

Temperamental Predictive Factors for Success in Korean Professional Baseball Players

Kyoung Doo Kang¹, Doug Hyun Han²✉, James C. Hannon¹, Morgan S. Hall¹, and Jae Won Choi³

¹Department of Exercise and Sport Science, University of Utah, Salt Lake City, UT, USA

²Department of Psychiatry, Chung-Ang University Hospital, Seoul, Republic of Korea

³Department of Sports, Chung-Ang University, Anseong, Republic of Korea

Objective In this five-year cohort study, we hypothesize that factors of temperament and character in professional baseball players predict the speed of obtaining success and the quality of success as well as anxiety control.

Methods Participants included 120 male rookie players from the Korea Baseball Organization (KBO) and 107 male non-players with no history of playing baseball. The personality/characters and state/trait anxieties of participants were assessed with the Temperament and Character Inventory (TCI) and Spielberg's State-Trait Anxiety Inventory-Y (STAI-Y). Over the duration of five years, all the players were subsequently classified into either a success group (major leaguers) or a non-success group (non-major leaguers), depending on their status in the professional baseball league in Korea.

Results The players in the group of starters had higher novelty seeking (NS) scores than those of non-starters. The reward dependence (RD) scores of the success group were higher than those of the non-success group. The state anxiety scores in the starter group were negatively correlated with NS scores. The state and trait anxieties in the non-success group were positively correlated with RD scores.

Conclusion The results of this study suggest that predictive temperamental factors for success in baseball players include traits of novelty seeking and reward dependence.

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Key Words Korean professional baseball players, Temperament and Character Inventory, Success, Anxiety.

INTRODUCTION

Several studies report that only exceptionally talented people break through the very narrow gates of becoming professional major league baseball players.¹⁻⁵ Exceptional talent requires highly coordinated units, including physical, emotional, and mental components in individuals. Accordingly, a player who seeks maximum performance in a professional sports arena should possess a mental-emotional structure which enhances this physical development.⁶ In baseball, which is a competitive sport, a player's level of performance is determined by a complex set of variables involving certain characteristics of the play-

er such as fitness, technique (coordination abilities and kinetic skillfulness), tactics (cognitive and planning abilities), and psychological factors (personality and level of motivation).⁷ In particular, the personalities and characters of athletes have been regarded as crucial determinants of the athlete's performance and goals.⁸ Numerous studies suggest that personality is considered to be an important predictor of long-term success in professional sports.^{6,9-12} In addition, factors of personality and character are thought to reflect genetic and epigenetic influences on behaviors and predictable behaviors of individuals in response to perceived world and social stimuli.¹³⁻¹⁵ Consequently, the concept of an individual's "traits" describes the predisposition of individuals to react and to behave predictably to a variety of occurrences in their lives.^{16,17} Vanden Auweele et al.¹⁸ assert that the predictable behavior functionality of athletes is particularly important in sports psychology, thereby justifying studies that attempt to distinguish athletes from control populations. In addition, personality and sports have been further linked in the context of a player's position on a team and their level of performance in the game.¹⁵ In this context

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✉ Correspondence: Doug Hyun Han, MD, PhD

Department of Psychiatry, Chung-Ang University Hospital, 102 Heukseok-ro, Dongjak-gu, Seoul 06973, Republic of Korea

Tel: +82-2-6299-3132, Fax: +82-2-6299-1114, E-mail: hduk@yahoo.com

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of differences between professional athletes and control groups, athletes display higher emotional stability, extroversion and self-confidence, as well as higher mental resistance, in comparison to non-athletes. Previous studies report a positive correlation between sports performance, extroversion and conscientiousness, and a negative correlation between sports performance and neuroticism.^{11,19}

Anxiety is known to be correlated with personality—most prominently with neuroticism—but also with extroversion.^{2,20} A Temperament and Character Inventory (TCI)-based study by Parmigiani et al.²¹ indicates that among players of competitive sports, winners with higher levels of novelty seeking traits and lower levels of harm avoidance traits score significantly lower than losers on trait anxiety scales, as measured by the State-Trait Anxiety Inventory-Y (STAI-Y). Athletes with a greater number of anxious traits have a higher probability of losing to the competition. Several clinical studies report that high levels of harm avoidance characterize individuals with high levels of shyness and anxiety, and these traits are particularly evident in anxiety disorders.^{22,23}

The TCI measures four higher-order personality dimensions, as defined by.^{24,25} The temperament traits are defined in terms of individual differences in associative learning in response to areas of novelty, danger or punishment, and reward.²⁵ The inventory is used to analyze the temperamental traits (and associated behaviors) of novelty seeking (NS), harm avoidance (HA), reward dependence (RD) and persistence. Generally, the risk-taking and exploratory features of NS are often highlighted. However, there are also several factors of NS that may be described as self-regulatory skills, such as limiting impulsivity.²⁶ On the other hand, harm avoidance is related to the inhibition or cessation of behaviors, passive avoidance, shyness of strangers, and rapid fatigability. Reward dependence (RD) is related to the maintenance or continuation of ongoing behaviors, sentimentality, and social attachment. In previous sports-based personality studies, Han et al.²⁷ compared groups of highly-skilled athletes and less-skilled athletes in a sample of high school students. The authors²⁷ reported that the levels of novelty seeking and reward dependence traits of the highly-skilled athletes were higher than the levels of these traits among the less-skilled athletes, but that the differences in novelty seeking traits were not statistically different between the groups. In a subsequent study comparing winners and losers, winners scored significantly higher than losers in the area of novelty seeking, while losers scored significantly higher than winners in areas of harm avoidance, reward dependence and persistence.²¹

In this five-year cohort study designed to investigate factors of temperament and character in professional baseball players predict the speed of obtaining success and the quality of suc-

cess (i.e., achieving major league status), as well as anxiety control among athletes.

METHODS

Participants

Participants included 120 rookie baseball players and 107 age-matched and sex-matched non-players who were all boys in department of sports science from Chung Ang University and were no history of playing baseball. From 2004 to 2014, we have observed the status and career of baseball players who were agreed to participate in current research. All the rookies were players in the Korea Baseball Organization (KBO) during one of five seasons: 2004, 2005, 2008, 2009, or 2010. Two professional KBO teams select 20–30 amateur players from high school and university baseball teams on an annual basis. Of 129 rookie players on the two professional baseball teams, 120 players agreed to participate in our survey. To collect data, we processed interview with each player when they participated in the their spring camps. In accordance with rookie draft reports published by the KBO, all the players were classified into two groups, including 21 higher-ranking players (the top 10% of drafted players) and 99 general players (the remaining 90% of players who were not ranked in the top 10% of each season's draft). Further classification involved a “starter” group (n=21), which included players who made the starting roster of a major league team during their rookie season, and a “non-starter” group (n=99), which included the players who failed to make the starting roster of a major league team during their rookie season. The “success” group (n=35) included players with 396 plate appearances or 128 innings over 128 major league games in each season (full time major leager) during the full five seasons in our study (2014, Korean Baseball Rules, Korea Baseball Organization). The “non-success” group (n=85) included players who failed to make the roster of any major league team throughout the five seasons. The protocol of this study was approved by the Chung Ang University Institutional Review Board. Also, written informed consent was provided by all the participating players.

Measures

Trait analysis

The Korean version of the Temperament and Character Inventory (TCI) was used for trait analysis.²⁸ The inventory consists of 240 items of true or false questions to evaluate four dimensions of temperament and three dimensions of character. The Cronbach's α and test-retest reliability of TCI have been previously reported as 0.77 and 0.81, respectively.²⁸

Anxiety analysis

The Korean version of the State-Trait Anxiety Inventory-Y (STAI-KY) was used to estimate state and trait anxiety levels among participants.²⁹ This scale includes a total of 40 items, 20 of which describe trait anxieties, and 20 items that describe state anxieties. The Cronbach's α of STAI-KY is 0.91 for state and 0.82 for trait anxieties.

Analysis and statistics

Demographic characteristics including age, years of participation in sports, years of education, and state/trait anxiety were analyzed with ANOVA. Draft ranking was analyzed with independent t-tests. Starter/Non-starter, success/Non-success, and positions were analyzed with chi-squared tests. The comparisons of TCI and state-trait anxieties were as follows. At first, TCI scores and anxiety scores between baseball players and general people were analyzed with ANCOVA tests, controlling for age and years of education. Second, TCI scores and anxiety scores between the higher-ranking players and general players were analyzed with ANCOVA tests, controlling for age, years of participation in sports, and years of education. Third, TCI scores and anxiety scores between the starter and non-starter groups of players were analyzed with ANCOVA tests, controlling for age, years of participation in sports, and years of education. Finally, TCI scores and anxiety

scores between the success and non-success groups were analyzed with ANCOVA tests, controlling for age, years of participation in sports, and years of education. In the comparison of demographic characteristics, statistical significance was set at two-tailed $p < 0.05$. In the comparison of TCI traits, statistical significance was set at two-tailed $p < 0.05/7$ (0.007). All analyses were conducted with the Statistical Package for the Social Sciences (SPSS) software package version 18.0.

RESULTS

Demographic characteristics

There were no significant differences in demographic variables between the players and non-players with regard to age, years of participating in sports, or years of education (Table 1). Also, there were no significant differences in demographic variables between the higher-ranking players and general players, starter and non-starter groups during the rookie season, and success and non-success groups over the course of five years (Table 1, 2, and 3).

Comparison of TCI scores and anxiety scores between professional baseball players and non-players

At a trend level, scores for traits of novelty seeking (18.08 ± 4.92 , $p = 0.23$), reward dependence (18.34 ± 3.78 , $p < 0.001$), per-

Table 1. Demographic characteristics in player and non-player

	Player (N=120)	Non-player (N=107)	t/p
Age	20.48 (2.42)	20.53 (1.11)	0.303/0.912
Sports/education years	10.50 (2.68)	10.99 (0.92)	1.804/0.872
State anxiety	36.01 (9.96)	38.84 (9.6)	2.177/0.872
Trait anxiety	38.51 (7.29)	41.30 (5.08)	3.305/0.001*

*statistically significant, means (SD)

Table 2. Demographic characteristics in high ranking players, general players, and general people

	High ranking players (N=21)	General players (N=99)	General people (N=107)	F, t
Age	19.76 (2.07)	20.63 (2.47)	20.56 (1.11)	F=1.87/0.157
Sports/education years	9.86 (1.93)	10.64 (2.8)	10.99 (0.92)	F= 2.91/0.057
Draft ranking	19.67 (21.85)	56.25 (28.76)	-	t=5.50/0.018*
State anxiety	28.67 (10.91)	37.56 (9.06)	30.22 (8.75)	F=19.744/<0.001*
Trait anxiety	36.38 (9.71)	38.96 (6.65)	41.3 (5.08)	F=6.949/0.001*

*statistically significant, means (SD)

Table 3. Demographic characteristics in starter and non-starter

	Starter (N=21)	Non-starter (N=99)	t/p
Age	19.76 (2.07)	20.64 (2.47)	1.51/0.049*
Sports/education years	9.86 (1.93)	10.64 (2.78)	1.21/0.051
Draft ranking	19.67 (21.85)	56.26 (28.76)	5.5/0.018*
State anxiety	28.66 (10.91)	37.56 (9.06)	3.94/0.503
Trait anxiety	36.38 (9.71)	38.96 (6.65)	1.48/0.005*

*statistically significant, means (SD)

sistence (6.01±1.43, p<0.001) and cooperativeness (30.38±5.55, p<0.001) in professional baseball players were higher than the scores for these traits in non-players (Table 4). The state and trait anxiety scores in professional baseball players were lower than these scores in non-players (F=4.74, p=0.03; F=10.92, p=0.001) (Table 4).

Comparison of TCI scores between higher-ranking players and general players

There was no statistical significance in differences of age, sports carrier, and years of education between higher-ranking players and general players. Of the higher-ranking players, 85.7% had experience on a starting roster during their rookie season, while 28.3% of general players had experience on a starting roster as rookies. Of the higher-ranking players, 54.3% had experience as full-time major leaguers (i.e., our definition of success), while 2.4% of general players had experience as full-time major leaguers during the full five years of this study (Table 1, 2, and 3). State anxiety scores in higher-ranking players were lower than these scores in general players and non-players (Table 1, 2, and 3).

Comparison of TCI and anxiety scores between the starter and non-starter groups

Among the player groups, the novelty seeking scores of the starter group were higher than those of the non-starter group (i.e., starter vs. non-starter: 22.67±4.81 vs. 17.11±4.39, p<0.001) (Table 5). The state anxiety scores of the starter group were lower than those of the non-starter group (F=15.52, p<0.001) (Table 5).

Comparison of TCI scores between the success and non-success groups

Among the player groups, scores for the trait of reward dependence were higher in the success group than those in the non-success group at a trend level (i.e., success vs. non-success: 19.66±3.15 vs. 17.8±3.9, p<0.01) (Table 6). The novelty seeking scores of the success group were higher than those of the non-success group (F=3.737, p=0.056) (Table 6).

Correlation of anxiety levels and scores of TCI

In all the athlete groups, trait anxieties were correlated with state anxieties (r=0.30; p<0.01). In the non-starter group, re-

Table 4. Comparison of Temperament and Character Inventory between players and non-players

		Players (N=120)	General people (N=107)	F	p
TCI	NS	18.08 (4.92)	19.77 (4.02)	5.278	0.023*
	HA	13.28 (5.82)	14.59 (4.97)	2.19	0.140
	RD	18.34 (3.78)	15.22 (3.21)	32.086	<0.001***
	P	6.01 (1.43)	4.82 (1.6)	26.371	<0.001***
	SD	23.19 (9.91)	22.52 (6.03)	0.931	0.336
	CO	30.38 (5.55)	27.89 (5.54)	12.813	<0.001***
	ST	15.21 (6.04)	15.87 (5.41)	0.097	0.756
STAI-Y	State ANX	36.01 (9.96)	38.84 (9.6)	4.739	0.031*
	Trait ANX	38.51 (7.29)	41.3 (5.08)	10.924	0.001***

*p<0.05, ***p<0.001, data are means (±SD). TCI: Temperament and Character Inventory, NS: novelty seeking, HA: harm avoidance, RD: reward dependence, P: persistence, SD: self-directedness, CO: cooperativeness, ST: self-transcendence, ANX: anxiety

Table 5. Comparison of Temperament and Character Inventory between starter and non-starter of players

		Starter (N=21)	Non-starter (N=99)	F	p
TCI	NS	22.67 (4.81)	17.11 (4.39)	21.223	<0.001*
	HA	13.05 (5.38)	13.33 (5.93)	0.102	0.75
	RD	19.43 (3.70)	18.11 (3.8)	3.652	0.059
	P	6 (1.38)	6.01 (1.45)	0.133	0.716
	SD	21.24 (10.81)	23.61 (9.72)	0.614	0.435
	CO	30.43 (5.23)	30.37 (5.65)	0.053	0.819
	ST	15.24 (4.41)	15.2 (6.36)	0.021	0.886
STAI-Y	State ANX	28.67 (10.9)	37.56 (9.06)	15.52	<0.001*
	Trait ANX	36.38 (9.71)	38.96 (6.65)	2.187	0.142

*p<0.001, data are means (±SD). TCI: Temperament and Character Inventory, NS: novelty seeking, HA: harm avoidance, RD: reward dependence, P: persistence, SD: self-directedness, CO: cooperativeness, ST: self-transcendence, ANX: anxiety

ward dependence scores were correlated with state anxiety scores ($r=0.30$; $p<0.01$) (Table 7). In the success group, novelty seeking scores were negatively correlated with state anxiety scores ($r=-0.34$; $p<0.05$). In the non-success group, reward dependence scores were correlated with both state and trait anxiety scores ($r=0.34$; $p<0.01$) (Table 7).

DISCUSSION

To the best of our knowledge, this is the first study to follow the careers of rookie players in two professional KBO baseball teams for a period of five years.

Not surprisingly, a greater number of higher-ranking players were registered on major league rosters in comparison to general players in each of their years as players in the professional baseball league in Korea. In addition, a greater number of

higher-ranking players were full-time major leaguers in comparison to general players. One intriguing result of this study, however, concerns our analysis of the temperament and characters of the athletes, which shows that starting players in the professional baseball league have higher levels of novelty seeking traits than non-starters. Novelty seeking is hypothesized to be a heritable tendency toward intense exhilaration or excitement in response to novel stimuli or cues for potential rewards.²⁵ As one factor of an individual's temperament, novelty seeking is correlated with extroversion.³⁰ Recent studies of extroversion in athletes report that professional athletes are more extroverted than average players of competitive sports.^{31,32} An athlete's level of extroversion can be improved with the achievement of goals and success in sporting activities.³³ In addition, individuals with higher novelty seeking traits are characterized by the ability to regulate a broad band of goal-seeking behaviors

Table 6. Comparison of Temperament and Character Inventory between groups of success and non-success

		Success group (N=35)	Non-success group (N=85)	F	p
TCI	NS	19.81 (5.23)	17.3 (4.64)	3.737	0.056
	HA	12.88 (5.91)	13.44 (5.81)	0.206	0.651
	RD	19.66 (3.15)	17.80 (3.92)	7.735	0.006*
	P	6.23 (1.26)	5.92 (1.53)	1.868	0.174
	SD	21.94 (10.9)	23.71 (9.52)	0.0520	0.821
	CO	31.03 (5.53)	30.11 (5.58)	0.814	0.369
	ST	13.97 (5.31)	15.71 (6.28)	2.343	0.129
STAI-Y	State anxiety	32.17 (10.87)	37.59 (9.16)	7.760	0.006*
	Trait anxiety	37.03 (8.16)	39.12 (6.87)	2.048	0.155

*statistically significant, data are means (\pm SD). TCI: Temperament and Character Inventory, NS: novelty seeking, HA: harm avoidance, RD: reward dependence, P: persistence, SD: self-directedness, CO: cooperativeness, ST: self-transcendence, STAI-Y: State and Trait Anxiety Inventory

Table 7. Correlation between anxiety levels and TCI

	All athlete (N=120)		Starter (N=21)		Non-starter (N=99)		Success (N=35)		Non-success (N=85)	
	State	Trait	State	Trait	State	Trait	State	Trait	State	Trait
State	-	0.30**	-	0.30	-	0.36**	-	0.14	-	0.40**
(r/p)	-	0.000	-	0.864	-	0.000	-	0.414	-	0.000
Trait	0.30**	-	0.30	-	0.36**	-	0.14	-	0.40**	-
(r/p)	0.000	-	0.864	-	0.000	-	0.414	-	0.000	-
NS	-0.15	0.03	-0.15	-0.04	0.03	0.002	-0.34*	-0.04	0.03	0.05
(r/p)	0.097	0.736	0.506	0.864	0.741	0.986	0.046	0.649	0.803	0.622
HA	0.72	0.18*	-0.22	-0.25	0.13	0.27**	-0.11	-0.04	0.15	0.27*
(r/p)	0.436	0.015	0.341	0.262	0.184	0.008	0.515	0.649	0.172	0.013
RD	0.13	0.13	-0.25	-0.32	0.30**	0.21*	-0.14	-0.25	0.34**	0.24*
(r/p)	0.137	0.480	0.283	0.152	0.002	0.042	0.414	0.142	0.001	0.03
P	0.01	-0.12	-0.04	-0.17	0.02	-0.11	-0.08	-0.19	0.08	-0.10
(r/p)	0.935	0.244	0.864	0.429	0.861	0.288	0.649	0.362	0.469	0.374

* $p<0.05$, ** $p<0.01$. TCI: Temperament and Character Inventory, State: state anxiety, Trait: trait anxiety, NS: novelty seeking, HA: harm avoidance, RD: reward dependence, P: persistence

and motivation, including positive affectivity, energy, and attention.³⁴ Interestingly, NS scores of the success group were negatively corrected with the state anxiety scores of these players in the current study. Individuals with higher NS scores are characterized as having hyperthymic temperaments in terms of extroversion, sociability, and activeness.³⁵ Doherty and Nugent³⁶ suggested that personal traits including sociability, extraversion, openness, and self-esteem were associated with academic success in medical school students. Therefore, NS scores may be an important temperamental indicator for the more rapid achievement of major leaguer title in Korean rookie baseball players.

Reward dependence scores of the success group were higher than those of the non-success group. Characteristics of individuals with high levels of reward dependence include persistence, industriousness, sensitivity to social cues and social support, as well as the ability to delay gratification with the expectation of eventually being rewarded.³⁷ A study by Cloninger et al.³⁰ suggests that the RD score represents the sensitivity of a person who is highly stimulated by social rewards. The work of Brock et al.³⁸ reports that a high ability to delay gratification involves persistence, conscientiousness, and endurance, which may influence emotions, motivations, and goal-directed behaviors under challenging circumstances. Therefore, RD may be associated with long-term success (major leaguer not at first season but second season after) in Korean rookie baseball players.

In the results of this study, reward dependence in the non-success group was correlated with state anxiety, while state anxiety was not associated with RD in the success group herein. Moreover, state anxiety in the success group was correlated with the NS scores of players. The meaning of correlation between RD and anxiety was associated with the success of players in current results.

Individuals with higher levels of reward dependence are characterized as being eager to please others, warmly sympathetic, and dependent on others.²⁵ A study by Robazza and Bortoli³⁹ report that non-elite athletes report higher levels of cognitive and somatic anxiety symptoms, and experience these symptoms as more debilitating than elite athletes do. Taken together, players in the non-success group may treat anxiety with the help of other people, while the players in the success group may treat anxiety with persistence, industriousness, and delay gratification with the expectation of eventually being rewarded.

There were several limitations in current study. First, due to the small number of subjects comprising our study, we are unable to generalize the results of the current research. The number of athletes in the success group was less than 30. Second, because this study does not assess the clinical characteristics associated with the personality traits herein, we are limited to speculation about them based on the conclusions of

previous studies.

Conclusions

Based on the results of the current research, predictive personality factors for successful careers in major league baseball are the traits of novelty seeking and reward dependence. Novelty seeking traits are associated with the rapid achievement of success, and RD traits are associated with long-term success among aspiring professional baseball players in Korea.

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