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Sports lunch breaks, vigor, and creativity at work: a test of the work-home resources model

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ABSTRACT

We use the Work-Home Resources (W-HR) model to investigate how daily positive experiences in the sports domain may spill over and enrich the work domain. We hypothesize that satisfaction with sports performance during the lunch break generates momentary vigor (i.e., cognitive liveliness and emotional energy) immediately after the lunch break and is indirectly related to creativity at work in the afternoon. Furthermore, we predict that positive work reflection during the sports activity strengthens the relation between satisfaction with sports performance and vigor when back at work. To test this positive spillover process, we collected diary data from 59 employees who engaged in sports activities during their lunch break. Data was collected at two time points per day for three days (total number of observations, $n = 177$). Multilevel analyses revealed partial support for our hypotheses. We found that satisfaction with sports performance was positively related to momentary cognitive liveliness and emotional energy, but only when employees reflected positively on their work during the sports lunch break. Further, cognitive liveliness was positively related to employees' creativity. However, formal mediation analyses did not support the idea that cognitive liveliness and emotional energy mediate the link between satisfaction with sports performance and creativity. We discuss how these findings contribute to the W-HR literature by showing the potential of sports to improve employees' feelings and functioning at work.

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Creativity; lunch break; physical activity; vigor; work-home resources model

It is well known that sports activities positively contribute to health and well-being (Boulé et al., 2001; Li & Siegrist, 2012; Wiese et al., 2018). Sports activities are isolated activities involving physical exertion and skills that are often governed by a set of rules or customs. They are characterized by an aim to express or improve physical fitness, increase enjoyment or form social relationships, and achieve results (in competitions; Council of Europe, 2001). There is also growing evidence that sports activities can be beneficial for work-related outcomes, as indicated by reduced job burnout (De Vries et al., 2020; Naczenski et al., 2017) and improved task performance (Coulson et al., 2008). Most

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scholars investigating sports activities in relation to work have taken a recovery perspective, showing that sports activities replenish resources that are lost during the workday (Coffeng et al., 2015; Demerouti et al., 2009; Díaz-Silveira et al., 2020; Feuerhahn et al., 2014; Meijman & Mulder, 1998; Oerlemans & Bakker, 2014; Sonnentag, 2001).

Although we acknowledge the recovery potential of sports activities, in the present study, we take a different theoretical perspective. That is, we propose that a sports activity may generate volatile personal resources, regardless of one's level of resources before the activity. Further, we suggest that employees can immediately use these volatile personal resources to perform their work well (cf. Ten Brummelhuis & Bakker, 2012a). The current study focuses on the impact of sports activities during the lunch break – typically the longest and most common break during the workday. We use an event-based design (Iida et al., 2012), in which employees who engage in a sports activity during their lunch break are closely followed for three days. Utilizing quantitative diary surveys, employees reported on satisfaction with their sports performance during the lunch break, their feelings immediately after the break, and, at the end of the workday, their functioning at work during the afternoon. Thus, instead of relying on end-of-workday recall (Coffeng et al., 2015; Díaz-Silveira et al., 2020), we asked participants about their experiences twice a day, making it more likely that we capture actual experiences instead of potentially biased distal memories.

We aim to make at least two contributions to the literature. First, we combine sports and exercise psychology with work and organizational psychology literatures and provide more insight into the positive spillover of sports activities during lunch breaks to work outcomes. We use the Work-Home Resources (W-HR) model (Ten Brummelhuis & Bakker, 2012a) to propose that one's satisfaction with sports performance during the lunch break serves as a positive nonwork experience that can facilitate vigor at work (i.e., cognitive liveliness and emotional energy). Vigor, in turn, can be used as a personal resource to be more creative at work during the subsequent afternoon. By focusing on employees' subjective evaluation of their sports performance during their lunch break, we go beyond previous studies that concentrated on the duration or intensity of sports activities. Additionally, by focusing on vigor derived from sports performance in relation to creativity, we aim to extend the scarcely available studies suggesting that sports activities benefit work outcomes (Patel, 2019; Ten Brummelhuis & Bakker, 2012b).

Second, we aim to provide insight into the role of positive work-related thoughts during a sports lunch break. So far, most studies focused on the *absence* of work-related thoughts, i.e., psychological detachment, during lunch breaks in relation to employees' recovery states (e.g., Bosch et al., 2018; Sianoja et al., 2018; von Dreden & Binnewies, 2017; Wendsche & Lohmann-Haislah, 2017). We suggest that employees may take additional advantage of their sports lunch break if work-related thoughts are *present*, i.e., if they positively reflect on their work during the sports activity in which they performed well. As employees need to start working immediately after the lunch break, we argue it is particularly important to reflect positively on their work during the break. In this way, employees remain cognitively attached to their work in a positive way, making it more likely that they gain additional personal resources that can be used to feel and function well at work (De Jonge et al., 2012; Zijlstra et al., 2014). We further add to previous studies about positive work reflection by focusing on these thoughts during a specific nonwork time activity (i.e., sports lunch break) instead of during evenings and weekends

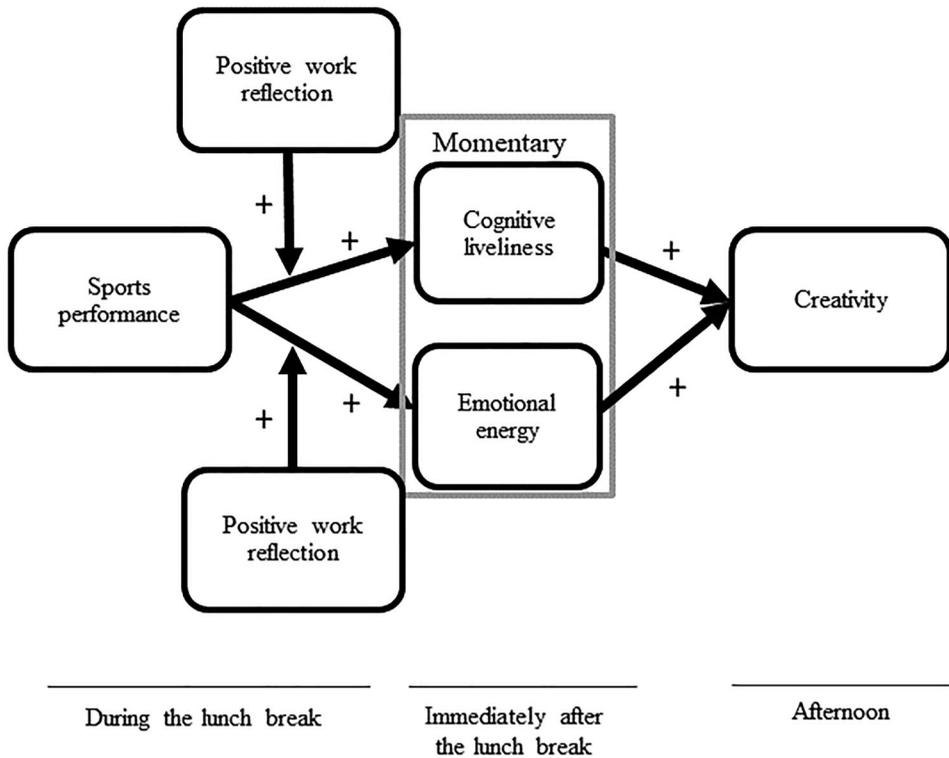


Figure 1. Conceptual model.

(Firoozabadi et al., 2018; Weigelt et al., 2019). The conceptual model of this study is graphically presented in Figure 1.

Theoretical background

Work-home resources model

A central proposition in the present paper is that positive experiences in the sports domain may improve work outcomes. Greenhaus and Powell (2006) refer to this positive spillover or enrichment process as the “extent to which experiences in one role improve the quality of life in the other role” (p. 72). Thus, resources gained in one domain can transfer to feelings and functioning in another domain (Geurts & Demerouti, 2003; Hecht & Boies, 2009). This spillover process could take place directly (e.g., through imitation) or indirectly (e.g., through evoking specific affective states). The W-HR model (Ten Brummelhuis & Bakker, 2012a) provides a more detailed account of the latter process. Up till now, this model has mainly been applied to spillover from the work to the home domain (e.g., Bakker et al., 2019; Du et al., 2018). However, the model may apply equally well to the sports-work interface. The “home” domain also captures the personal domain, which refers to activities one engages in for personal interests outside one’s family, including physical activities (Wilson & Baumann, 2015).

In the present study, we focus on a non-work to work short-term enrichment process that is described in the W-HR model (Ten Brummelhuis & Bakker, 2012a). This enrichment process takes place on days at which one's volatile (resources that are transient in nature) contextual resources from one domain result in volatile personal resources (e.g., energy), which subsequently facilitate outcomes in the other domain. Resources refer to objects, conditions, personal characteristics, or energies that people value or use as a means for the attainment of these objects, conditions, personal characteristics or energies (Hobfoll, 2002). Contextual resources originate in an individual's (social) context, are located outside the self, and refer to conditions or events that can trigger spillover processes. Personal resources are located inside the individual and incorporate beliefs and energies. We argue that sports activities can be seen as a contextual resource because these are events that tend to be appraised as favorable and meaningful, corresponding with personal goals and needs (Ohly & Schmitt, 2015). Vigor can be regarded as a personal resource related to feelings of energy that are individually possessed (Shirom, 2011). We focus on employee creativity as a favorable outcome since it is critical to the growth and performance of organizations (Fürst & Grin, 2018). Below, we provide definitions of our study variables and set out our rationale for the proposed relations.

Sports as a means to improve vigor at work

A central idea that is tested in the present study is that sports performance during the lunch break can facilitate vigor (i.e., cognitive liveliness and emotional energy) at work. Vigor at work is a multi-faceted personal resource and refers to positive feelings concerning the energy reservoir one possesses at work (Shirom, 2004; 2011). We concentrate on the two psychological components of vigor (Shirom, 2004; 2011). First, we focus on *momentary* cognitive liveliness, which refers to one's flow of thought processes and mental agility. Second, we focus on *momentary* emotional energy, which refers to one's capability to show sympathy and empathy to colleagues or clients. We do not focus on the third component of vigor, physical strength, which refers to one's physical energy (Shirom, 2004), as we are mainly interested in the immediate psychological consequences of sports activities. Further, most probably, the acute effect of a sports activity on *momentary* physical strength is complex and therefore beyond the scope of our study. That is, a sports activity may result in momentary feelings of lower (i.e., due to depletion of physical resources) and higher (i.e., due to successfully moving to a personally meaningful sports goal; Shirom, 2004) physical strength.

It has been argued that vigor will notably be present when someone appraises a certain situation or event as personally meaningful or valuable (Shirom, 2011; Wang et al., 2020). This implies that vigor does not depend on sensory (i.e., physiological) pleasure, such as the secretion of endorphins during sports activities (Shirom, 2011), which is one of the suggested explanations for the sports – positive feelings relation (cf. Dishman & O'Connor, 2009). It has been shown that contextual resources in the work domain, such as job control and feedback, predict vigor (Armon et al., 2012; Shrager & Shirom, 2009). However, contextual resources outside the work domain may predict vigor as well since these resources may be appraised as personally meaningful and valuable (Shirom, 2011).

In this study, we focus on employees' subjective evaluation of their sports performance during the lunch break, and argue that this is a contextual resource that triggers vigor. This idea is in line with sports theories positing that the sports stimulus itself (i.e., intensity, duration) and associated interoceptive cues (e.g., fast breathing and high heart rate) are not sufficient to produce positive affective reactions, but that these reactions are particularly achieved through cognitive factors. Cognitive factors may comprise the appraisal of the meaning or value of a sports activity, the extent to which sports goals are met and the social context (Ekkekakis, 2009; Lazarus, 1991; Roseman & Evdokas, 2004). Research shows that people are well able to evaluate their own sports performance by assessing their satisfaction with their progress towards their goal(s) and/or own achievement criteria (Balk et al., 2019; Hall & Terry, 1995; Terry, 1995). Many theories highlight the importance of successful performance accomplishments for increasing efficacy beliefs, feelings of self-confidence, and feelings of control (e.g., Social Cognitive Theory; Bandura, 1997; Control Theory; Carver, 2018; Poon, 2001). These beliefs and feelings have been found to be antecedents of positive affect (Reis et al., 2000; Salanova et al., 2011), for instance, because when individuals perform well, they feel that their basic psychological need for competence is fulfilled (i.e., the feeling of being effective in producing desired outcomes and exercising one's capacities; Deci & Ryan, 2000; Ng et al., 2012).

Based on previous empirical findings, it remains unknown whether performance accomplishments in a specific non-work domain, i.e., sports, could spill over to feelings at work. Previous empirical research has established that a higher intensity or longer duration of sports activities is a means to increase vigor at work (Jindo et al., 2020; Scotto di Luzio et al., 2019; Ten Brummelhuis & Bakker, 2012b), but these earlier studies neglected cognitive factors. Further, other studies have shown that successful work performance accomplishments are related to increments in positive affect at work (e.g., Ilies et al., 2007; Wang et al., 2020). Based on the idea that vigor at work will be present when one experiences accomplishments in the sports domain (Lazarus, 1991; Ohly & Schmitt, 2015; Shirom, 2011), we propose:

Hypothesis 1: Satisfaction with lunch break sports performance is positively related to momentary (a) cognitive liveliness and (b) emotional energy after the lunch break.

Vigor in relation to creativity at work

Another idea tested in the present study is that vigor is positively related to employee creativity. Employee creativity is behavior that can be defined as a mental and social process of generating ideas, products, and procedures that are (1) original and novel, and (2) potentially functional to the organization (Amabile et al., 2005), and has been shown to fluctuate based on situational contingencies (e.g., Breevaart & Zacher, 2019; Zacher & Wilden, 2014). It is considered a favorable work outcome, since creativity may help generate value for organization's multiple stakeholders to adapt to the ever-changing and competitive environment.

Empirical evidence shows that positive feeling states can stimulate creativity (Baas et al., 2008; Davis, 2009) predominantly after *activating* positive feeling states such as happiness and gratification (Baas et al., 2008; To et al., 2012). Vigor at work facilitates employee creativity because it is a positive feeling moderate in activation that is contextualized in the work situation (Shirom, 2011). The idea is that positive activated feeling

states enable individuals to have access to a fuller, more diverse range of information, both within the individual (e.g., memory), and outside the individual (e.g., environment; Baas et al., 2008; De Dreu et al., 2008; Fredrickson, 2001; Isen, 1999), facilitating individuals' flexibility in creating associations and processing information. Furthermore, through activation, individuals tend to show more approach behavior and feel more motivated to spend effort on creative tasks (Baas et al., 2008; De Dreu et al., 2008).

Thus, based on previous theoretical notions and empirical findings, it can be expected that on days employees experience more vigor after the lunch break, they are more creative in the subsequent afternoon. As the definition of creativity denotes (Amabile et al., 2005), creativity is both a mental and social process of generating ideas, products and procedures. Cognitive liveliness may be a prerequisite for the mental process of creativity. When people feel mentally alert, they have more cognitive capacity and are more willing to find creative solutions for work-related problems, which may result in behaviors such as solving difficult problems, trying out new ideas and approaches to problems, and finding new uses for existing methods or equipment (Tierney et al., 1999). Emotional energy may particularly trigger the social process of creativity. When employees feel the energy to invest emotionally in coworkers or clients, they are more likely to engage in actual interactions with others. Interacting with people with different ideas and perspectives could enhance creativity (Glăveanu, 2010). Scarce available empirical findings indeed lend support to the claim that vigor at work predicts creativity (Carmeli et al., 2013; Zhang et al., 2021). Hence, we expect:

Hypothesis 2: Momentary cognitive liveliness (a) and emotional energy (b) after the lunch break are positively related to employees' work creativity in the afternoon.

Vigor as a Mechanism in the Spillover between Sports and Work

Taking hypotheses 1 and 2 together, in line with the W-HR model (Ten Brummelhuis & Bakker, 2012a), we test whether a contextual resource in the sports domain (i.e., satisfaction with sports performance) leads to the development of a personal resource (i.e., vigor), which subsequently contributes to creativity in the work domain. Previous research has found that sports activities increase creativity, but, so far, the spillover process from sports to work creativity remains unknown (Cavallera et al., 2011; Colzato et al., 2013; Gondola & Tuckman, 1985; Rominger et al., 2020; Steinberg et al., 1997). A few studies have demonstrated that daily positive events in the home domain increase functioning in the work domain through the generation of personal resources (see Du et al., 2020; Heller & Watson, 2005; Patel, 2019; Ten Brummelhuis & Bakker, 2012b). We expect that this short-term enrichment process may apply to the sports-work interface as well. Accordingly, we predict:

Hypothesis 3: Satisfaction with lunch break sports performance is positively related to employees' work creativity in the afternoon through (a) cognitive liveliness and (b) emotional energy.

Positive Work Reflection as a Moderator of the Sports – Vigor Relationship

In line with the idea that a certain level of cognitive work involvement during a lunch break needs to be sustained to optimally function at work afterward (De Jonge et al., 2012; Zijlstra et al., 2014), we suggest that it is important for employees to reflect positively on their work during the sports activity to obtain the most beneficial effects of the break. Positive work reflection is a unique type of rumination (Martin & Tesser, 1996) that

refers to conscious thinking about the positive aspects of one's job that recur in the absence of situations requiring these thoughts. It includes thoughts about enjoyable work situations such as successful task accomplishment and supportive work relationships (Meier et al., 2016; Weigelt et al., 2019).

Positive work reflection during a sports activity that is perceived as favorable may result in the generation of additional personal resources as there is increased awareness of work situations that are personally meaningful and successful. As a result, efficacy feelings and positive emotions may occur that lengthen and intensify positive consequences of the recalled work situations (Clauss et al., 2018; Meier et al., 2016; Weigelt et al., 2019). The presence of positive work reflection during a lunch break sports activity seems to have considerable benefits compared to other forms of rumination. For instance, employees who do not think about work during the break may experience difficulties re-attaching to work immediately after the break (Sonnentag et al., 2020). Additionally, negative work reflection or worrying about work may result in a resource-draining instead of a resource-gaining lunch break experience (Weigelt et al., 2019). Research indeed shows that positive work reflection is more beneficial for increasing positive energetic states and creativity compared to psychological detachment (Weigelt et al., 2019; Wendsche & Lohmann-Haislah, 2017), negative work reflection or affective rumination (Weigelt et al., 2019), which underlines the resource generating potential of positive work reflection during lunch breaks. Further, there is empirical evidence showing that positive experiences during a sports activity may strengthen the effect of sports on well-being, especially on outcomes that are positive in nature (cf. De Vries et al., 2018; De Vries et al., 2020). As positive work reflection in conjunction with satisfaction with the sports performance allows for a greater possibility that the lunch break is perceived as favorable, we expect:

Hypothesis 4: Positive work reflection during sports moderates the relation between lunch break sports performance and (a) momentary cognitive liveliness and (b) emotional energy after the lunch break. Specifically, satisfaction with sports performance will result in higher cognitive liveliness and emotional energy when employees experience high (vs. low) positive work reflection during their sports lunch breaks.

Method

Participants and procedure

This study was conducted among Dutch employees. The responsible researchers acted in compliance with the Netherlands Code of Conduct for Research Integrity (2018). Employees were recruited via social media (e.g., Twitter, Facebook, LinkedIn) and via recruitment posters in worksite fitness locations. As compensation for their efforts, participants were offered a brief report regarding the main study outcomes, and they were entered into a raffle to win a check for buying sports clothes.

Participation in this study required the completion of a baseline survey. This baseline survey consisted of informed consent and questions about participants' demographics, employment details, and sports habits. In this survey, participants also filled out their work and sports schedule, i.e., for three weeks, they indicated at which days and which specific times they intended to do their usual sports activities during their lunch break

and their work times. Based on this work and sports schedule, the researchers chose three workdays at which participants engaged in sports activities during their lunch breaks. Participants were sent the two daily questionnaires by email on these three days. The first daily questionnaire was sent to participants immediately after the indicated time of their sports lunch break (T1; between 11 AM-2 PM; average send time: 12:57 PM [$SD = 1:36$]), the second daily questionnaire was sent at the indicated ending of their workday (T2; between 4 PM-7 PM; average send time: 5:20 PM [$SD = 1:48$]). If a participant did not carry out his or her sports activity according to their schedule, the participant was asked to provide the researcher with a new work and sports schedule. Accordingly, the participant received new invitations for the daily questionnaires. On average, participants filled out the questionnaires $M = 17.43$ ($SD = 32.48$) minutes (T1) and $M = 13.91$ ($SD = 34.57$) minutes (T2) after receipt.

A total of 127 employees completed the background survey. However, 68 (53.54%) of these employees only completed one or two days of daily questionnaires and were therefore not considered eligible for participation since we are interested in within-person differences, and a minimum three observations is required to study such differences. The final sample consisted of 59 participants, who filled out three days of daily questionnaires (a total of 177 diaries). They About half of this final sample was female (47.50%). Participants' mean age was 39.46 years ($SD = 7.47$) and they were generally highly educated (79.66% obtained at least a bachelor's degree). They worked on average 34.58 h a week ($SD = 7.47$), and had high levels of autonomy ($M = 3.95$ on a 5-point scale, $SD = 0.81$) and moderate levels of task demands ($M = 2.52$ on a 5-point scale, $SD = 0.70$). Participants had administrative ($n = 10$), service ($n=11$), or commercial ($n=7$) jobs, or held a job in the health care setting ($n=10$), or were managers ($n=6$), teachers ($n=2$), or specialists in various occupations ($n=13$). Participants engaged in sports activities on average 7.10 h a week ($SD = 4.32$). As the minimum recommended level of physical activity for adults is 150 min a week (WHO, 2010), this means that the sample was highly physically active. Most participants considered themselves as having a good physical condition ($M = 3.96$ on a 5-point scale; $SD = 0.65$).

During the lunch break, participants engaged in a variety of sports activities: swimming, cycling, running, yoga, strength/circuit training, boxing, and fitness. The average duration of the sports sessions was 51.48 min ($SD = 23.04$), and the average effort expenditure was 3.94 ($SD = 1.93$) on a 10-point scale ranging from 1 (*no effort at all*) to 10 (*maximum effort*). Most sports activities were carried out outdoors (74.30%) and individually (63.40%).

Measures

Satisfaction with sports performance

We measured sports performance subjectively. It has been suggested that subjective performance provides a sensitive outcome of performance, especially when environmental factors such as the weather play a role (Males & Kerr, 1996). Further, sports performance is a broad construct and may consist of performance in skills, strength, endurance, and mental control (Biddle et al., 2001), which cannot all be measured objectively. A common method to measure subjective sports performance is to ask for participants' satisfaction with their sports performance (Biddle et al., 2001). This

was asked at T1, i.e., immediately following the sports lunch break. The question (“How satisfied are you with your performance during the sports lunch break?”) could be answered on a 10-point Likert scale ranging from 1 (*totally dissatisfied*) to 10 (*totally satisfied*).

Positive work reflection during sports

After their lunch break sports activity, participants were asked to what extent they reflected positively about their work during the sports activity. Three items, based on positive work reflection items of Binnewies et al. (2009), and Fritz and Sonnentag (2005), were used. The three items were as follows: “During my sports lunch break, I realized what I liked about my job,” “During my sports lunch break, I thought about the good sides of my work” and “During my sports lunch break, I thought about what I have achieved in my work”. The items could be answered on a 7-point Likert scale ranging from 1 (*not at all agree*) to 7 (*totally agree*).

Momentary vigor at work after the lunch break

The two indicators of vigor – momentary cognitive liveliness and emotional energy – were measured immediately after the lunch break sports activity. For both indicators, we used three items of the Dutch translation of the Shirom Melamed Vigor Measure (Shirom, 2005). A sample item of cognitive liveliness is: “Right now, I feel I can think rapidly”. A sample item of emotional energy is: “Right now, I feel I am capable of investing emotionally in coworkers and/or customers”. Items were rated on a scale that ranged from 1 (*not at all agree*) to 7 (*totally agree*).

Creativity at work

Creativity was measured at the end of the workday with seven items derived from Tierney et al. (1999). The items were introduced as follows: “Please indicate to what extent the following items apply to you. This afternoon ...”. A sample item is “... I demonstrated originality in my work”. Items were rated on a scale that ranged from 1 (*very seldom or never*) to 7 (*very often or always*).

Strategy of analysis

We tested our hypotheses using Mplus version 7.4 (Muthén & Muthén, 1998-2017). Because our hypotheses focus solely on the within-person (i.e., daily) level, we analyzed our data using the TYPE=COMPLEX option in Mplus. This option accounts for the nested structure of the data (i.e., days nested within persons) by adjusting the output for non-independence of the observations. Additionally, we group (i.e., person) mean-centered all our variables. We ran four regression models to test our hypotheses. In Model 1 we tested H1a and H1b; in Model 2 we tested H2a and H2b; in Model 3 we combined Model 1 and Model 2 to test the mediation hypotheses H3a and H3b; and in Model 4 we tested the moderation hypotheses H4a and H4b. Finally, we used the Excel sheet provided by Dawson and Richter (2006) to plot the two-way interaction effects.

Table 1. Means, Standard Deviations, Within-Person Level (Below the Diagonal) and Between-Person Level (Above the Diagonal) Inter-Correlations and Internal Consistencies (Cronbach's alphas on the diagonal) Between the Study Variables, $N = 59$ Persons, $N = 177$ Days.

	<i>M</i>	<i>SD</i>	1-ICC	1.	2.	3.	4.	5.
1. Lunch break sports performance	7.84	1.49	63.6%	(.825)	.199	.167	.566***	.262
2. Cognitive liveliness after lunch break	5.59	1.05	42.5%	.129	(.896)	.754***	.540***	.257*
3. Emotional energy after lunch break	5.50	.90	38.7%	.102	.418***	(.690)	.568***	.409***
4. Work creativity	4.45	1.07	50.6%	-.099	.203*	.107	(.877)	.497***
5. Positive work reflection during lunch break sports	3.39	1.66	40.7%	.052	.064	-.076	-.015	(.939)

Note. * $p < .05$, *** $p < .001$. 1-ICC reflects the percentage of within-person variance.

Results

Descriptive statistics

Table 1 includes the means, standard deviations, reliabilities, intraclass correlations (ICC's), and the within- and between-person correlations between all study variables. The ICC's show that most of the variance in satisfaction with lunch break sports performance was explained at the within-person level (63.6%). For daily work creativity, about half of the variance was explained by within-person fluctuations in work creativity (50.6%). A little less than half of the variance in positive work reflection during sports lunch break (40.7%), and momentary cognitive liveliness (42.5%) and momentary emotional energy after lunch break (38.7%) was explained by fluctuations at the day level.

Hypothesis testing

First, Hypothesis 1 states that satisfaction with sports performance during lunch breaks is positively related to (a) momentary cognitive liveliness and (b) emotional energy after the lunch break. This hypothesis was tested in a model including both momentary cognitive liveliness and emotional energy after the lunch break and showed no support for H1a and H1b. Specifically, lunch break sports performance did not result in higher momentary cognitive liveliness ($b^* = .129$, $SE = .089$, $p = .148$, $CI [-.046, .304]$) and also did not increase emotional energy ($b^* = .102$, $SE = .092$, $p = .267$, $CI [-.078, .282]$).

Next, Hypothesis 2 states that (a) momentary cognitive liveliness and (b) emotional energy after the lunch break positively relate to employees' work creativity in the afternoon. The results showed that there was no support for H2b: emotional energy after the lunch break was unrelated to work creativity in the afternoon ($b^* = .025$, $SE = .098$, $p = .800$, $CI [-.167, .216]$). However, the relation between momentary cognitive liveliness (H2a) and work creativity in the afternoon was marginally significant ($b^* = .170$, $SE = .095$, $p = .074$, $CI [-.016, .356]$).

Hypothesis 3 hypothesizes a mediation effect in which sports performance during lunch breaks is positively related to employees' work creativity in the afternoon through (a) momentary cognitive liveliness and (b) emotional energy after the lunch break. Again, we found no relation between satisfaction with lunch break sports performance on the one hand and momentary cognitive liveliness ($b^* = .129$, $SE = .089$, $p = .060$, $CI [-.046, .304]$) and emotional energy ($b^* = .102$, $SE = .092$, $p = .267$, $CI [-.078, .282]$) on the other hand. Also, the relation between emotional energy and work creativity in the afternoon was insignificant ($b^* = .044$, $SE = .101$, $p = .664$, $CI [-.215, .241]$), while the relation

between momentary cognitive liveliness and work creativity in the afternoon was marginally significant ($b^* = .182$, $SE = .097$, $p = .060$, $CI [-.007, .372]$). We did not find mediation of respectively momentary cognitive liveliness ($b^* = .024$, $SE = .022$, $p = .295$, $CI [-.021, .068]$) and emotional energy ($b^* = .004$, $SE = .011$, $p = .695$, $CI [-.018, .027]$) in the relation between satisfaction with lunch break sports performance and work creativity in the afternoon.

Finally, the moderation hypothesis states that satisfaction with sports performance will result in higher cognitive liveliness (H4a) and emotional energy (H4b) after lunch break on the days that employees engaged in more positive work reflection during their lunch break sports activity. Again, there were no direct relations between sports performance during lunch breaks on the one hand and momentary cognitive liveliness ($b^* = .129$, $SE = .090$, $p = .154$, $CI [-.048, .306]$) and emotional energy ($b^* = .109$, $SE = .090$, $p = .226$, $CI [-.067, .284]$) on the other hand. Additionally, positive work reflection during a lunch sports activity was unrelated to either momentary cognitive liveliness ($b^* = .064$, $SE = .090$, $p = .472$, $CI [-.111, .240]$) or emotional energy ($b^* = -.075$, $SE = .098$, $p = .442$, $CI [-.268, .117]$). However, in line with Hypothesis 4a and 4b, we did find two significant moderation effects. First, we found that positive work reflection during lunch sports moderated the relation between satisfaction with sports performance and momentary cognitive liveliness ($b^* = .125$, $SE = .046$, $p < .01$, $CI [.035, .215]$). Figure 2 shows that on the days that employees engage in more positive work reflection during their lunch break sports activity, employees experience more cognitive liveliness when they feel they performed well during their lunch break sports activity. Second, positive work reflection during lunch

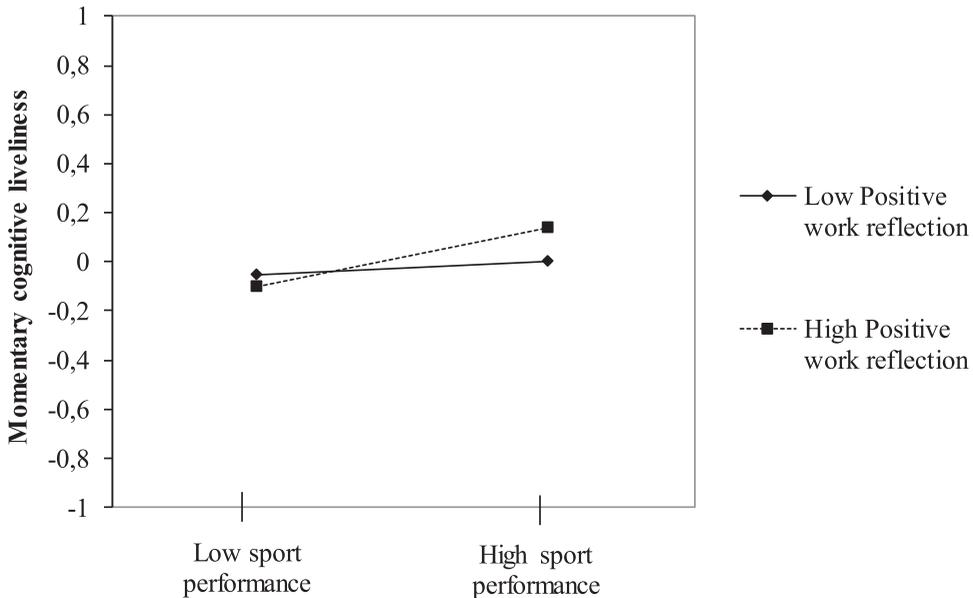


Figure 2 .#Positive work reflection during lunch break sports activity as a moderator in the relation between lunch break sports performance and momentary cognitive liveliness.

sports activity moderated the relation between satisfaction with lunch break sports performance and emotional energy ($b^* = .114$, $SE = .053$, $p < .05$, $CI [.010, .218]$). Figure 3 shows that for those who engage in positive work reflection during their lunch break sports activity, they gain more emotional energy when they are satisfied with their performance during the sports lunch break. The moderations explain 3.6% of the variance in momentary cognitive liveliness and 3.0% of the variance in emotional energy.

Additional analyses

Because positive work reflection during the sports lunch break moderated the relation between satisfaction with lunch break sports performance and momentary cognitive liveliness, and because the relation between momentary cognitive liveliness and work creativity in the afternoon was marginally significant, we exploratorily tested a moderated mediation model. Specifically, we tested whether the indirect relation between satisfaction with lunch break sports performance and employees' work creativity in the afternoon through momentary cognitive liveliness was stronger for employees who experience high (vs. low) positive work reflection during sports. We did not find support for a moderated mediation effect ($b = .016$, $SE = .011$, $p = .151$, $CI [-.006, .038]$), but we did find a significant positive relation between momentary cognitive liveliness and work creativity in the afternoon ($b^* = .180$, $SE = .089$, $p < .05$, $CI [.007, .354]$). The final model, including the results, can be found in Figure 4.

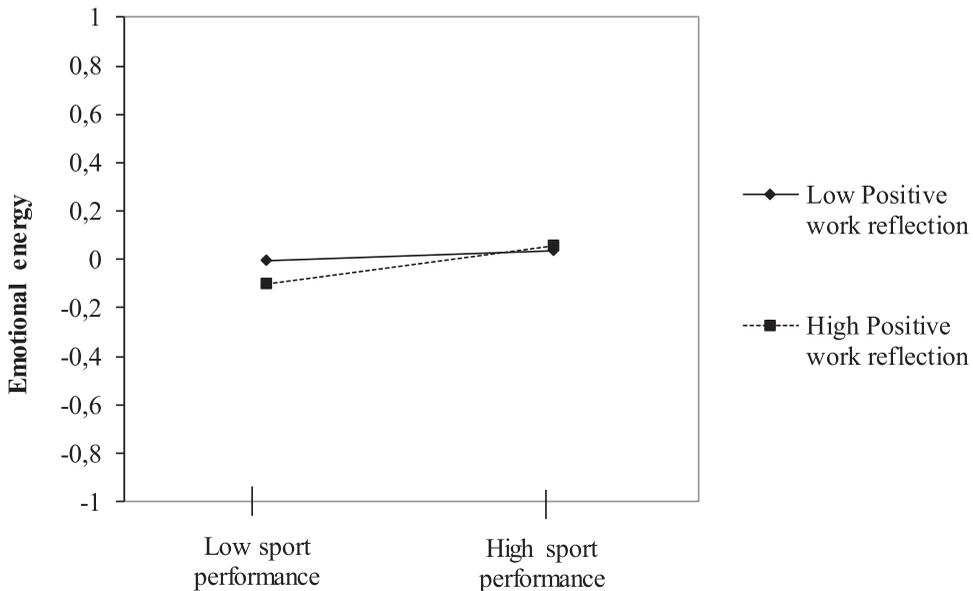


Figure 3 .#Positive work reflection during lunch break sports activity as a moderator in the relation between lunch break sports performance and emotional energy.

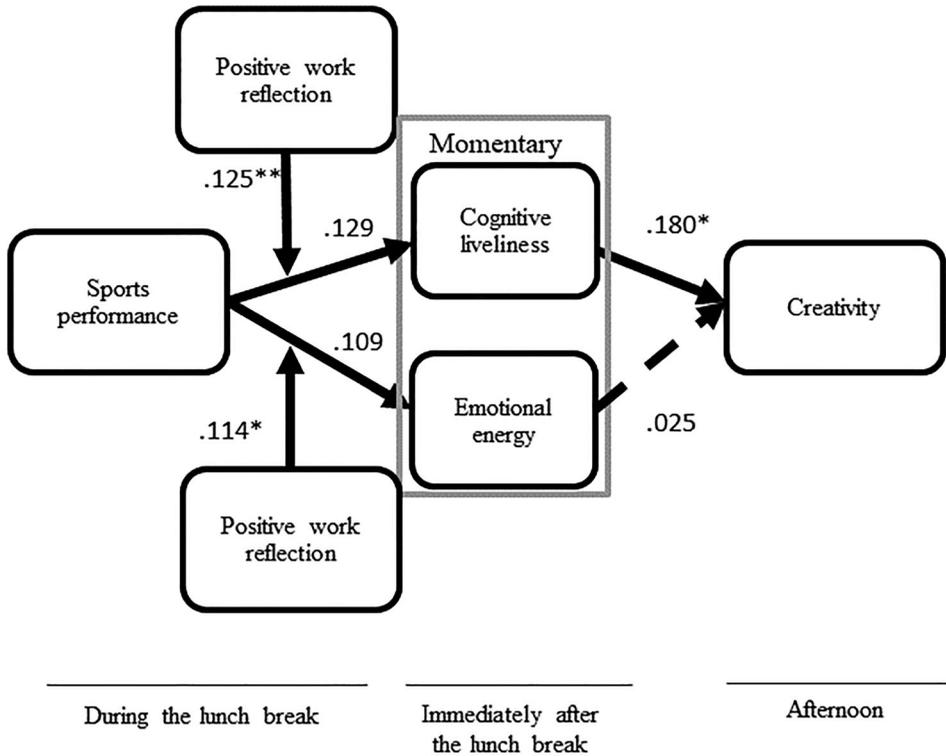


Figure 4 . Final model. Note. The model was tested in four separate regression models. * $p = <.05$
 $** p = <.01$

Discussion

In this study, we investigated a short-term spillover process between sports lunch breaks and work outcomes. We linked the Work-Home Resources model (Ten Brummelhuis & Bakker, 2012a) to the literature on sports and exercise psychology. More specifically, we studied a sports-to-work enrichment process by examining a contextual resource in the sports domain (i.e., satisfaction with sports performance) in relation to a favorable work outcome (i.e., creativity) through the generation of personal resources (i.e., vigor). Doing so, we took a broad resource perspective that included the notion that sports activities can generate resources useful for work rather than only assuming that resources must be depleted for exercise to be of value (i.e., recovery perspective; see Demerouti et al., 2009; Meijman & Mulder, 1998; Sonnentag et al., 2017).

Our results revealed that on days employees were satisfied with their sports performance during their lunch break, they experienced more cognitive liveliness and emotional energy immediately after the break, but only when employees positively reflected on their work during the sports activity. We also found that on days employees felt more cognitive liveliness immediately after the lunch break, they were more creative when back at work. However, formal mediation analyses showed that cognitive liveliness and emotional energy did not mediate the link between satisfaction with sports performance and creativity.

Theoretical implications

The present study has several theoretical implications. First, as we found support for the separate relations of the short-term enrichment process described in the WH-R model (Ten Brummelhuis & Bakker, 2012a), our research illustrates that this model has the potential to be applied to the sports-work interface. That is, by showing that one's satisfaction with sports performance combined with positive work reflection during the sports activity is positively related to momentary vigor (i.e., cognitive liveliness and emotional energy) immediately after the break, we found support for the idea that a contextual resource in the sports domain could trigger the development of volatile personal resources. Further, by showing that momentary cognitive liveliness after the break is positively related to work creativity in the subsequent afternoon, we also found support for the idea that a volatile personal resource facilitates one's performance in the work domain. Contrary to our expectations, we did not find statistical support for vigor as a crucial mechanism linking the sports and work domain, i.e., the complete short-term home-to-work enrichment process. This latter result is not in line with earlier theoretical notions (Ten Brummelhuis & Bakker, 2012a) and previous empirical findings combining different life domains (Du et al., 2020; Heller & Watson, 2005; Patel, 2019; Ten Brummelhuis & Bakker, 2012b). A possible explanation is that our sample size was relatively small, which may have led to limited statistical power and an inability to detect mediation (cf. Rucker et al., 2011). Therefore, we suggest that the lens of the Work-Home Resources model is still in place to better understand whether, and if so, how positive experiences in the sports domain may spill over to positive experiences and functioning in the work domain.

Second, by focusing on employees' satisfaction with their sports performance, we were able to study a sports-related cognitive factor in relation to employees' feelings at work. This is a different approach than earlier studies that mainly focused on the sport intensity or duration in relation to outcomes (e.g., Feuerhahn et al., 2014; Patel, 2019; Sonnentag, 2001; Ten Brummelhuis & Bakker, 2012b). Although several (sports) psychology theories posit that the generation of certain positive or negative feelings may depend on cognitive factors, such as the representation of the meaning of a sports activity and the goals of the individual (Ekkekakis, 2009), so far, to the best of our knowledge, none have actually tested whether the presence of these cognitive factors spill over to the work domain. Hence, it is well possible that cognitive factors other than satisfaction with sports performance predict employee outcomes as well, such as attentional focus (Wininger & Gieske, 2010), perceived social support (Freeman et al., 2011), and enjoyment during the sports activity (Kendzierski & DeCarlo, 1991). Another possibility is that sports intensity and duration may predict or interact with such cognitive factors (cf. De Vries et al., 2018; De Vries et al., 2020). For instance, it has been argued that cognitive factors are dominant at low intensities and interoceptive cues become more influential as intensity approaches the individual's functional limits (Ekkekakis, 2009). Therefore, we suggest that measuring aspects of the sports stimulus itself (i.e., intensity and duration) and cognitive factors may have complementary value in predicting employee outcomes.

Third, by showing that positive work reflection during the sports lunch break strengthens the relation between subjective sports performance and vigor, we add to previous research on lunch breaks in which psychological detachment during lunch breaks was

shown to benefit or to be unrelated to recovery (Bosch et al., 2018; Sianoja et al., 2018; von Dreden & Binnewies, 2017; Wendsche & Lohmann-Haislah, 2017). Our finding is in line with previous notions that employees need to be cognitively attached to work in order to generate resources that can be directly used at work (De Jonge et al., 2012; Zijlstra et al., 2014), but we expand this view by showing that this should occur in a positive way. We also extend previous studies on positive work-reflection (Firoozabadi et al., 2018; Weigelt et al., 2019) by showing that these thoughts during a specific nonwork activity are beneficial for generating vigor. It remains yet to be explored whether positive work reflection during other lunch break activities could generate resources, for instance, during social activities in which employees capitalize on positive work experiences by sharing them with others (Du et al., 2020). We note that 36.6% of sports activities in the present study were carried out with others, making it likely that positive work experiences were shared.

Limitations and future research

The present study has some limitations that should be discussed. First, all outcomes were measured by means of self-reports, which may result in common-method and social desirability biases (Podsakoff et al., 2003). We note that feelings and thoughts can only be measured by means of self-reports and that the temporal separation of predictors and outcomes reduces concerns about common-method bias (Podsakoff et al., 2003). Nevertheless, we suggest that future research could measure some of our variables differently and try to replicate current findings. For instance, creativity could be measured using other-ratings or creativity tasks (Fürst & Grin, 2018).

Second, by using a diary design and measuring some of our variables simultaneously, we were not able to determine causality. We did use two measurement points that allow for investigating temporality (i.e., the “cause” precedes the “effect”) and our findings are theoretically plausible – two of the suggested necessities for assessing causality (Hill, 1965). However, satisfaction with sports performance, positive work reflection and vigor were measured at one time point, leaving open the possibility for reversed relations. For instance, research shows that vigor could also predict sports performance (Beedie et al., 2000). As a consequence, we suggest that our research design could be improved by assessing all different steps in the proposed spillover process (cause, mechanism, and outcome) at different time points. Further, more rigorous designs, such as experiments in which positive work reflection are manipulated, could be carried out.

The third limitation refers to the generalizability of the present findings. Our sample comprised employees who were highly physically active. Research shows that people who are more physically active may respond more positively to acute bouts of sports activities, but only when these are of high intensity (Hallgren et al., 2010). As the average sport intensity in our research was relatively low (3.94 on a 10-point scale), it is not plausible that this issue seriously impacted our findings. Furthermore, our sample consisted of employees having jobs with high autonomy and moderate task demands (i.e., “active jobs”, Karasek, 1998), which has been shown to positively affect sports participation (Fransson et al., 2012). Moreover, for employees having high physical demands, sports activities during lunch breaks may require too many physical resources, resulting in resource depletion instead of resource generation. Part of our participants (20.3%)

had a job that may require physical effort (e.g., nurses, police officers), but we did not have information about the exact number of physical demands. Related to this point, it is conceivable that not all employees have the opportunity to engage in sports activities during their lunch break. Therefore, we suggest that future studies incorporate employees' work characteristics to further investigate which employees could benefit most from sports activities during lunch breaks.

Fourth, we focused on a specific type of breaks (i.e., lunch breaks). Hence, our study cannot inform whether our results apply to sports activities at different times of the day, such as mornings and evenings. Most likely, morning and evening sports activities have the potential to generate volatile resources as well (Calderwood et al., 2021). However, it is possible that staying cognitively attached to work during evening sports activities is less beneficial for recovery and work outcomes, as most employees do not need to start working immediately after these activities, and research has repeatedly shown that psychological detachment during evenings is crucial for adequate recovery (Demerouti et al., 2009; Wendsche & Lohmann-Haislah, 2017). Therefore, future research could investigate whether and if so, how, and under what conditions sports activities at specific times of the day can best generate resources that can be used to function and feel well at work.

Fifth, we only focused on two (cognitive liveliness and emotional energy) out of three dimensions of vigor, while vigor theoretically also consists of physical energy (Shirom, 2004). High *momentary* physical strength may occur when people are satisfied with their sports performance due to a successful meaningful sports event (Shirom, 2004). Still, low *momentary* physical strength may also happen when one successfully invested high levels of physical effort but has left physical resources depleted. In addition, low feelings of energy may also contribute to creativity because of the acceptance of unusual ideas (Middlewood et al., 2016). To provide more insight into these potentially complex processes, we suggest that future studies include additional (physiological) measures of *momentary* physical strength such as handgrip strength and blood lactate (e.g., García-Pinillos et al., 2015; Tanner et al., 2010).

Practical implications

Our study also has practical implications. First, our findings show that on days employees are satisfied with their lunch break sports performance and reflect positively on their work during this break, they have more mental agility and a better capability to show sympathy and empathy to colleagues or clients. Therefore, we suggest that employees may design their sports lunch breaks in such a way that satisfaction with sports performance is most likely to occur, for instance by setting sports goals that are challenging and attainable (Healy et al., 2018), and aimed at personal improvement or mastery of a sports task (i.e., mastery goals; Van Yperen et al., 2014). Additionally, during the lunch break sports activity, employees may actively try to relive positive work experiences, such as reflecting on the significance and good sides of one's work or thinking about enjoyable work situations such as successful task accomplishments and pleasant interactions with colleagues. As we also showed that cognitive liveliness was positively related to work creativity, employees may also seek other ways to increase cognitive liveliness, such as seeking feedback and emotional support from others (De Jonge et al., 2012; Shirom, 2011) and

proactively managing their vitality (Op den Kamp et al., 2018). Lastly, as breaks are embedded in the work context, employers may facilitate employees' engagement in sports activities during lunch break by providing opportunities to sports at work, such as indoor and outdoor exercise facilities (Coulson et al., 2008; Hipp et al., 2017).

Conclusion

This study examined the potential of a sports-to-work enrichment process in which a sports lunch break serves as a resource-generating positive event that results in favorable work outcomes. Although we did not find support for such a sequential process linking sports activities and work outcomes, we did show that sports activities improve employees' resources, i.e., emotional energy and cognitive liveliness at work. As we are among the first investigating a sports-to-work enrichment process, we conclude that the present study may function as a starting point for future studies understanding if, why, and under which conditions sports activities during lunch breaks benefit work outcomes.

Data availability statement

The data that support the findings of this study are available from the corresponding author (JdV).

Disclosure statement

No potential conflict of interest was reported by the author(s).

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