**Hi Ref, Are You in Control?**

**Self-Control, Ego Depletion, and Performance in Soccer Referees**

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Abstract

**Objectives**: Soccer referees are challenged by physiological, professional, and mental demands which require them to exercise self-control for optimal performance. We applied the strength model of self-control (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister & Vohs, 2016) to examine the relationship between self-control strength and performance in real matches.

**Design and Methods**: Sixteen soccer referees (*M* age = 30.06 yrs, *SD* = 7.38) completed a trait self-control scale. Then, over 2-4 matches they completed measures of daily hassles prior to the match and state self-control prior to and after the match. Personal, situational and performance indices were also collected. Data were analyzed using several statistical procedures, including hierarchical linear modeling.

**Results**: The referees exhibited higher levels of trait self-control compared with professional soccer players and the general population. Their state self-control scores were also high. A noticeable decrease (10% or more) in state self-control strength was evident in almost half of the matches. Experience of daily hassles and travel time to the match were related to lower pre-match self-control. Ego depletion was associated with self-reported match difficulty and was negatively related to self-rated match performance.

**Conclusions**: The findings are in line with previous studies and the strength model of self-control, indicating the role of self-control strength in soccer refereeing. Practitioners and referee unions should support referees in planning match day routines to maintain self-control strength.

**Keywords**: State self-control; trait self-control; daily hassles; officials; football

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The professional demands challenging soccer referees have increased in line with the changes in players' abilities, game pace, and public interest. In order to successfully perform, referees ought to maintain high fitness levels (Weston et al., 2012), make accurate decisions pertaining to various events and infringements (Helsen & Bultynck, 2004; Mascarenhas, O'Hare, & Plessner, 2006), as well as control the players and the match by applying game management skills (e.g., effective communication, assert accuracy and fairness; Mascarenhas et al., 2006; Mascarenhas, Collins, & Mortimer, 2002). Considering the various performance related stressors (e.g., players' aggression, crowd and media pressure, evaluation by the governing body; Page & Page, 2010; Samuel, 2015), referees should also exhibit mental toughness (Slack, Maynard, Butt, & Olusoga, 2013). In this context, Samuel (2015) proposed an applied framework designed to orient the psychological preparation of elite soccer referees for the unique demands of their task. This framework was developed based on the existing literature on soccer referees, several established mental preparation models (e.g., Vealey’s mental-skills model [2007)]), and the author’s applied consultation experience. This stage-based framework begins with the allocation of a match and a referee crew, continues with the various components required to psychologically prepare for a match, and ends with the post-match analysis and assessment. The framework specifies several psychological skills which soccer referees should possess in order to effectively adhere to the refereeing task, including motivation, self-confidence, and self-control. More specifically, Samuel (2015) suggested that referees need to make a conscious motivational decision to invest uncompromising effort in the upcoming match. Also, referees need to feel confident in their ability to meet the specific demands of the match. Finally, self-control was identified as a key psychological component in referees’ ability to maintain psychological composure (i.e., effective cognitive

processing, emotional stability) during a match.

In a rare examination of self-control in soccer referees, Vaziri, Mongashti, and Saiady (2014) examined the relationship between trait self-control and introversion-extraversion in 71 Iranian soccer referees, using a cross-sectional design. The results indicated that most referees (62%) were extraverted. Also, a small and positive correlation emerged between the extraversion scale and the trait self-control scale, whereas a small and negative correlation emerged between the introversion scale and the trait self-control scale. Finally, while there was no significant correlation between age and trait self-control, there were small positive correlations between the referees' years of experience and trait self-control.

To our knowledge, to-date no study examined referees' self-control during a match and how it may be related to performance. In this study, therefore, we investigated the relationship between soccer referees' self-control and their actual performance. Specifically, the strength model of self-control (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister & Vohs, 2016) was adopted to examine the relationship between referees’ temporarily available self-control strength during a match and its effects on performance.

The strength model of self-control posits that all acts of self-control are based on one global metaphorical resource with limited capacity (Baumeister, Heatherton, & Tice, 1994; Baumeister, Vohs, & Tice, 2007). Self-control describes the ability to volitionally suppress or alter certain behavioral tendencies or impulses in order to achieve more desirable long-term goals (Baumeister et al., 1998). Acts requiring self-control include amongst others: attention regulation (e.g., Schmeichel & Baumeister, 2010), emotion regulation (e.g., Englert & Bertrams, 2012), coping with daily hassles (e.g., Englert & Rummel, 2016), and decision making (e.g., Baumeister, Sparks, Stillman, & Vohs, 2008; Vohs et al., 2008). Self-control strength unfolds its effects via two paths: First, individuals may differ in their level of trait self-control strength, meaning that some individuals are generally better at controlling themselves than others (Hagger, 2014; Tangney, Baumeister, & Boone, 2004). Second, individuals may also differ in their state self-control strength, meaning their level of temporarily available self-control strength (e.g., Baumeister et al., 1994). After having exerted self-control, the resource temporarily depletes and is not immediately revitalized, which consequently affects performance in following self-control tasks (for meta-analyses see Cunningham & Baumeister, 2016; Dang, 2017; Hagger, Wood, Stiff, & Chatzisarantis, 2010). The state of a temporary loss of self-control strength is termed *ego depletion*.

The effects of trait and state self-control on performance have been repeatedly demonstrated in sport and exercise psychology (for an overview see Englert, 2016). On a trait level, it has been shown that physically inactive university students with higher levels of trait self-control strength follow their exercise intentions more rigorously than physically inactive university students with lower self-control strength, as higher trait self-control strength enables individuals to resist tempting alternatives in order to transform an intention into actual behavior (e.g., Englert & Rummel, 2016; see also, Martin Ginis & Bray, 2010; Toering & Jordet, 2015). Higher levels of trait self-control strength also seem to serve as a buffer against the negative effects of anxiety on performance. For instance, Landman and colleagues demonstrated that in police officers, higher levels of trait self-control strength were associated with better shooting performances in high-pressure situations (Landman, Nieuwenhuys, & Oudejans, 2016). On a state level, it has been found that athletes in a state of ego depletion performed worse in physical exercises (e.g., sit-ups; Dorris, Power, & Kenefick, 2012) and displayed a lower power output in an indoor cycling task (Englert & Wolff, 2015; Wagstaff, 2014). The importance of state self-control strength has further been demonstrated in a series of studies in which anxiety led to impaired perceptual-motor performance only in ego-depleted athletes. For instance, anxious basketball players with depleted self-control strength performed worse in a free-throw task than anxious basketball players with temporarily available self-control strength (e.g., Englert & Bertrams, 2012; see also, Englert, Zwemmer, Bertrams, & Oudejans, 2015). In these studies, temporarily available self-control strength served as a buffer against the negative anxiety effects on subsequent motor performance. To conclude, trait as well as state self-control strength seem to be beneficial for performance in a wide variety of sports-related tasks.

There are several domains in which referees might apply self-control in a match. First, referees make numerous decisions per match, including many decisions to not whistle or stop the fluency of the match (Helsen & Bultynck, 2004). This creates an increased mental demand for referees’ attentional control and short-term working memory (Ste-Marie, 2003). Attention regulation can be defined as a self-control act which is dependent on self-control strength (Schmeichel & Baumeister, 2010). This is in line with previous findings indicating that making (difficult) decisions may lead to ego depletion (e.g., Baumeister et al., 2008; Vohs et al., 2008). Research on soccer referees (Voight, 2009) and basketball referees (Anshel, Sutarso, Ekmekci, & Saraswati, 2014) indicated stress related to *making a controversial call* and *making a wrong* *call*. Upon making a controversial call or an error during a match, referees need to control their human tendency to dwell on the previous decision, to not debilitate the new decision-making or to make a biased decision. In this context, research has documented several biases which referees need to resist in order to accurately officiate the match. For example, referees need to control their inclination not to issue yellow and red cards against the home team players (i.e., the home advantage effect; Nevill, Balmer, & Williams, 2002). They also need to resist any prejudices they possess towards aggressive teams which might lead to excessive use of cards (Jones, Paull, & Erskine, 2002). Furthermore, research on soccer referees indicated a bias concerning consecutive penalty decisions within the same match. For example, Plessner and Betsch (2001) used a video-based laboratory setting and showed soccer referees potential foul infringements in the penalty area from a single match. A negative correlation was revealed between referees' successive penalty decisions concerning the same team whereas a positive correlation was evident between successive penalty decisions concerning the first team and then the opposing team. Schwarz (2011) further examined penalty-related data from 12,902 matches from the German Bundesliga. The data indicated that the number (441) of matches in which two penalties were awarded was larger than expected by chance. Among these 441 matches, there were considerably more matches in which each team was awarded one penalty than would be expected on the basis of independent penalty kick decisions. Therefore, referees are expected to exert self-control after awarding a penalty in favor of one team in order to avoid compensating and awarding a penalty more easily in favor of the other team.

Referees must also cope with the pressure elicited by players, coaches, and the crowd concerning their decisions (Anshel et al., 2014; Folkesson, Nyberg, Archer, & Norlander, 2002; Page & Page, 2010; Voight, 2009). In this context, referees need to control their cognitive, emotional, and behavioral responses towards the players and coaches (Mascarenhas et al., 2006; Samuel, 2015). They should maintain an authoritative approach, controlling players’ dissent and aggression, while being patient and professional (i.e., not letting personal issues or emotions control their responses). Moreover, referees need to self-regulate physiological demands (e.g., pain associated with high physical strain) throughout a match, especially if they are under-fit or somewhat injured, which according to Bray and colleagues, requires self-control strength (Bray, Martin Ginis, Hicks, & Woodgate, 2008). According to previous research, the requirements associated with refereeing discussed so far describe self-control acts (i.e., making difficult decisions, regulating subjective physiological needs and emotions), which consequently may lead to low levels of state self-control strength (e.g., Baumeister et al., 2007).

Taylor and Daniel’s (1988) early study on sources of stress experienced over a season

by Canadian soccer referees revealed five stress factors. One of these factors was *time pressure*, reflected in having conflicts between officiating and occupational or family demands, as well as arriving late at a game. Therefore, in addition to the actual refereeing task, referees might also deal with pre-match personal tasks or daily hassles. These may deplete self-control resources and impair self-control performance (Englert & Rummel, 2016). For example, a referee who has an important presentation at work or an academic exam in college might feel depleted when arriving to his or her evening match. In this context, travelling to the match might also become demanding especially if it is lengthy and/or the referee is required to drive to the match. A study on French soccer referees’ patterns of coping across three competitions found that coping utilization displayed both trait-like and state-like properties, differing for distinct subgroups of referees. Whereas most referees were stable in utilizing coping-focused coping, disengagement-oriented coping and seeking support coping decreased over the season (Louvet, Gaudreau, Menaut, Genty, & Deneuve, 2009). Age and expertise moderated these effects. These findings have implications for referees who attempt to cope with daily hassles through mental disengagement or social support, suggesting variation of coping between different matches.

In the present study we were interested in examining the effects of self-control strength on actual refereeing performance. Referees typically self-assess their performance following a match, analyzing their decision-making processes, game-management and refereeing style (Samuel, 2015). They also tend to assess the difficulty of the match in terms of demands, especially related to match and players’ control as reflected in incidents of dissent and mobbing (Mascarenhas et al., 2006). These diverse and simultaneous demands can be challenging and self-control is required to stay focused (Schmeichel & Baumeister, 2010) and in order to officiate the respective match efficiently. In line with the strength model, constantly exerting self-control strength during a match might eventually lead to ego depletion (Baumeister et al., 1998). Previous research has shown that under ego depletion individuals report higher levels of mental exhaustion (e.g., Graham, Martin Ginis, & Bray, 2017) and tend to evaluate subsequent situational demands as being more difficult and challenging, compared to situations in which their self-control strength has not been temporarily depleted (e.g., Baumeister et al., 1998). In addition, the referee’s performance is evaluated by a match observer, an experienced former referee who provides verbal feedback, a written report, and a performance mark. This mark represents a more objective evaluation of the referee’s performance (Chaplin, 2007), reflecting: (a) application and interpretation of the Laws of the Game / match control, tactical approach and management of the game, (b) disciplinary control, management of players and team officials, (c) physical condition, (d) cooperation with assistant referees, and (e) referee’s personality.

Considering the potential effects of self-control strength on soccer referees’ performance, there are very few studies that have focused on this aspect of refereeing. Moreover, studies on self-control in athletes were mostly conducted in laboratory settings (Englert, 2016), which might not translate into representative findings. Therefore, this study reflects a novel attempt to examine self-control strength in soccer referees, in relation to real match performance. Our three research questions were: (a) do soccer referees experience ego depletion during real matches? (b) do personal (i.e., age, trait self-control, professional level, and years of experience) and situational variables (i.e., daily hassles, travel time to match) predict state self-control and ego depletion? (c) do pre-match state self-control and ego depletion predict perceived match difficulty, mental exhaustion, self-rated match performance, and the match observer’s mark?

**Methods**

**Participants**

Sixteen soccer referees volunteered for this study (*M* age = 30.06 yrs, *SD* = 7.38).

Participants were recruited from the Referee Union in the Israel Football Association. Previous research on soccer referees suggested that years of experience may be associated with self-control (Vaziri et al., 2014) and that age may be associated with a higher need for coping with threat and aggression (Folkesson et al., 2002). Therefore, we sampled referees from several divisions, representing a large range of age and years of experience (see Table 1). It should be noted, that these referees received previous guidance on the strength model of self-control as part of a consultation process (Samuel, 2015) or during lectures on refereeing psychology (Samuel, 2017). Furthermore, all referees were highly experienced in match analysis which substantially increased their ability to self-analyze their own match performances. The study received an institutional ethical approval, and all participants provided informed consent.

**Measures**

**General measures.** After collecting demographic information (i.e., professional level, years of experience, present match information), we assessed participants’ trait self-control strength using the brief version of the Self-Control Scale (SCS; Tangney et al., 2004; Cronbach’s α = .74). Participants had to answer 13 items (e.g., “*I wish I had more self-discipline”*) on Likert-type scales ranging from 1 (*not at all*) to 5 (*very much*). For this measure and all the other measures applied in this study, we calculated overall scores by averaging each participant’s score on the respective measure. Higher scores on the measures always stand for higher scores on the respective psychological construct. Next, participants completed the social desirability scale (SDS-17; Stöber, 2001; Cronbach’s α = .66), which enabled us to control for potential response biases. The SDS-17 contains 17 dichotomous items (e.g., *“I always eat a healthy diet;” yes* vs. *no*).

**Pre-match assessment.** Approximately one hour prior to each match, the referees completed the short version of the State Self-Control Capacity Scale (SSCCS; Ciarocco, Twenge, Muraven, & Tice, 2004; Cronbach’s α = .73). The SSCCS contains 10 items (e.g., “I feel drained”) which referees had to answer on 7-point Likert-type scales (1 – *not true* to 7 – *very true*) in regard to how they felt at that given moment. Also, the referees reported the time it took them to travel to the match (in minutes), their state motivation (“to what degree you currently feel motivation to officiate the match?”) and their state self-confidence (“to what degree you currently feel self-confidence to officiate the match?”) towards the current

match using one-item each with 7-point Likert-type scales (1 – *not at all* to 7 – *very much*).

Then, we assessed participants’ perceived daily stress levels by applying the daily hassles scale (Holm & Holroyd, 1992) which had been adopted and validated in sport and exercise contexts by Englert and Rummel (2016). The daily hassles scale consists of 14 items, with each item describing a daily event which can potentially be perceived as being stressful (e.g., *“I did not perform well in a task*;*”* Cronbach’s α = .64). Participants had to indicate for each item whether the respective event had happened to them within the last 24 hours, and if so, how stressful it was on 7-point Likert-type scales (0 – *did not happen to me*; 1- *did happen to me but didn’t bother me at all*; 2 –*bothered me very little*; 3 –*bothered me a little*; 4 –*bothered me moderately*; 5 –*bothered me strongly*; 6 –*bothered me very strongly*; 7 – *was unbearable*).

**Post-match assessment.** Following each match, the referees were instructed to complete once more the SSCCS (Ciarocco et al., 2004). They were also asked to assess the perceived match difficulty (“how do you assess the difficulty of this match?”) and their current mental exhaustion (“to what degree do you currently feel mentally exhausted?”), using one-item for each with 7-point Likert-type scales (1 – *not at all* to 7 – *very much*). The use of single-item scales to evaluate athletes’ responses to a self-control task (i.e., the Stroop task) was previously validated (Englert & Bertrams, 2014).

Referees’ match performance was evaluated in two ways. First, as part of their post-

match assessment, the referees were asked to self-rate their performance (“how do you evaluate your performance in this match?”) using one-item with 7-point Likert-type scale (1 – *poor* to 7 – *excellent*). Second, we asked the referees to indicate the match observer’s mark in the inventory, upon receiving it. This mark uses a scale ranging from 6 to 10. Typically, a good performance is reflected in a mark of 8.4, a very good performance in a mark of 8.5 to 8.6, a poor performance in a mark of 7.9 to 8.3, and a very poor performance in a mark lower than 7.9. The match difficulty is also specified in the assessment (i.e., ‘normal,’ ‘quite challenging,’ ‘very challenging’).

**Procedure**

Potential participants were recruited by the ﬁrst author who serves as the sport psychologist of the Israel Referee Union. The research topic and purpose of the study were explained and the voluntary nature of participation was emphasized, and then the participants were asked to read and sign the consent form. Following this, the researcher introduced the measurements and explained instructions for completion. The participants were instructed to complete the social desirability scale and the trait self-control scale on that day, when they are by themselves. Then, for their next four matches, the referees were asked to complete state measurements prior to and following each match. Our rationale was that the effects of self-control strength on performance are related to both referee-related variables (e.g., years of experience, trait self-control) as well as to situational ones (e.g., state self-control, daily hassles). Therefore, in order to identify both types of effects we wished to explore each referee over several matches. On the other hand, as this study involved real matches, we did not wish to debilitate the referees' mental preparation, and therefore limited the number of matches per referee.

The referees were instructed to complete the state self-control scale, the daily hassles inventory, and their mental state towards the upcoming match approximately one hour prior to a match. The referees completed the measurements while they were at the stadium, during their preparation period for the match. Immediately following the match, while still at the stadium, the referees were asked to complete once more the state self-control scale, their assessment of the match difficulty and their current mental exhaustion, as well as self-rate their performance (all by pencil and paper). Upon receiving the performance mark for each match (i.e., from the match observer), they were asked to indicate it on the inventory. The

participants were assured of conﬁdentiality and anonymity throughout the research process.

**Data analysis plan**

All data analyses were conducted using SAS v. 9.4 (SAS Institute Inc.) and SPSS v. 23.0 (Armonk, NY: IBM Corp.). A binary indicator was created describing whether there was noticeable decrease in self-control strength from before to after the respective match (as measured by the SSCCS; Ciarocco et al., 2004) or not. Specifically, with a reduction of at least 10% in state self-control, indicator of ego depletion was coded as 1 (i.e., ego depletion); otherwise it was coded as 0 (i.e., no ego depletion). We decided to choose a 10% threshold as previous studies have shown that the SSCCS-scores of depleted and non-depleted individuals often differ 10% or more from each other (e.g., Graham et al., 2017). Also, Baumeister and Vohs (2016) explain that although ego depletion refers to a state of partial or total exhaustion of self-regulatory resources, individuals do not typically reach a point at which their resources are entirely depleted. We then computed the frequencies for this variable to examine *research question a*. In addition, we computed descriptive statistics of the referees’ characteristics.

For testing *research questions b* and *c*, we needed to choose appropriate statistical models. To handle the nested data structure (i.e., matches within referees), we used hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002). HLM is able to examine intra-individual effects/relations within a typical referee as well as inter-individual differences in these effects/relations. To test the research questions, we conducted HLM using SAS PROC MIXED. Prior to fitting HLM models to the data for addressing our research questions, we first examined the intra-class correlation (ICC), which represents the proportion of variance in the outcome variable among referees, or Level-2 units. ICC ranges from 0 to 1. The closer it is to 1, the greater proportion the variance at the second level takes and HLM needs to be used; in contrast, when ICC is close to 0, variance among Level-2 units

can be essentially ignored and regression models can be used (Raudenbush & Bryk, 2002).

***Research question b.*** For answering research *question b*, we first predicted mean levels of *state self-control* prior to a match (*SSC*) and *ego depletion* (*ED*) using referee-level variables (*age*, *trait self-control*, *professional level*, and *years of experience*). This allowed us to answer the question of whether personal variables were related to *state self-control* and *ego-depletion*. In this case, the HLM model for addressing this question was:

where is used to represent the observed scores of *SSC* or *ED* obtained during match *i* for referee *j*. At the referee-level, represents the mean of *SSC* or *ED* scores across matches for referee *j*, and it is predicted by each of the referee-level variables:

where denotes in general one of the referee-level variables. When the coefficient is significantly different from zero, the corresponding referee-level variable has an effect on the outcome; otherwise, we conclude that there is no evidence supporting a relation between the referee-level variable and the outcome.

To examine how situational variables, *daily hassles* or *travel time to match*, predict *state self-control* or *ego-depletion*, we used the following model:

where still represents *state self-control* or *ego-depletion* scores and represents scores for a situational variable. is the effect of a situational variable on an outcome for refer *j* (thus we have effects within each referee). In addition, differences of the effects of a situational variable on an outcome among referees can be modeled as

The coefficient is the effect of a situational variable on an outcome for an average

referee. It is our parameter of interest. When is significantly different from zero, we conclude that there is an effect between the corresponding situational variable and outcome for an average referee; otherwise, we conclude that there is no evidence supporting a relation between the situational variable and the outcome for an average referee.

To make sure that the estimation procedure converges properly (e.g., Singer & Willet, 2003), we assumed effects of the situational variable to be the same across referees and therefore dropped for modeling :

***Research question c.*** To examine how *state self-control* or *ego depletion indicator* predicts *perceived match difficulty* or *mental exhaustion*, we used a similar model as the model in answering *question b.* Specifically, we used *state self-control* or *ego depletion indicator* as the predictors for perceived match difficulty or mental exhaustion in HLM models. Similarly, *state self-control* or *ego depletion indicator* were used as the predictors for match performance scores (i.e., *self-rated performance* and *match observers’ mark*).

**Power estimation**. In their review of sample size issues in sport psychology research, Schweizer and Furley (2016) commented that “it might sometimes not be possible to have large sample sizes as there is only a very limited population to draw from when one’s goal is to investigate the highest level of performers” (p. 121). These authors suggested reporting adjusted effect sizes in studies with small sample sizes. As the present study’s participants were expert referees, it was difficult to produce a larger sample size, and therefore when applicable (e.g., in univariate analyses) we shall report the adjusted effect sizes for our analyses. It should be noted, however, that the effect sizes discussed in Schweizer and Furley (2016) were about single-level analyses, such as correlation coefficient or Cohen’s d. These were not applicable for our HLM analyses.

For our data set, the numbers of matches the 16 referees attended ranged from 2 to 4 (overall 55 matches). Comparing the number of referees (clusters) and the number of matches for each referee (cluster size), the former influences more heavily on estimates and statistical inferences of HLM model parameters. According to Maas and Hox (2005), when the number of clusters is greater than 10, statistical inferences of fixed effects (an average of effects across referees) are reasonably accurate with one level-1 predictor and one level-2 predictor (see Table 5 in Maas & Hox, 2005). Therefore, with 16 referees, we will have accurate inferences of fixed effects with at most one level-1 (match level) and/or level-2 predictors, which is the case for our HLM models. This indicates that significant findings should be correct, whereas insignificant findings might be because of a lack of sufficient statistical power for detecting an effect.

**Results**

**Preliminary analyses**

 Descriptive statistics of the referees’ characteristics are presented in Table 1 (upper section). The mean value for the social desirability scale was a bit smaller than the relevant age groups (i.e., 18-29 and 30-39; Stöber, 2001), yet comparable. The mean value for the trait self-control scale was higher than previously reported in a large sample of Norwegian professional soccer players (*M* = 3.66; Toering & Jordet, 2015) as well as in general populations (*M* = 3.26, *SD* = 0.58; De Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012). Trait self-control did not correlate with age or years of experience. Descriptive statistics of the match-related factors are presented in Table 1 (lower section). Each referee officiated 2-4 matches, mostly at evening time, after 18:00. It took the referees 73 minutes, on average (*SD* = 42 min), to travel to the match location. The referees’ reported very high pre-match state self-control (across all matches), in fact much higher than reported in previous studies (*M* = 4.55; Lian, Ferris, & Brown, 2012). The referees also showed high means for pre-match motivation and state self-confidence, across all matches. Match difficulty and mental exhaustion were perceived as moderate. Self-rated performance was perceived favorably and the mean match observer's mark was also high (i.e., a mark of 8.4 is considered by UEFA’s marking system as good performance; Chaplin, 2007). Finally, across all 55 matches officiated by the referees, in 27 matches (49%) we found noticeable states of ego depletion (i.e., a change of 10% or more in state self-control from pre- to post-match).

**How referee-level and situational variables predict state self-control and ego depletion**

The ICCs for *state self-control* and *ego depletion* were .631 and .548 respectively, which suggests that the proportions of variance between referees in terms of the two outcomes were more than 50%. Therefore, this provided strong evidence for using HLM in addressing this research question. Based on our proposed HLM model in the analysis plan we found that none of the referee-level variables (i.e., *age*, *years of experience*, *trait self-control*) significantly predicted the means of *state self-control* and *ego depletion.* Specifically, for *state self-control*, among the four referee-level variables, only trait self-control was on the borderline of significance (*p* = .076).

The average effect of *daily hassles* on *state self-control* was significant (*p* < .01) with a standardized coefficient (Hox, Moerbeek, & van de Schoot, 2010). Therefore, the higher the score of daily hassles the lower the pre-match state self-control was, and their strength of association was moderately strong. A similar analysis was conducted when using *travel time to match* as the predictor of *state self-control*, resulting in a significant effect (*p* < .05) with a standardized coefficient of . Thus, the longer time it took to arrive at the match, the lower the pre-match state self-control was. These results are summarized in Table 2. In addition to examining research question *b*, we were interested in the effect of *trait self-control* on *daily hassles*, for an average referee. This effect was borderline significant (*p* = .054), meaning that higher levels of trait self-control related to lower daily hassles.

**How state self-control or ego depletion indicator predict perceived match difficulty, mental exhaustion, and match performance**

The ICCs of *perceived match difficulty* and *mental exhaustion* were .155 and .581 respectively. Therefore, the proportion of variance between referees for both variables were great enough to warrant HLM analysis. We found that *state self-control* had a non-significant effect on *perceived match difficulty* and *mental exhaustion* for a typical referee (both had *p* values greater than .10). *Ego depletion indicator,* on the other hand, had a significant effect on *perceived match difficulty (, p* < .01). This indicates that for an average referee, noticeable ego depletion is associated with more difficult matches. A similar effect was not evident for *mental exhaustion* (, *p* = .085).

Estimation of the empty model for obtaining ICC of the *match observer’s mark* did not converge, and the ICC for *self-rated match performance* was .005. Therefore, the proportions of variance between referees for the two performance outcomes were not available or very close to zero. This justifies that for predicting the *match observer’s marks* and *self-rated match performance* scores, we can use regression or univariate analysis of variance techniques.Therefore, to evaluate the differences in *self-rated match performance* between matches with and without noticeable ego depletion, a univariate analysis of covariance was conducted. Even though we did not use HLM in this analysis, we still wished to account for the hierarchical nature of the data (i.e., the matches were nested within referees). We, therefore, used *trait self-control* and *perceived match difficulty* as covariates, to account for a referee-related factor and a situational factor related to *self-rated match performance*. The analysis was significant, *F*(1,51) = 4.96, *p* < .05, *ɳp*2 = .09, adj. *R*2 = .044. This indicates that there was a difference in the means of *self-rated match performance* scores, controlling for *trait self-control* and *perceived match difficulty*. Matches in which referees experienced noticeable ego depletion indicated lower self-rated match performance mean (*n* = 28, *M* = 5.44, *SD* = 0.70) compared with matches in which referees did not experience ego depletion (*n* = 27, *M* = 6.00, *SD* = 1.22). A similar analysis was performed to predict the *match observers’ marks*, which did not result in a significant effect, *F*(1,43) = 0.17, *p* = .67. These results are summarized in Table 2.

**Discussion**

 The high physiological, professional, environmental, and mental demands imposed on soccer referees require them to exercise self-control strength for optimal performance (Guillen & Feltz, 2011; Samuel, 2015). Referees may employ self-control when feeling high physiological exertion in the final moments of the match. Having to make numerous decisions per match while maintaining adequate attentional focus (Helsen & Bultynck, 2004; Mascarenhas et al., 2006) as well as resisting decision-making biases (e.g., Plessner & Betsch, 2001) further requires self-control. The purpose of this study, therefore, was to examine self-control strength in soccer referees, in the context of real match performance.

 The descriptive statistics indicated that the mean value for trait self-control was much higher than previously reported in samples of elite soccer players and the general population (De Ridder et al., 2012; Toering & Jordet, 2015). This finding raises questions concerning what is the cause and what is effected? Are individuals with high trait self-control drawn to become referees or does being a soccer referee entail the development of self-control strength? Indeed, further research is required to examine these issues. We also found in this context that the referee-level variables of age and years of experience did not relate to state or trait self-control. Vaziri et al. (2014) reported a small positive correlation between Iranian soccer referees’ years of experience and trait self-control. This effect was not evident in the present sample of referees. It is possible that the high trait self-control scores (with a small standard deviation) created a ceiling effect, thus the correlation in the current study was not significant.

The study findings indicated that in almost half of the matches the referees experienced a noticeable reduction in their state self-control strength. This provides support for our first research question, that the various self-control demands associated with soccer refereeing require self-control strength and may lead to states of ego depletion. It is unclear, though, which aspects of refereeing are most demanding for self-control (i.e., physiological, technical, mental, environmental, or interpersonal ones). It is also unclear from our findings which referee-level or situational-level variables might increase the likelihood of ego depletion. Therefore, both qualitative (e.g., interviews with referees) and experimental (e.g., manipulation ego depletion states) study designs are required to examine the factors leading to referees’ experiences of ego depletion.

Previous research has shown that daily stress (i.e., daily hassles) may deplete self-control resources and impair self-control performance (Englert & Rummel, 2016). In Taylor and Daniel’s (1988) early study of Canadian soccer referees, one of the stressors identified was related to time pressures. In this study, we found a moderate negative association between daily hassles and state self-control strength. There was also a negative association between travel time to the match and state self-control. Therefore, soccer referees’ daily experiences prior to a match might pose a significant effect on their self-control strength, especially if these elevate stress levels. It should be noted that trait self-control might buffer against the debilitative effects of daily stress on self-control strength (Englert & Rummel, 2016; Tangney et al., 2004). In this study, trait self-control was negatively related to daily hassles, at a level very close to statistical significance. However, additional research is required to determine the exact nature of this effect in referees.

Furthermore, the daily hassles scale (Englert & Rummel, 2016) we used includes ordinary situations that people tend to experience, not major stressors (e.g., a transition to a higher league) that referees might experience (see Samuel, Galily, & Tenenbaum, 2017). Considering that even such ordinary experiences may affect their state self-control strength, soccer referees should be conscious about planning their match day routine in a manner that reduces stress and helps them to maintain their self-control strength. We also recommend referees to consider their arrival to matches. Using car services and taking breaks during long travels can be important for reducing the potential debilitative effect on self-control strength. This is in line with previous research, which has demonstrated the positive effects of short recovery breaks prior to a self-control demanding situation (e.g., Tyler & Burns, 2008).

The major findings of our study concern the negative effects that noticeable ego depletion has on self-rated performance and perceived match difficulty. These findings correspond to previous studies, which have shown that self-control strength and performance decrease over time (e.g., Englert & Wolff, 2015), implying that referees should maintain self-control strength for optimal performance. Typically, soccer referees are accustomed in self-analysis concerning their match performance. Specifically, the Israeli referees who participated in this study tend to conduct video analysis of their matches with a refereeing coach, on a regular basis (see Samuel, 2015; 2017). Therefore, we had confidence in the referees’ ability to accurately self-rate their performances post-match. On the other hand, these evaluations were conducted very close to the end of the match, and it is possible that the referees were influenced by their subjective feeling of being ego depleted, and as a result perceived their performance as less favorable. In this context, our findings also indicated that ego depletion during a match was associated with the match being evaluated as more difficult. Interestingly, previous research has outlined that individuals evaluate their self-control performance differently depending on their level of temporarily available self-control strength (DeBono & Muraven, 2013). In our study, the referees’ self-rating of their performances and their perceptions of match difficulty were not correlated. Therefore, it is possible that indeed the influential factor on performance was the referees’ state of ego depletion. It seems that the referees felt they had to exert large capacity of self-control strength in the match, which translated into less favorable performance. Still, additional research is required to determine the validity of the ego depletion effect on referees’ performance. For example, by asking referees to self-rate their performance also one or two days after the match (e.g., after seeing the recording of the match on video), or by experimentally manipulating the degree of match difficulty.

We did not find a significant association between ego depletion and the match observer’s mark. The match mark, given by the match’s observer (see Samuel, 2015), reflects various performance indices, including fitness and field locations, major and minor decision-making, and game management. Even though we found a moderate correlation between self-rated match performance and observer’s mark, referees often evaluate their performance differently than the match observer. For example, the referee might feel that he or she controlled the match well and made accurate decisions, and the observer might think differently. Also, in certain cases the accuracy of a major decision (e.g., a red card, a penalty) is decided only after the match by using video replay. The referee might think he or she made a correct decision when in fact he or she did not.

Ego depletion was not associated with self-reported mental exhaustion. The referees did not report high levels of mental exhaustion, although these were real and important matches. However, previous studies have found mixed results on the relationship between ego depletion and mental exhaustion. While for instance Bray and colleagues (Bray, Martin Ginis, & Woodgate, 2011) reported increases in mental exhaustion in a state of ego depletion, other researchers have found no significant relationship between ego depletion and mental exhaustion (Vohs, Glaxx, Maddox, & Markman, 2011). Therefore, future studies should try to investigate the specific associations between ego depletion and mental exhaustion.

The above findings portray the following picture concerning the complex process which relates self-control strength to refereeing performance: prior to a match, the situational variables of daily hassles and travel time to the match increase the likelihood that the referee would arrive to the match with lower state self-control strength. Trait self-control might buffer against these debilitative situational effects. During a match, referees might experience a noticeable reduction in their state self-control until ego depletion. This reduction might be related to match demands which require the application of self-control strength. When referees experience this reduced mental state, they perceive the match as more difficult. They also perceive their own performance worse. Yet, as this study did not employ an experimental design we cannot deduce a cause and effect chain of events, and can only speculate on this process. Further research is required to determine the nature of this complex process.

This study has significant practical implications for referees, Referee Unions, and practitioners. Practitioners should teach referees self-control skills and stress management strategies (Samuel, 2015), as well as practical ways to maintain self-control strength (for an overview on self-control trainings, see Friese, Frankenbach, Job, & Loschelder, 2017). It is important that referees arrive to matches mentally prepared for the various demands they might meet. Also, that they are aware of the potential debilitative effects of such demands on their self-control strength. For example, performing in extreme or unfamiliar weather conditions or when ill or under fit. Designing effective match day routines is also practically important, as routines do require less self-control and are therefore less likely to be affected by ego depletion (e.g., Webb & Sheeran, 2003). We also advise referees to plan their game management strategies in advance and to anticipate match situations which may potentially drain their self-control strength. Referees should come as prepared as possible with several strategic drawer plans for how the match will develop and how they wish to manage it in terms of communication with players, assertiveness, and card policy (Samuel, 2015). This is also in line with previous studies, which have shown that the use of implementation intentions or so called coping plans may help to avoid states of ego depletion (e.g., Webb & Sheeran, 2003). Concerning the potential effects of ego depletion on self-rated performance and perceived match difficulty, it is possible that when referees begin to feel depleted during a match they already initiate negative self-talk thereby debilitating their performance perception. Therefore, it is important to develop with referees psychological skills to maintain adequate performance under ego depletion. For example, by using positive self-talk, setting short-term goals for these parts of the match, and relying more substantially on the assistants.

Potentially, this mental and tactical preparation can help to reduce the self-control demands and enable them to maintain their self-control strength during the match. In this context, the referee crew can be a factor that further depletes the referee’s self-control or rather maintain it (Samuel, 2015). There are matches when the referee is required to use much of his or her self-control strength simply to manage the crew. On the other hand, the referee crew may support the head referee, and even reduce some of the mental load by being more active in decision-making and game management. In general, social support by significant others has been shown to reduce the ego depletion effect (e.g., VanDellen & Hoyle, 2010). Also, referees should be aware of the importance of genuine rest during half time breaks, as previous studies have delivered sound empirical evidence that short breaks may lead to a quicker replenishment of depleted self-control strength (e.g., Tyler & Burns, 2008). In addition, if trait self-control would prove to be a good indicator of high-level referees, then perhaps this measure can also be used for selection purposes. Yet, further

research with diverse populations is required to determine its predictive validity.

Referee Unions should assist referees in decreasing daily hassles prior to challenging matches as well as arriving to the match with high self-control strength. This objective can be achieved in several manners. For example, by announcing match allocation early, so referees can plan their work schedule. Also, by providing car services, as well as accommodation, for referees whose matches require travelling long distance. Moreover, in many countries soccer referees do not hold a professional status and have to maintain an additional vocation (Gagne, 2014; Samuel et al., 2017). Therefore, referees might arrive to a match at the end of a stressful workday with a reduced self-control strength. Only at the top level, referees earn sufficiently to be able to focus entirely on refereeing. Even then, it is questionable whether maintaining a professional status is beneficial or not for referees’ mental state, as this can also increase performance anxiety. Therefore, we recommend referees to plan their daily routine in a way that promotes self-control strength, considering aspects pertaining to sleep, nutrition, and stress.

 This study had some limitations. The sample was relatively small, as well as highly contextual. It also included only male referees. However, this had organizational reasons, as there is only a limited pool of potential referees from the first division in Israel. Nonetheless, future studies should use diverse soccer referee samples (and referees and officials from other sports), representative of different levels and cultures. Moreover, even though the strength of this study is the measurement of state self-control in real match contexts, we could not control for external variables and therefore could not draw any causal conclusions. Therefore, future studies should employ experimental designs to examine how stress, fatigue, and additional factors (i.e., situational and stable) affect referees’ self-control strength. Of importance are qualitative designs to assess factors that referees evaluate as relevant to self-control and performance. In this context, we acknowledge that perceived match difficulty and ego-depletion represent the sum of several events unfolding in the same single match. Nonetheless, a match is comprised of several events that could potentially lead to ego-depletion. Further research is required to determine the unfolding patterns of ego-depletion during the same match.

 We would also like to mention that there is ongoing controversy regarding the validity of the strength model of self-control. While some recent studies failed to find empirical support for the ego depletion effect, highlighted by the non-significant findings of the Registered Replication Report (Hagger et al., 2016), a recent meta-analyses did find evidence for the ego depletion effect (e.g., Cunningham & Baumeister, 2016; Dang, 2017). Furthermore, alternative models have been developed to explain lapses in self-control performance, arguing that self-control impairments may not be the consequence of depleted resources but are rather caused by shifts in motivation, attention, and emotion (e.g., Inzlicht & Schmeichel, 2012), by self-efficacy (e.g., Graham & Bray, 2015), or by resource allocation (e.g., Beedie & Lane, 2012). Job and colleagues (Job, Dweck, & Walton, 2010) posit that the ego depletion effect seems to depend on one’s implicit theories about willpower, meaning that only individuals who believe in limited self-control resources may suffer under ego depletion, while the ego depletion effect cannot be found in individuals who believe that self-control can be exerted infinitely. These findings also have important practical implications for referee training, as future studies should try to change the implicit theory of referees’ who believe in limited self-control resources to an unlimited implicit theory.

**Conclusions**

 This was the first study to explore self-control strength and performance in soccer referees. Our unique pre- post-performance design can also be used in future studies. The findings support the self-control strength model (Baumeister et al., 1998; Baumeister & Vohs, 2016) in that: (a) ego depletion is a common feature of refereeing, (b) soccer referees’ self-control strength is affected by daily hassles, and (c) ego depletion is associated with perceived match difficulty and reduced self-rated match performance. These findings have meaningful implications for referees, Referee Unions, and practitioners in designing effective match day routines and teaching self-control skills.

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Table 1

*Descriptive Statistics of the Referees’ Characteristics (upper section) and the Match-Related Factors (lower section)*

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Range* | *M* (*SD*) | *Skewness* |
| Referees’ Characteristics |  |  |  |
| Age | 20-42 | 30.03 (7.39) | 0.30 |
| Years of Refereeing Experience  | 4-25 | 13.00 (7.11) | 0.24 |
| Social Desirability | 5-14 | 9.43 (2.97) | 0.07 |
| Trait Self-control | 3.31-5 | 4.09 (0.49) | 0.26 |
| Match-Related Factors |  |  |  |
| State Self-control\*  | 5.20-7 | 6.37 (0.46) | -0.55 |
| State Motivation\* | 2-7 | 6.43 (0.93) | -2.51 |
| State Self-confidence\* | 4-7 | 6.38 (0.75)  | -1.02 |
| State Self-control\*\* | 4.9-6.9 | 5.89 (.68) | -0.11 |
| Match Difficulty\*\* | 1-7 | 4.62 (1.37) | -0.39 |
| Mental Exhaustion\*\* | 1-7 | 3.58 (1.82) | 0.35 |
| Ego Depletion | -10-18 | 4.85 (5.76) | -0.29 |
| Self-rated match performance\*\* | 2-7 | 5.72 (1.03) | -1.23 |
| Match Mark\*\* | 7.8-8.7 | 8.39 (0.20) | -0.15 |

\* Evaluated pre match \*\* Evaluated post match

Table 2

*HLM and Univariate Analyses*

|  |  |  |
| --- | --- | --- |
| Predictor | *Outcome* | *p Value* |
| Age | State Self-control\* | > .10 |
| Years of Experience | State Self-control\* | > .10 |
| Trait Self-Control | State Self-control\* | = .076 |
| Age | Ego Depletion\*\* | > .10 |
| Years of Experience | Ego Depletion\*\* | > .10 |
| Trait Self-Control | Ego Depletion\*\* | > .10 |
| Daily Hassles\* | State Self-control\* | < .01 |
| Travel Time to Match\* | State Self-control\* | < .05 |
| State Self-control\* | Perceived Match Difficulty\*\* | > .10 |
| State Self-control\*  | Mental Exhaustion\*\* | > .10 |
| Ego Depletion Indicator\*\* | Perceived Match Difficulty\*\* | < .01 |
| Ego Depletion Indicator\*\* | Mental Exhaustion\*\* | = .085 |
| Ego Depletion Indicator\*\* | Self-rated match performance\*\* | < .05 |
| Ego Depletion Indicator\*\* | Match Mark\*\* | = .067 |

\* Evaluated pre match \*\* Evaluated post match