

Investigating Factors Associated With Mental Toughness Using The Psychological Performance Test Among Ghanaian Athletes.

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Abstract

This study aims to improve the research on mental toughness by investigating its interactions with the variables age, gender and experience (the amount a person has exercised his/her sport). A total of 43 participants (male = 19 and female = 24) of an age ranging from 18 to 40+ years, were included in this study. They successfully completed the Psychological Performance Inventory (PPI) in an online survey. Demographic data were also collected and interactions were analyzed with MANOVAs and ANOVAs. A significant effect of gender on mental toughness was observed ($F(7, 29) = 1.045, p = .041$, Pillai's Trace = .373, Partial Eta Squared = .373). However, due to missing significance in subsequent ANOVAs as well as a high correlation between two subscales within the PPI, a real effect of the variable is rejected. No significant effect of age or experience on mental toughness was found – neither in subcomponents of the PPI, nor in the total mental toughness scores. In this study, age, gender and experience did not influence mental toughness. These findings contradict with other studies while also corresponding with some researches. Further investigations are required to uniformly define mental toughness and its assessment in order to enable results to be compared with each other without limitations.

Keywords: Age, gender, experience, mental toughness, psychological performance

Introduction

Loehr (1986) indicated that coaches and athletes attribute at least 50% of success to psychological factors that are associated with mental toughness (MT). MT can be understood as having the natural or developed psychological edge that enables an athlete to be able to cope better than his/her opponents with the demands (e.g. competition or training) that affect the performer (Jones, 2002). In other words, MT refers to an athlete's psychological skills which are beneficial for his/her performance. The requirements to achieve top performance are extremely challenging and demand not only an exceptional physical condition but also the ability to overcome mental obstacles. On a high performing level, there is no room for mistakes, the line between a professional athlete and a champion

can be slim but just as important. Of course, this does not only apply to professional athletes; almost everyone has been under pressure in a sports context at some time or another. In the same way, almost everyone wants to perform at the best of his/her capabilities, no matter the degree of individual performance level. The majority of the athletes or sportsmen in Ghana had competitions at one point or another, where mental toughness plays a significant role. “The tougher athlete often prevails, and the difference between success and failure is often more easily, and perhaps more appropriately, attributable to psychological factors” (Golby et al., 2003).

Controversially, although mental toughness is classified as an important predictor of athletic success, there is still no clear definition or way of measuring MT. Equally unknown and sometimes contradictory are the factors that influence MT. As a matter of fact, it is probably one of the least understood constructs in the field of sports psychology (Jones, 2002). The purpose of this study was to investigate the impact of possible factors on MT in order to gain a better understanding of possible influencing variables on mental toughness.

Theoretical Background

Regardless of its frequent use, MT remains to be subjective (Liew et al. 2019) and can be interpreted as multidimensional (Antony & Antony, 2016; Crust & Azadi, 2010; Middleton et al., 2004). MT is most often associated with unshakeable self-belief, the ability to rebound after failures, persistence or refusal to quit, coping effectively with adversity and pressure and retaining concentration in the face of many potential distractions” (Antony & Antony, 2016). As of now, there are many subtle different definitions of MT, which all try to specify the essence of the theoretical construct in their own way. Loehr (1986) proposed that mentally tough athletes remain energized, relaxed and calm during times of pressure, because they possess the ability to increase their flow of positive energy during challenging obstacles. Loehr (1986) proposed that MT consists of seven subcategories, which all are relevant in their own way for the total MT of an athlete. Another definition attempt was done by Middleton et al. (2004) – “Mental toughness is defined as an unshakeable perseverance and conviction towards some goal despite pressure or adversity.” In addition, they did not subdivide MT into seven categories but into twelve instead within two main categories: Toughness strategies, meaning factors that include actions, and toughness orientation, which contain factors that are personal characteristics. Yet another determination was established by Clough et al. (2002) who used the “four C’s”-model. They suggest that central elements of mental toughness are composed by confidence, challenge, commitment and control. Along with their four components, they define MT as follows: “Mentally tough individuals tend to be sociable and outgoing; as they are able to remain calm and relaxed, they are competitive in many situations and have lower anxiety levels than others. With a high sense of self belief and an unshakeable faith that they can control their own destiny, these individuals can remain relatively unaffected by competition or adversity.” Summarily, there seems to be a certain agreement about the universal term of MT as each of these definitions differ in their specificity (narrow or broad) and focus (processes or outcomes), but generally still outline the same idea. The question whether there is a distinct construct underlying MT, which is applicable for any circumstance and sport, still remains to be answered (Bull et al., 2005).

Just as there are many different approaches to defining MT, there are also various methods and measurement tools that can be used to analyze MT. Loehr (1986) was one of the first scientists who designed a sport specific instrument for measuring mental toughness for competitive athletes (Nicholls et al., 2008). His previously mentioned concept of mental toughness in seven subdivisions led to the development of the Psychological Performance Inventory (PPI) - a questionnaire to assess MT. While this instrument was a very important

step towards the exploration of MT, the PPI has also been criticized quite a few times (Golby et al., 2007; Middleton et al., 2004). On the one hand the test was found to have a questionable low factorial validity, while on the other hand there was a rather low empirical basis of Loehr's theoretical approach. Golby et al. (2007) thus suggested a successor for the PPI, the Alternative Psychological Performance Inventory (PPI-A), which is assumingly psychometrically stronger than the original questionnaire. However, while the PPI-A does seem to have a better model fit than the PPI, inadequate levels of internal consistency have been reported (Gucciardi, 2012). Despite the criticism, both questionnaires are still relevant today, however, these flaws must be taken into consideration when using these questionnaires. Besides, additional questionnaires among others have been developed to investigate MT, including the Mental Toughness Inventory (MTI) (Middleton et al., 2011) and the Mental Toughness Questionnaire (MTQ48) (Clough et al., 2002).

The relevance of mental toughness for an athlete in a sports competition is an essential element of success. Gould et al. (2002) studied the psychological characteristics of Olympic champions by interviewing them ($n = 10$), their coaches ($n = 10$) and a parent, guardian or significant other ($n = 10$). As a result, they determined MT as a highly relevant factor related to performance enhancement skills. In another study Gould et al. (1987) referred to mental toughness as the most relevant aspect for success in wrestling as 82% of coaches rated MT as the most important psychological attribute. A relationship between MT and physical endurance could be demonstrated by Crust and Clough (2005). In their study, a significant correlation of .34 was observed between the time a relative weight could be held suspended and the scores for overall MT measured by the MTQ48. As almost every sport has a competitive dimension to it, an overall higher MT appears to be a relevant advantage for the competitor. Consequently, the development of a strong MT is therefore of great interest to coaches in terms of maximizing their athletes' performance.

Emphasizing the weight of mental toughness, the concept does not only have a significant effect on the performance of athletes but also has an impact on other aspects of life. As summarized in Crust and Azadi's (2010) paper "Mental toughness and athletes' use of psychological strategies", people with a high MT have an increased pain tolerance and rehabilitation from injury, a greater use of coping strategies, an increased potential to bounce back after negative feedback and even lower ratings of exertion while under a demanding cycle task. They also question whether MT is more stable and can be seen as a trait or if it's a rather dynamic variable that can be affected by training. This uncertainty combined with the need to gain a better understanding of MT can be addressed by investigating the effect of different factors on MT, because little is yet known about possible variables which may be related to MT (Nicholls et al., 2009).

A relevant variable which is associated with the expression of MT is age. Marchant et al. (2009) found in a study with 522 participants living in the UK, that MT is related to age, meaning that the overall MT is improved when people get older. More specifically, older persons had higher values in the subscales of the MTQ48 in commitment, emotional control and life control. They thus suggest that "increased exposure to significant life events may have a positive developmental effect on mental toughness". Weiss and Raedeke (2004) have shown that evidence from developmental sport psychology research has found old and younger adults differ in their social influences, emotional responses, self-perceptions, motivations and self-regulation with regard to sport and exercise participation. Thus, Nicholls et al. (2009) suggest that age could be a relevant influence as a developing factor on MT. They designed a study with a total of 677 British participants (male $n = 454$; female $n = 223$) - aged between 15 and 58 years and executing their sport on different levels of performance - to investigate the effect of achievement level, gender, age, experience and sport type difference on MT by using the MTQ48. Increasing age and years of experience

indicated a higher total MT score as well as enhanced values for the subcategories “challenge”, “commitment” and “life control”.

The just mentioned years of experience of a sport that has been practiced by a person is another predictor associated with MT. The variable age and experience are closely related (Nicholls et al. 2009); however, they still have to be distinguished from each other. Just because a person is older doesn't inherently mean that they have also been playing the sport for a longer period of time. After all, the person could also have started with the sport at a later age or a participant with a lot of experience could still be relatively young if he/she started at an early age. According to Connaughton et al. (2008), who interviewed seven Olympic athletes regarding the development of mental toughness, competitive experience, which grows the longer an athlete engages in his or her sport, is a critical determinant for the growth of MT in athletes. Similarly, Buhrow et al. (2017) examined 102 college athletes and came to the conclusion that mental toughness develops over the years by “maximizing athletes’ opportunities and competition experiences.

Not only are further studies required for age and the athletes’ experience of sports in relation to MT, but also the effect of gender has to be continuously examined. Generally speaking, there seems to be a gender difference in favor of males having a higher MT than females (Nicholls et al., 2009; Newland et al., 2013). The previous mentioned research by Nicholls et al. (2009) found significant higher scores for males in total MT and in four subscales of the MTQ48, namely challenge, control of emotions, control of life and confidence. Another research paper, consisting of 197 American college basketball players, has also found significant gender differences using the PPI-A as a measurement tool for MT. Specifically, the males again had a higher MT than the females (Newland et al., 2013). However, contradictory results have been found by Kuan and Roy (2007). In their study no relevant gender differences regarding the athletes’ MT could be found among a total of 40 Wushu athletes in Malaysia using the PPI. Similar outcomes have also been reported by Buhrow et al. (2017), showing no sex differences in a group of 102 American college athletes from age 18 to 23. Particularly striking is the study conducted by Sanyal et al. (2017), which did report significant gender differences in Indian sports players aged between 16 to 21 ($n = 401$), however, this time the females “were found to be more focused, resilient and confident”. In result, there are already a few studies that have looked at the impact of gender on MT, but there still needs for additional research in order to fully comprehend the interactions of these variables (Sanyal et al., 2017).

In summary, there seems to be a measure about the effect of age and gender on mental toughness, although partly contradictory. Not as many studies can be found regarding the number of years a person exercises his/her sport and its contiguous effect. The present study aims to examine factors associated with mental toughness and to test the under listed hypotheses.

Research question and hypotheses

The present study addresses the following central question:

Which effect has age, gender and the amount of years a person has practiced his/her sport on the mental toughness components as well as on the total mental toughness of people who have been or currently are practicing at least one sport on a competitive level?

Based on the preliminary literature review, the following hypotheses are assumed:

- 1) The amount of years a person has practiced his/her sport has a positive effect on the mental toughness components as well as on the total mental toughness of people who have been or currently are practicing at least one sport on a competitive level.

- 2) Age has a positive effect on the mental toughness components as well as on the total mental toughness of people who have been or currently are practicing at least one sport on a competitive level.
- 3) Gender has a positive effect on the mental toughness components as well as on the total mental toughness of people who have been or currently are practicing at least one sport on a competitive level.

Materials and Methods

Participants

The descriptive survey design of the quantitative research approach was adopted for the study. The study targeted 53 sports performers who have been participating in sport for some time on a competitive level, however, only 43 of them successfully completed the survey. The participants' ages ranged from 18 to 40 years and above. Participants' ages were categorized as 18 – 25 ($n = 25$), 26 – 30 ($n = 13$), 31 – 35 ($n = 1$) and 40 and above ($n = 4$). The study was dominated by females ($n = 24$, 58.7%) while males were in the minority ($n = 19$, 41.3%). In terms of educational qualification, most of the participants had high school degree or equivalent ($n = 20$), followed by bachelor degree holders ($n = 16$). Only one of them had vocational training as an educational qualification. The types of sport in which the participants participated were ball sports ($n = 12$), dancing or gymnastics ($n = 14$) and miscellaneous ($n = 17$) (i.e., martial arts, horse riding and fencing). The participants have been performing their sports for averagely 12.44 years ($SD = 9.48$). Participants also practice averagely for 8.39 hours ($SD = 3.25$) a week.

Procedures

The data was collected from December 2021 to January 2022 using an online survey (i.e., google forms). The questionnaires were converted to online survey using the google forms and the link was sent to the WhatsApp platforms for the respondents to respond. Respondents were made to briefly respond to the informed consent form before proceeding with the actual questions. Respondents were assured that their responses would be kept confidential and anonymous and will only be used for the purposes of the study. All research protocols and ethical procedures were in line with the Institutional Review Board (IRB) at University of Cape Coast and adhered to the ethical standards of the sixth revision of the Declaration of Helsinki prior to data collection.

Instrumentation

The Psychological Performance Inventory (PPI) by Loehr (1986) was used. The PPI is a questionnaire to used to evaluate the respondents' mental toughness by calculating seven different scores of components of MT. The questionnaire consists of 42 items and the responses are indicated on a 5-point Likert-type scale, where 1 = "never" and 5 = "almost always" or vice versa, depending on the question. From the 42 items, 7 subscales can be derived, each consisting of 6 individual questions. These subscales are self-confidence (*"Mentally, I'm a strong fighter"*), negative energy (*"In a competition, I get nervous or anxious"*), control of attention (*"During competitions, I get distracted easily and lose my concentration"*), control of visualizing (*"I train my physical capacities mentally"*), degree of motivation (*"I'm bored and feel burnt-out"*), positive energy (*"I feel challenged and inspired in difficult situations"*) and lastly control of attitude (*"I can turn a crisis into a chance for me"*). Beyond the different subscales the total MT can be calculated by adding up all seven subcategories, scores can range from a minimum of 42 up to a maximum score of 210. In total, 27 items are worded positively (*"I believe in me as a fighter"*) and the

remaining 15 items were negatively worded (“*In competitions, I get nervous or anxious*”). In addition, demographic information about gender, age, level of education, type of main competitive sport, the amount of competitions per time period and the amount of practice per week in hours of the respective main sport have been collected.

For this investigation there were several independent and dependent variables to be distinguished. Independent variables included in the analyses were age, gender and experience (the number of years a person has practiced his/her sport). Dependent variables included all seven subscales of the PPI and the total mental toughness score.

Statistical analysis

The 20th version of the IBM SPSS software was used in analyzing the data. The assumptions of normality, outliers, linearity, multicollinearity and homogeneity of variance matrices were checked. Four of the data were outliers, hence they were excluded from the analysis. Violations of normality were found using the Kolmogorow-Smirnov-test in the subcategories “control of attention” ($p = .040$) and “control of attitude” ($p = .006$). Otherwise, no serious violations of assumptions could be found. A two-way multivariate analysis of variance (MANOVA) was conducted to examine the significant effect of gender, age or both of the variables combined in regard to the mental toughness subscales. Additionally, a one way MANOVA was carried out to investigate the effect of the amount of years exercising the sport on MT. Finally, a separate univariate analysis of variance (ANOVA) was done for the different independent variables and their effect on the total MT score (because of the substantial correlation with the subscales). In case of a significant result regarding the MANOVAs, a follow up ANOVA was conducted to distinguish the effect of the independent variable on the different dependent variables. Both, the one way MANOVA and the two way MANOVA were executed three times, because the assumption of multicollinearity for the MT subscale “control of attitude” and “self-confidence” correlated heavily (0.836).

According to Pallant (2016) “Correlations up around .8 or .9 are reason for concern you may need to consider removing one variable.” This approach of running multiple MANOVAs assures that the violation of multicollinearity does not falsely depict a significant result when there really is none. Because in MANOVA the number of cases must not be greater than the number of dependent variables, the category “age” was divided into two new groups. This results in the group of 18-25 year olds and the second group with all participants whose age is above 25 years (Pallant, 2016). For the same reason, the variable describing the number of years the sport is exercised by the participant has been merged from five to four categories – participants with over 20 years of their sports practice were combined with participants with 16 to 20 years of practicing their sport into the new variable “16 years of sports practicing and above”. Lastly, the scores of the negative items were reversed before executing the analyses. The significance level for all the analyses was set at $\alpha = 0.05$.

Results

Table 1 shows the results of the means and standard deviation of the Psychological Performance Inventory.

Table 1: Means and standard deviation of the PPI among the independent variables age and gender

Dependent variable	Total sample (n = 39)	Male (n = 17)	Female (n = 22)	≤ 25 years (n = 23)	> 25 years (n = 16)
Control of Attitude	23.74 (SD=3.59)	23.23 (SD=3.34)	24.14 (SD=3.80)	24.30 (SD=2.77)	22.93 (SD=4.51)
Positive Energy	25.05 (SD=2.82)	25.64 (SD=2.71)	24.59 (SD=2.88)	25.35 (SD=3.10)	24.63 (SD=2.41)
Negative Energy	19.61 (SD=4.01)	19.41 (SD=3.57)	19.77 (SD=4.41)	20.30 (SD=3.69)	18.62 (SD=4.36)
Visualizing	19.84 (SD=3.59)	19.05 (SD=3.88)	20.45 (SD=3.32)	19.73 (SD=3.68)	20.00 (SD=3.57)
Degree of Motivation	25.82 (SD=2.71)	25.76 (SD=3.25)	25.86 (SD=2.29)	25.86 (SD=2.81)	25.75 (SD=2.64)
Selfconfidence	23.66 (SD=3.68)	24.05 (SD=3.31)	23.36 (SD=3.99)	24.47 (SD=3.12)	22.50 (SD=4.19)
Control of Attention	22.21 (SD=3.62)	22.23 (SD=2.77)	22.18 (SD=4.23)	22.56 (SD=3.64)	21.69 (SD=3.66)
Total MT	159.94 (SD=17.15)	159 (SD=15.26)	160.36 (SD=18.82)	162 (SD=14.90)	156.13 (SD=19.8)

SD = Standard deviation, Total MT = Total mental toughness

Table 2 shows the mean and standard deviation results of the Psychological Performance Inventory among the independent variable experience (amount of years a person has exercised his/her sport)

Table 2: Means and standard deviation of the PPI among the independent variable experience (amount of years a person has exercised his/her sport)

Dependent variable	Total sample (n = 39)	< 6 years (n = 10)	6-10 years (n = 8)	11-15 years (n = 10)	> 15 years (n = 11)
Control of Attitude	23.74 (SD=3.59)	23.60 (SD=3.89)	24.63 (SD=3.37)	22.10 (SD=4.36)	24.73 (SD=2.45)
Positive Energy	25.05 (SD=2.82)	24.90 (SD=3.57)	25.38 (SD=3.29)	24.60 (SD=2.41)	25.36 (SD=2.37)
Negative Energy	19.61 (SD=4.01)	18.70 (SD=3.97)	19.75 (SD=4.02)	19.60 (SD=4.14)	20.36 (SD=4.34)
Visualizing	19.84 (SD=3.59)	19.30 (SD=4.00)	23.00 (SD=3.85)	19.20 (SD=2.49)	18.63 (SD=2.90)

Degree of Motivation	25.82 (SD=2.71)	27.60 (SD=2.41)	25.50 (SD=3.20)	25.20 (SD=2.49)	25.00 (SD=2.36)
Selfconfidence	23.66 (SD=3.68)	24.00 (SD=4.21)	23.62 (SD=2.92)	22.80 (SD=4.69)	24.18 (SD=2.92)
Control of Attention	22.21 (SD=3.62)	22.40 (SD=3.86)	22.25 (SD=4.33)	21.70 (SD=3.68)	22.45 (SD=3.29)
Total MT	159.94 (SD=17.15)	160.50 (SD=19.73)	164.13 (SD=17.54)	155.20 (SD=19.25)	160.72 (SD=13.44)

SD = Standard deviation, Total MT = Total mental toughness

No particular abnormalities in the distribution of means among the independent variables age, gender and experience can be observed within the scores of mental toughness. Next, the results of the MANOVAs as well as ANOVAs with different variations of independent variables are presented with respect to the scores of mental toughness of the PPI in Table 3.

Table 3: Overview of the MANOVA and ANOVA results

Analysis <i>(Dependent variable(s))</i>	Independent variables	Pillai's Trace	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
MANOVA <i>(all 7 subdivisions of the PPI)</i>	Age	.203	1.054	7.000	29.000	.417	.203
	Gender	.373	2.467	7.000	29.000	.041*	.373
	Age*Gender	.195	1.000	7.000	29.000	.451	.195
MANOVA <i>(all 7 Ø Attitude)</i>	Age	.184	1.130	6.000	30.000	.369	.184
	Gender	.244	1.617	6.000	30.000	.177	.244
	Age*Gender	.194	1.203	6.000	30.000	.332	.194
MANOVA <i>(all 7 Ø Confidence)</i>	Age	.111	0.624	6.000	30.000	.709	.111
	Gender	.179	1.089	6.000	30.000	.392	.179
	Age*Gender	.194	1,207	6.000	30.000	.330	.194
MANOVA <i>(all 7)</i>	Experience	.699	1.345	21.000	93.000	.168	.233
MANOVA <i>(all 7)</i>	Experience	.534	1.155	18.000	96.000	.314	.178

Ø Attitude)

MANOVA (all 7	Experience	.642	1.452	18.000	96.000	.126	.214
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**Ø
Confidence)**

ANOVA (TMT)	Age	/	1.317	1	35.000	.259	.036
	Gender		.001	1	35.000	.982	.000
	Age*Gender		.141	1	35.000	.710	.004
ANOVA (TMT)	Experience	/	.405	3	37.000	.751	.034

* Statistically significant if $p < 0.05$; Attitude: Control of attitude (subscale of the PPI), Confidence: Self-confidence (subscale of the PPI), TMT: Total mental toughness, Ø: without

In the end, the subsequent ANOVAs of the significant MANOVA with age and gender as it's independent variables are outlined in Table 4.

Table 4: Follow-up ANOVAs of the significant MANOVA conducted with gender and age as independent variables

Dependent variable	F	Sig.	Partial Eta Squared
Control of Attitude	.330	.570	.009
Positive Energy	1.385	.247	.038
Negative Energy	.012	.913	.000
Visualizing	1.232	.275	.034
Degree of Motivation	.000	.998	.000
Self-confidence	.866	.358	.024
Control of Attention	.005	.943	.000

*Statistically significant with an adjusted Bonferroni alpha level if $p < 0.007$

Due to the small sample size and rare violations of assumptions reference was made to the Pillai's Trace as it is believed to own a higher robustness (Pallant, 2016). A significant result

can be found in the MANOVA for age and gender with all seven subdivisions between gender and the subcategories of the PPI, $F(7, 29) = 1.045$, $p = .041$, Pillai's Trace = .373, Partial Eta Squared = .373. However, no significant effect can be determined after the follow up ANOVA for gender on the dependent variables after applying the Bonferroni adjustment and thus setting a new significance level of $p = .007$. With regard to the other analyses performed, no significant effects are observed.

Discussion

The present study examined factors associated with mental toughness.

Gender and age

A significant effect of gender on the subscales of the PPI was found. Therefore, gender supposedly affects a person's mental toughness. This finding would be coherent with studies already mentioned earlier that also report a gender difference (Marchant et al., 2009, Nicholls et al., 2009). However, the reliability of this significance should be interpreted with caution, because the two subsequent MANOVAs, each conducted without one of the strongly correlated subscales, showed neither a statistic significance without self-control ($p = .392$), nor without control of attitude ($p = .177$). The initial correlation between the subscales possibly distorted the real effect to a certain extent. This caution is further emphasized by the fact that the follow-up ANOVA of the significant result for the first MANOVA with all seven subcategories does not show any significance on the individual subscales what so ever. In addition, if there was an actual connection between gender and MT, it would be reasonable to assume that the total MT score should also be influenced by gender. For example, this was the case for the analysis by Nicholls et al. (2009), in which both the total MT and the subcategories of MT, here control, commitment, challenge and confidence, were affected by gender. This finding could not be observed in this study. Relatable studies that propose an effect of gender on the subcomponents of MT but not on the total MT were not to be found. Because of the ambiguous results, the author tends to lean towards the rejection of an actual effect of gender on MT, due to multicollinearity between two subscales and the missing follow up significance of the univariate analysis of variance. Maybe the violation of normality had also its effect on the results, however, according to Field (2013), an "N" as small as 20 can already be large enough in a light-tailed distribution. The lack of the gender's influence is supported by the research of Kuan and Roy (2007) and Buhrow et al. (2017), referred to in the theoretical background, who also couldn't point out significant differences in gender and its effect on MT.

Potentially, the lack of significance in this study can be interpreted as an actual assessment. Many studies which have shown a relation between gender and MT are already some time ago (Nicholls et al., 2009; Newland et al., 2013). Especially during the recent years, women's rights and gender equality have been an important topic in society. Various movements and plans are set out to establish equal rights between males and females (UN Women, 2019). Although it is unlikely that something as big as gender equality changes suddenly over a few years, maybe the increased awareness had a little effect on the participants, too, especially if it's only a relatively small sample size. Another factor that may have caused the lack of significance is the individual types of sports the participants take part in. The amount of subjects competing in dancing or gymnastics was among the highest ($n = 14$). This distribution may have caused a "balancing" of MT between the genders, as socially seen gender specific sports, such as ballet for women and boxing for men, have shown to increase the self-confidence of the respective socially preferred gender (Lirgg, 1991).

Neither age, nor the interaction between gender and age seems to be related to mental toughness in this study. Even without the heavily correlated subscales, no significance could be found. This finding may suggest that age is not as relevant as previous studies suggested (Marchant et al., 2009; Nicholls et al., 2009). However, the results might differ as the variable in this study had to be split into only two subdivisions and could not be analyzed as a continuous variable due to the small sample size. With the categories being “25 years and below” and “above 25 years”, there is only two categories that could’ve been compared with each other. Maybe MT differs especially in the earlier years with only a few years difference between subjects. Indeed, various studies observed a variance of MT in the earlier stages of life. In Temel's study (2018) 122 female student athletes were shown to have a lower mental confidence between the ages of 18 and 19 compared to those aged from 20 to 21. If an athlete can stay emotionally stable as well as positive during a competition, even though in the face of challenging situations, he/she constructively copes with adversity (Weinberg & Gould, 2015), which is a relevant factor for MT (Kruger & Pienaar, 2014). On this basis, Donaldson et al. (2000) suggest in their research of coping strategies among boys and girls between age 9-17 ($n = 768$), that young children in early and middle adolescence have not developed sufficient abilities to cope with adversities; this is probably one of the reasons why older individuals tend to have a higher MT. The mentioned example illustrates the relevance of a younger age on MT, which could not be investigated in this current study. The absent significance for the interaction of gender with age seems to be plausible due to the likewise missing effect of only the individual variables.

Experience

The different MANOVAs conducted as well as the ANOVA performed on the total MT depict no relevant effect between the variables, implying that the amount of years a person practices his/her sport has no effect on his/her MT. As mentioned earlier, the amount of research done for this specific variable is rather low. Still, the results do not align with the already reported studies. Both, (Connaughton et al., 2008) and (Buhrow et al., 2017) state that MT develops over time, especially through the amount of competitions and challenges that athlete faces over the years. A possible explanation for this contrast of results might be due to that very reason. The average amount of years a person has practiced his/her sport is relatively high (12.44 yrs, $SD = 9.48$). It is unlikely that the intensity throughout these roughly twelve years has always been the same. Presumably, the intensity decreased at a certain point of exercising the sport and thus decreasing the competitions and challenging situations arising from the sport. Although the participants have been asked how long they have been practicing their sport on a competitive level, the amount of competitions has probably reduced over the years. It is also possible that people have mistaken the question to just name the number of years of their respective sport, neglecting the competitive aspect of the question. Both considerations might explain the absent significance.

Another reason might be due to the method MT was raised. In the study of Connaughton et al. (2008) a qualitative interview has been conducted and for Buhrow et al. (2017) the Mental, Emotion, and Bodily Toughness Inventory (MeBTough) was utilized. Although the MeBTough and the PPI do not contain the same subscales and questions, there should still be a general relation between the two measurement tools under the assumption that there is a general understanding and consensus of MT in science. Nevertheless, the potential effect of the sports experience on MT did not even indicate a close significant result ($p = .168$), which is why the difference of measurement tools causing non relatable results probably plays a subordinate role.

Limitations

Several limitations might have influenced the reported results and therefore ought to be taken into consideration. Firstly, the data collection took place during the Covid-19 pandemic, hence the small sample size. The participants were asked to answer their questions prior to the pandemic, which was about nine months ago. This extensive period of time might have affected their responses, as they could have recalled their feelings and memories much better if the last competition took place more recently. Furthermore, the PPI has often been criticized due to its lack of empirical background as well as its insufficient validity (Golby et al., 2007; Middleton et al., 2004). Consequently, the essence of MT may not have been captured as well as it might have been possible with other measurement tools and thus the results should be interpreted with caution.

Another noteworthy factor is the social-desirability bias. Participants might have had a tendency to report an answer in a more socially acceptable manner, for example pretending to have a high self-confidence when the “true confidence” is considerably lower. Lastly, the variable “age” had been captured only in categories and not as a continuous variable. As MT seems to differ especially in stages of adolescence and earlier levels of adulthood, no distinct differentiation could be carried out to investigate their effects.

Conclusion

The study investigated the effect of gender, age and the amount of years a person has exercised his/her sport (experience) on mental toughness. The study showed that neither age, nor gender, nor experience had substantial effect on mental toughness as well as the subcomponents of the PPI.

Recommendations

Future research could investigate the development of MT and its components over time in a longitudinal study to contribute to the further understanding of MT. Also, the effect of the amount of years an athlete exercises his/her sport on MT should be investigated further in future studies. There is also the need for a standardized definition of mental toughness for scientists to refer to the same theoretical concept with equivalent subcategories so that results can be compared with each other indefinitely.

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