediction of how they react when the environment provides a stimulus (Barrett, 2017). Neuroscientists suggest that brain structures play an essential role in human emotions. Brain regions, the amygdala, and the prefrontal cortex contribute to human emotion perception and regulation. The amygdala is a unique brain structure which links the rapid emotion process of incoming stimuli, emotional behaviors, fear conditioning, reward, and nociception (Zald, 2003). The amygdala attributes emotional valence and arousal to external stimuli and integrates adaptive responses to stressors, and it grows dramatically during adolescence. For example, an intense, fast pace rally (stimuli) might be emotionally perceived stronger to the adolescent than to the children and to the adults.

A slower development in the prefrontal cortex cannot catch the rapid growth of the amygdala, which makes the emotional regulation a difficult task in adolescent years. Stanly Hall (1904)

characterized adolescents as a time of "storm and strife." A longitudinal study of football (soccer) player found that the emotional, interactive process of "reaction and regulation" were differed between adolescents and either children or adults (Piero, Saxbe & Margolin 2016). Older adolescent athletes showed more effective coping stressors skills than younger teenagers (Reeves, Nicholls and Mckenna, 2009).

Motivation

Several motivation theories have been examined in a variety of sports contexts. Harter's competence motivation theory stated that people are motivated to achieve competence in different content areas. The more people reach an achievement, the higher the perception of mastery they will report. The mastery competence drives athletes toward higher goals. Coaching style also influences athletes' perception of their ability and subsequently their motivation to perform. Coaching with mastery goals in mind predicts greater ability perception, motivation, and fun (Weiss, Amprpse & Wilko, 2009). Achievement goal theory suggests that an athlete has to balance his/her competence, cognitive level, strength, and emotion to achieve a goal.

Younger athletes possess different types of motivation and goals when compared to adolescents and adults. For example, social status was shown as a more important motivation factor for adolescents than children and adults. Also, there are health/fitness differences between age groups (Brodkin & Weiss, 1990), with younger athletes valuing coaches/parents opinions more than adolescents and adults.

Motor Behavioral:

Speed, agility, explosive strength, shoulder strength, and muscular endurance are the most critical five motor components in badminton performance (Tiwarl, Rai and Srinet, 2011). Players in different age group exhibit different motor abilities due to physical development. Therefore some levels of performance are correlated to physical development status (Filipcic, Pisk, & Filipcic, 2010). Based on these development differences, specific neuromuscular training is suggested to accommodate the training for children and adolescent (Zemkova, and Hamar, 2018).

Volition:

Bandura (1995) indicated that individuals cannot always rely on the external environment to provide accurate feedback and guidance during learning experiences. Learners need to develop an internal process of self-observation, self-judgment, and evaluation. This form of self-regulation system is essential in various sports and physical education contexts (Zimmerman, 1989, 1998). Experienced athletes exhibit higher levels of self-regulation. They organize skills more efficiently, exhibit better recall, and are more accurate in anticipating stimuli (Starkes et al. 1994; McPherson, 1993). A longitudinal study showed that that gaining experiences in sports contexts could present better self-regulation in emotion controls in other aspects of life (Oaten and Cheng, 2006). Zimmerman's Cyclical phases model of self-regulation learning (See Figure 1) presented the connections between performances, motivation and strategy selections

(Zimmerman, 2000). The model and its interactions have been shown to exist in both classroom and sports contexts (Cleary & Zimmerman, 2001; Zimmerman, 1998).

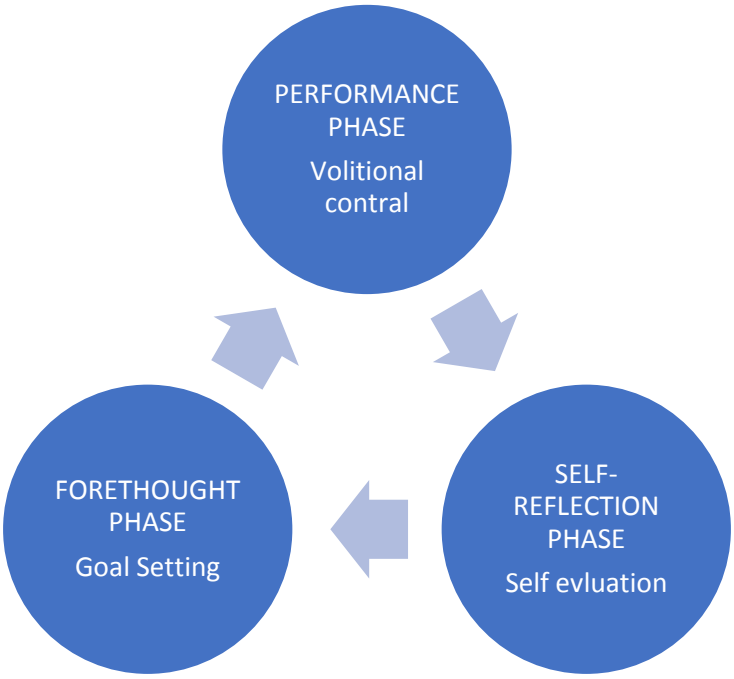

Figure 1. Cyclical phases model of self-regulation learning (Zimmerman, 2000).

Bodily:

Physical differences play a significant role in sports performances. Height, body mass, aerobic power, muscular strength, endurance, and speed provide performance advantages in most sports (Malina, Bouchard, Bar-Or 2004), including badminton. A year of maturation, especially during puberty, can be associated with performance differences (Cobley, Baker, Wattie, and McKenna,

2009). Between the ages of 12 to adulthood, male players can grow as much as three feet and gain 15-65 lbs (7-30 kg) with a mean gain of 52.2 lbs. Body mass and body fat level dramatically changed from pre-teen to adulthood years (Chahar, 2014; Stang and Story, 2005**).**

Operations:

Badminton involves a high volume of cognitive exchanges, rapid problem solving, and instant crisis identification. Hicheur et al. (2017) defined the cognitive-motor performance (CMP) " .. as the capacity to rapidly use sensory information and transfer it into efficient motor output, determines performance in almost all sports." (p. 2/20)

Atkinson and Shiffrin (1968) created a model to link information processes to memory, known as 'The multi-store model and memory', describes memory in terms of the information flow through a system. Memory involves three stages: sensory register (how stimulus presents, attention span), short-term/working memory (interpretation of the stimulus, capacity of the incoming information), and long-term memory (strategies, experiences, coding). Age was a strong predictor in memory recall during the performance. Research shows that CMP increases with increasing age. (Hicheur et al. 2017; Touron, & Hertzog, 2004).

Research Question

1. Which Psychobiosocial states are most intense during player's recall of their best and worst badminton performance?
2. Are there developmental differences in the psychobiosocial states?

METHOD

Participants

The sample for the study included high performing male athletes who participated in sanctioned USA Badminton section tournaments during the 2017 season. The sample consisted of thirty juniors age between the ages of 10 to 12 (Mean=11.36, SD= .66); thirty late adolescents between the ages of 16 to 19 (Mean =16.9, SD=.84); thirty-one adults between the ages of 23 to 45 (Mean= 32.5, SD=7.93). Table 1 shows the ages, years of competition, and the amount of training per year by the category.

Table 1. Age, years of competition, and average practice per week.

	Junior	**Adolescents**	**Adults**
Age	Mean=11.36 SD= .66	Mean =16.9 SD= .84	Mean= 32.5 SD= 7.93
Years Competing	M=3.4 SD= 1.40	M=6.48 SD= 2.14	M=14.96 SD=5.95
Training per week	M=4.24 SD=2.4	M=3.65 SD=1.49	M=3.72 SD=1.80

Measure

The PBS-ST Scale (Bortoli & Robazza, 2008, 2011) contains functional and dysfunctional descriptors of competitive play and has been used in priors studies with several types of sports.

The items on the survey were provided to badminton players' psychobiosocial experiences in competitive tournaments. Each Psychobiosocial State (PBS-ST) included two or three descriptors. Items include: Emotional (affective functional, emotional-affective dysfunctional, anxiety functional, anxiety dysfunctional, anger functional, anger dysfunctional), Cognitive (functional, dysfunctional), Motor behavior (functional, dysfunctional), Motivational (functional, dysfunctional), Volitional (functional, dysfunctional), Operational)functional, dysfunctional), Bodily (functional, dysfunctional), and Communication (functional, dysfunctional). The items were randomly ordered. Each participant responded to both their Best Performance (Appendix A) and Worst Performance (Appendix B). The participants were asked to respond to each PBS-ST on a 5-point Likert scale, ranging from zero (not at all) to four (very much). Demographic information was solicited at the beginning of the survey (Appendix A).

Procedure

There were two phases in the implementation of measures for this study. First, Loyola University Maryland Institutional Review Board (IRB) reviewed the proposal and assessed the rights and protections of the participants, especially there are minors involved in this study. Second, the instrument was administered to the participants in various tournaments in the U.S. during the 2017-2018 season.

Then the survey was administrated to athletes between October 2017 to July 2018. The primary investigator (PI) collected the player lists before major USAB sanctioned tournaments. ThePI provided a brief introduction to qualified participants. The introduction included a description of

the purpose of the study and the rights of participants. Athletes who agreed to complete the study indicated their consent to participate. Both parents and players under the age of 18 signed consent and assent forms respectively. There was no time limit to complete the survey and the time to complete varied between 10- 25 mins. Participants received two racquet grips as a modest thank you for completing the survey.

Data Analysis

Mean scores on all items were calculated for the three age groups. One- way ANOVAs were performed to examine the identify similarities and differences the mean differences in PBS-STs for each age group, and to analyze the PBS-ST impact on best and worst performance across age groups.

RESULTS

Research question 1: Which Psychobiosocial states are most intense during player's recall of their best and worst badminton performance?

Best Performance

The five most chosen psychobiosocial states for junior athletes during their best performances are motor behavior functional, volitional functional, bodily functional, cognitive functional and motivational functional.

Table 2. Five Psychobiosocial States for Best Performance -- Juniors

	Psychobiosocial States	Descriptors
1	**Motor behavioral functional** (M=3.50, SD=.68)	Relaxed, coordinated, powerful, effortless-movement
2	**Volitional functional** (M=3.43, SD=.57)	Purposeful, determined, persistent, decisive
3	**Bodily functional** (M=3.4, Sd= .72)	Vigorous, energetic, physically-charged
4	**Cognitive functional** (M=3.23, SD= .77)	Alert, focused, attentive
5	**Motivational functional** (M=3.23, Sd= .77)	Motivated, committed, inspired

The five most chosen states for adolescents are bodily functional, cognitive functional, emotional anger functional, volitional functional, and motivational functional.

Table 3. Five Psychobiosocial States for Best Performance (Adolescents)

	Psychobiosocial States	Descriptors
1	**Bodily functional** (M=3.63, SD=.49)	Vigorous, energetic, physically-charged
2	**Cognitive functional** (M=3.56, SD=.50)	Alert, focused, attentive
3	**Emotional Anger functional** (M=3.55, SD=.57)	Fighting spirit, fierce, aggressive
4	**Volitional functional** (M=3.26, SD=1.04)	Purposeful, determined, persistent, decisive
5	**Motivational functional** (M=3.13, Sd=1.10)	Motivated, committed, inspired

The five most chosen states for adults are cognitive functional, motivational functional, emotional affection functional, volitional functional, and bodily functional.

Table 4. Five Psychobiosocial States for Best Performance (Adults)

	Psychobiosocial States	Descriptors
1	**Cognitive functional** (M=3.41, Sd=.67)	Alert, focused, attentive
2	**Motivation functional** (M=3.32, SD=)	Motivated, committed, inspired
3	**Emotional Affection** functional (M=3.32, SD=)	Enthusiastic, confident, carefree, joyful
4	**Volitional functional** (M=3.29, SD=.78)	Purposeful, determined, persistent, decisive

5	**Bodily functional** (M=3.22, SD=.99)	Vigorous, energetic, physically-charged

Worst Performance

The five most chosen states for junior athletes during their worst performance are bodily dysfunctional, operational dysfunctional, motor behavioral dysfunctional, emotional anxiety functional, emotional anger dysfunctional, and emotional anger dysfunctional.

Table 5. Five Psychobiosocial States for Best Performance (Juniors)

	Psychobiosocial States	Descriptors
1	**Bodily dysfunctional** (M=3.06, SD=1.14)	Physically-tense, jittery, tired, exhausted
2	**Operational dysfunctional** (M=3.06, SD=.94)	Ineffective, unskilled, unreliable, inconsistent-task
3	**Motor behavioral dysfunctional** (M=3.06, SD=1.01)	Sluggish, clumsy, uncoordinated, powerless-movement
4	**Emotional anxiety functional** (M=2.87, SD=1.04)	Nervous, restless, discontented, dissatisfied
5	**Emotional Anger dysfunctional** (M=2.80, SD=1.18)	Furious, resentful, irritated, annoyed

The five most chosen states for adolescents during are: Emotional anger dysfunctional, cognitive dysfunctional, motor behavioral dysfunctional, operational dysfunctional, and bodily dysfunctional.

Table 6. Five Psychobiosocial States for Best Performance (Adolescents)

	Psychobiosocial States	Descriptors
1	**Emotional anger dysfunctional** (M=3.1, SD=1.01)	Furious, resentful, irritated, annoyed
2	**Cognitive dysfunctional** (M=3.03, SD=.808)	Distracted overloaded, doubtful, confused
3	**Motor behavioral dysfunctional** (M=2.93, SD=1.11)	Sluggish, clumsy, uncoordinated, powerless-movement
4	**Operational dysfunctional** (M=2.86, Sd=1.07)	Ineffective, unskilled, unreliable, inconsistent-task
5	**Bodily dysfunctional** (M=2.72, Sd=1.16)	Physically-tense, jittery, tired, exhausted

The five most chosen states for adults are Emotional anxiety functional, cognitive dysfunctional motor behavioral dysfunctional, operational dysfunctional, and bodily dysfunctional.

Table 7. Five Psychobiosocial States for Best Performance (Adults)

	Psychobiosocial States	Descriptors
1	**Emotional anxiety functional** (M=3.09, SD=1.01)	Nervous, restless, discontented, dissatisfied
2	**Cognitive dysfunctional** (M=3.03, SD=.87)	Distracted overloaded, doubtful, confused
3	**Motor behavioral dysfunctional** (M=2.93, SD=.99)	Sluggish, clumsy, uncoordinated, powerless-movement
4	**Operational dysfunctional** (M=2.84, Sd=.87)	Ineffective, unskilled, unreliable, inconsistent-task
5	**Bodily dysfunctional** (M=2.58, Sd=1.31)	Physically-tense, jittery, tired, exhausted

Research question 2: Are there development differences in the psychobiosocial states PBS-ST?

Best Performance

The analysis found significant differences among the three age groups in their PBS-ST during their best performance ($F(2,86)= 5.6$, $p<.01$). The PBS-ST total in Table 8 revealed that juniors experience a higher intensity of their psychobiosocial states during their best performance than their adolescent and adult counterparts.

Differences between juniors/adolescents ($p<.05$) and junior/adults ($P<.01$) are found, but there are no differences between adolescents/adults' PBS-ST in their best performance.

Table 8. PBS-ST Total Score on Best Performance.

	N	PBS-ST total	SD
Junior	30	42.63*/**	8.15
Adolescents	28	36.85	6.53
Adults	31	35.74	5.42

Note: *p<.05, **p<.01

For more advanced analysis, ANOVA is adapted to examine each states impact on performances across each group. There is age significant differences in 9 states: emotional anger functional ($F=3.23$, $p=.044$), cognitive dysfunctional ($F=4.37$, $p=.015$), communicative dysfunctional ($F=6.17$, $p=.003$), emotional anxiety functional ($F=5.02$, $p=.009$), motor behavioral dysfunctional ($F=15.79$, $p=.000$), motivational dysfunctional ($F=15.36$, $p=.000$), emotional anxiety

dysfunctional (F=8.87, p=.000). emotional anger dysfunctional (F=8.49, p=.000), volitional dysfunctional (F=4.9, p=.009). Table 9 shows the means, standard deviations, indicates the means of 9 items.

Table 9. Differences on Psychobiosocial Stages by Age

PBS-ST	Junior	Adolescent	Adult
Emotional Anger Functional *	M=2.96 SD=1.06	M=3.55 SD=.57	M=3.19 SD=.94
Cognitive Dysfunctional*	M=1.06 SD= 1.12	M=.83 SD=.94	M=.61 SD=.11
Communitive dysfunctional **	M=.93 SD=.98	M=.60 SD=.81	M=.22 SD=.08
Emotional Anxiety functional **	M=1.46 SD=1.45	M=.93 SD=1.17	M=51 SD=.81
Motor behavioral dysfunctional**	M=1.13 SD=.77	M=.16 SD=.37	M=.38 SD=.84
Motivational dysfunctional **	M=.63 SD=.66	M=.06 SD=.25	M=.09 SD=.30
Emotional anxiety dysfunctional **	M=1.73 SD=1.63	M=.60 SD=.72	M=.67 SD=.94
Emotional Anger dysfunctional**	M=1.43 SD=1.33	M=.80 SD=.80	M=.38 SD=.76
Volitional dysfunctional **	M=.73 SD=1.14	M=.10 SD=.30	M=.32 SD=.70

*p < . 05; **p< .01

Although there are age differences found in 9 PBS-STs, the distributions are not consistent. Most of the differences are found In between juniors/adolescents and junior/adults. Juniors and adolescents report significantly different scores on Emotional Anger functional and Volitional Dysfunctional during their perceived best performance. Juniors stated stronger feelings toward

cognitive dysfunctional, communicative dysfunctional, emotional anxiety functional, and emotional anger dysfunctional when compared with adult players. Juniors consistently receive higher intensity toward motor behavioral dysfunctional, motivational dysfunctional, and emotional anxiety dysfunctional when compared to both adolescents and adults.

Worst Performance

There were is no significant differences found in PBS-ST when comparing their perceived worst performance across the three age groups.

Table 10. PBS-ST Total Score on Worst Performance

	N	PBS-ST total	SD
Junior	30	36.90	4.41
Adolescents	28	34.42	7.21
Adults	26	35.42	6.54

While there were no overall differences, some differences emerged by functional component. For example, there were significant differences in cognitive functional, communicative functional, volitional functional, and emotional anger dysfunctional.

Table 11. Differences on Psychobiosocial Stages by Age

PBS-ST	Junior	Adolescent	Adult
Cognitive functional	M=1.6** SD=.93	M=.60** SD=.78	M=1.07 SD=.84

Communicative functional	M=..93 SD=.82	M=.42* SD=.69	M=1.0* SD=.97
Volitional functional	M=1.36 SD=.92	M=.57 SD=.87	M=1.23**/* SD=.86
Emotional anger dysfunctional	M=2.8 SD=1.18	M=.3.10 SD=1.03	M=1.76** SD=1.17

*p < . 05; **p< .01

Juniors showed higher levels of intensity in cognitive functional and volitional functional compared to adolescents, but no differences when compared to adults. Adolescents and adults felt differently in communicative functional and volitional functional. Compared to their adult counterparts, juniors and adolescents reported stronger feeling in emotional anger dysfunctional during their perceived worst performance.

DISCUSSION

The purpose of this study was to identify the intensity of psychobiosocial states in competitive badminton following athlete's perceived best and worse performance at the tournament. The study also examined the extent to which development, as defined by age group, impacts athletes' perceptions of play. The study showed that emotion is a key element that affects performance in competitive sports. While this comes as no surprise to those who compete or watch competitive sports, the study reveals a deeper level of understanding of seven additional psychobiosocial states that play a crucial role in the competition. The eight psychobiosocial states and athlete's ability to manage each will influence a player's perceived quality of performance. The study showed that developmental differences emerged on the total scale score on the instrument as well as within and between various components. Adult participants experienced a higher perception of cognitive and emotional during both their best and worst performance.

On the other hand, juniors' consistently perceived stronger intensity in physical actions (bodily and motor behavioral) during both best and worst performance. During their worst performance, physical and negative emotional anxiety dominated juniors' competition states. They were less likely to focus on cognition functions such as information processing and strategic planning. The findings echo the classic Piaget's theory stages of cognitive development that suggests that children under 12 in the stage of concrete operational experiences with the environment focus on what they see in front of them. Physical reaction is the most direct and immediate reaction available to them. Adolescents, especially older adolescents, and adults entering higher levels of cognition possess the ability to think more abstractly. This was consistent with their intensity on more cognitive than physical reactions.

Unlike their junior and adult counterparts, a unique emotion emerged in adolescents. Adolescent emotions were presented more consistently with anger rather than anxiety/affection in both best and worst performances. Anger was presented as both facilitator and damage during the competitions. Besides the dysfunctional emotion anger, adolescent and adult participants experienced very similar psychobiosocial states during their worst performance.

Similarities across age groups emerged primarily in their reflection on their worst performances. They all reported experiencing negative physical reactions. Secondly, drive (motivation and volition) were in the top 5 states in their best performances. Third, the top 5 states reported in best performances were functional, while the top 5 states in worst performances were dysfunctional. This finding echoed the ZOF model, where positive states facilitate the performances, and negative states work against athlete's performance.

During their reported best performance, junior participants experienced significantly stronger feelings, with higher overall total scores. Compared with juniors, later adolescents are similar to adults in their cognitive, emotional and physical developments. The intensity of states was more pronounced in juniors, with higher mean scores on 8 out of 20 states as compared to their adults and adolescent counterparts. Adult and adolescent did not experience as many dysfunctional states as junior participants did. The one exception was in the emotional anger function. Adolescents counted on the emotional anger, such as fighting, spirit, fierce, aggressive, to facilitate their performance more than juniors and adults reported. Adolescent's perception of the matches, especially the perception of emotional anger, echoed Stanly Hall (1904) characterized

adolescents as a time of "storm and strife". Anger presented as drive and damage to adolescents performance (Arnett, 2006). Third, when compared to adolescents and adults, juniors experienced a higher level of anxiety (both functional or dysfunctional) during their best performance. This is most likely associated with their lack of experiences or immaterial brain development, causing inaccurate evaluation during intensive competition. The uncertainty produces elevated anxiety during the match. It is reasonable to find a higher anxiety level in juniors than in adolescents and adults, especially in the winning condition. When evaluating their worst performance, Participants' overall psychobiosocial states were found similar across all age groups. Adolescents presented less intensive mental states compared to juniors and adults participants in cognitive, communication, and volition. Negative emotional anger was found in juniors and adolescents mental states, but this had less impact on adults' performance.

Implications for Theory and Practice

The findings from this study have theoretical implications from both ZOF model and developmental psychology. Not all psychobiosocial states were perceived similarly across all age players. Developmental differences were found in the perception of the psychobiosocial states in competitive badminton matches. Psychobiosocial states presented in juniors are not as distinguished as adolescents and adult players. Junior players perceived more dysfunctional psychobiosocial states during their best performance and some functional states during the worst matches.

To promote the most optimal results during a match in a split second, coaches need to understand that players of different ages perceive and experience various psychobiosocial states differently during matches. With unique physical, cognitive and psychosocial developmental status, a player experiences three distinguished stages within their own growth. Coaches need to be sensitive to a player's development status during matches and more importantly during training when coaches can discuss how the player is reacting in real time to a particular drill or practice match. The conversation can help the player articulate their psychobiosocial state, in their own words, and the coach can help them with strategies to identify and react the next time the player feels a similar way. They can create signs and talking points that can translate to how to coach during competitive badminton matches. This is particularly salient when players express anger. During the interval, coaches can refocus the player and give them reminders of how to regulate the feelings during the next several points. Additionally, after matches, coaches can ask players to reflect on how they reacted to various states during the match. To move in this direction, additional coach training and reading of development and psychobiosocial states should be considered as part of coach credentialing.

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