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Start-up Conflict and Hair Cortisol

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1. Introduction

Hair cortisol concentration (HCC) can be considered a potential biomarker of long-term exposure to work stressors (Herr et al., 2018; van der Meij et al., 2018). However, a recent meta-analytic review shows no consistent associations between HCC and self-reported stress (Stalder et al., 2017). As proposed by Van der Meij et al. (2018), these mixed findings may be due to the fact that the review does not distinguish between specific categories of sources of stress. Another reason can be the limited use in research of more elaborate stress assessment techniques (Stalder et al., 2017), such as those involving intensive longitudinal designs (e.g., diary, experience sampling) that help to minimize retrospection bias.

In this study, we concentrate on one specific type of work stressor that is exposure to interpersonal conflict (Dijkstra et al., 2009). We already know that conflict at work can have strong negative consequences (De Dreu and Weingart, 2003), trigger negative stress-related outcomes (e.g., individual strain) (Dijkstra et al., 2009), and that chronic exposure to stress is related to a sustained excessive secretion of cortisol leading to behavioral and somatic pathological conditions (Chrousos, 2009). Accordingly, a prolonged exposure to conflicts at work may bring about long-term physiological response that can jeopardize health. However, the knowledge on the physiological response to conflicts at work over longer periods of time is limited.

Because interpersonal conflict is inevitable in high-performing teams (Amason, 1996), start-up teams appear to be relevant context to study conflict and its effects. The essence of start-up teams (recently-formed companies with a clear growth ambition; Morris

et al., 2016) is that they need to take decisions on high-stake and conflictive issues, which require challenging discussions (Ensley et al., 2002).

The purpose of this study is to investigate the association between perceived conflict in start-up teams over a period of 11 weeks on HCC levels in start-up team members.

2. Method

2.1. Participants

A power analyses using G*Power (Version 3.1.9.3; Faul et al., 2007) indicates that a sample size of at least 55 participants is required to detect a medium effect size ($f^2 = 0.15$), characteristic of most social psychological findings, considering a statistical power of 0.80, and given α level of .05. The sample included in the present study is composed of 63 healthy adults (mean age = 29.02, $SD=5.51$; 30.2% women) who are start-up team members from 33 start-up ventures in Flanders (Belgium). There is no comparable research study examining conflict at work and HCC. Given that the focus of this study is on perceived conflicts in start-up teams, we included startups only with at least two co-founders or with a clear top team of at least two members. In the final sample, the number of members per startup who joined the research was ranging from 1 to 4, with an average of 1.90 members per startup. The majority of the final sample (77.8%) were members of the startup top team, while 22.2% were employees in the startup. Sixty-eight percent of the female used hormonal contraceptives, and 15.9% of the whole sample used hair treatment.

2.2. Procedure

One hundred twenty-four startup team members were, after giving their informed consent, asked to fill out a baseline questionnaire followed by an invitation via email to fill out a short questionnaire every week at the end of the week during 11 consecutive weeks. To minimize potential recall bias, we only included responses to the questionnaires that

were given by the participants with no delay, that means during the week the questionnaires were distributed by email. After the completion of the 11-week questionnaire period, we collected the hair samples on average after 14.5 days after their filling out the last weekly questionnaire. Two respondents withdrew from the study. Also, we failed to collect weekly questionnaire data on 207 occasions (15% out of 1342 possible weekly data points for the sample) and we excluded 209 data points (16% out of possible weekly data points), because the respondents did not fill out the weekly questionnaires during the week they were asked to do so. Finally, six participants were excluded because of health issues and one because of not filling out the baseline questionnaire. This gave us a total number of 108 participants. Out of these, 63 participants provided hair samples. Therefore, the final sample included 63 participants with a total of 430 time points. Participation in the study was voluntary, and the data were treated in a confidential way. Ethical approval for research was received from the University Ethics Committee. Table 1 shows the characteristics of the sample used in this study.

2.3. Measures

2.3.1. Perceived Start-up Team Conflict

Conflict was measured using a 4-item version of the COCO scale (Kozusznik et al., 2018) shortened by the authors (mean Cronbach α for 11 consecutive weeks = .70). Each of the items refers to the extent to which a person experienced disagreements with their startup team during the past week regarding each of the following four issues: money, norms, teamwork, and vision. Response scale was ranging from 1 (No, I totally disagree) to 7 (Yes, I totally agree), where higher scores indicate greater levels of perceived conflicts. The scores for the four items were averaged for each week, resulting in a continuous score for this variable (Norman, 2010). Because we were interested in the total level of conflict

perceived by each start-up member during the 11 weeks, we obtained the index of average perceived conflict by aggregating the weekly conflict scores for the 11 weeks.

2.3.2. Perceived Stress at Work

Perceived stress at work was measured using one-item Visual Analogue Scales (VAS) (Lesage and Berjot, 2011). We asked participants to indicate on a continuum of 100 possible points to what extent they felt stressed at work during the past week. The response ranged from 1 (Not at all) to 100 (Extremely). As in the case of perceived conflict, we were interested in the total level of stress at work perceived by each start-up member during the 11 weeks. Therefore, we obtained the index of perceived stress at work by aggregating the weekly stress scores for the 11 weeks.

2.3.3. Cortisol

Three-centimeter hair strands (each of at least 7.5 mg) were cut as close as possible to the scalp from a posterior vertex region. Based on an average hair growth rate of about 1 cm per month (Pragst and Balikova, 2006), these 3-cm segments represent hair grown over the past three months. In case of three participants, the length of the segments was 2 cm. HCCs were determined with an immunoassay method by the laboratory of Prof. Kirschbaum (Department of Psychology, Technische Universität Dresden, Germany), following the laboratory protocol (see Russell et al., 2015 for a more detailed description).

2.4. Analyses

We carried out linear regression analyses in SPSS v25. We controlled for age, sex, BMI, SES, use of contraceptives, hair wash frequency per week, hair treatment, status in the startup (top-team member or employee), and stress levels. Also, given that the sample was gathered from across 33 different organizations, we accounted for this variability in our analyses by calculating Box's M to test whether there are relevant differences in the data

between the different organizations. The analyses of standardized residuals and cook distances indicate that there are neither multivariate outliers ($\pm 3SD$) nor influential cases (>1.0) in our data.

3. Results

Descriptive statistics and correlations among the variables in our study are displayed in Table 1. Taking as reference the hair cortisol value ranges for healthy working adults of $10.8 \pm 9.4 \text{ pg/mg}$ obtained by Gidlow and colleagues (2016), we can describe the levels of HCC in our sample ($M=7.04$, $SD=5.90$) as medium. As the Table 1 reveals, the variability in the perceived conflict over 11 weeks in our study is rather limited, showing that startup members in the current sample are not perceiving on average high levels of conflict in their entrepreneurial teams. Specifically, the average perceived conflict scores were ranging from 1.00-5.10 on a 1-7 scale. Correlations show marginally significant association between perceived conflict and stress ($r=.21$, $p=.098$). The results of Box's M statistic ($p = .89$) indicate that the variance-covariance matrix of HCC can be assumed to be equal in the different startups. Regression analyses show that the level of perceived conflict over 11 weeks is positively associated with HCC ($F=4.81$, $p=.032$, $Beta=.27$, $p=.032$, $CI [LL=.020; UL=.432]$), see Table 2. This relationship holds after controlling for age, sex, BMI, SES, use of contraceptives, hair wash frequency, hair treatment, status in the startup, and stress levels ($Beta=.27$, $p=.039$, $CI [LL=.011; UL=.441]$), none of which was significantly associated with HCC (all $ps > .05$). Also, the relationship between perceived conflict and HCC remains the same after excluding the three participants with hair length segments of 2 cm. The results also show that the levels of stress over 11 weeks are not significantly associated with HCC ($Beta=.09$, $p=.53$, $CI [LL=-.01; UL=.01]$).

4. Discussion

This study sought to investigate the relationship between perceived conflict over a period of 11 weeks on the levels of HCC, a biomarker of long-term exposure to work stressors (Herr et al., 2018; van der Meij et al., 2018), in real start-up ventures.

The results go in line with researchers showing that interpersonal conflict at work is a stressor associated with negative outcomes (De Dreu and Weingart, 2003; Dijkstra et al., 2009). Also, they suggest that, at the physiological level, perceived conflict over longer time can have negative health outcomes for start-up members, potentially leading to pathology (Chrousos, 2009). In this way, we reiterate that HCC can serve as a biomarker of long-term exposure to (specific) work stressors (Herr et al., 2018; van der Meij et al., 2018), such as interpersonal conflict.

The fact that, in this study, we found a significant association between conflict and HCC and a non-significant relationship between general levels of perceived stress at work and HCC resonates with a meta-analysis of Stalder and colleagues (2017) who showed general self-reported stress to be unrelated to HCC. The fact that such a specific stressor as conflict is related to HCC echoes van der Meij and colleagues (2018) who suggested that, in order to detect a significant relationships with HCC, it is necessary to investigate specific sources of stress (e.g., conflict). Additionally, we may explain this significant association as due to the fact that, in this research, we increased the quality of the questionnaire data by employing a more elaborate longitudinal design as suggested by (Stalder et al., 2017). Repeated weekly measurements employed in this study allow to assess phenomena closer to the moment when they occur, helping, in this way, to minimize retrospection bias.

To our knowledge, this is the first study to analyze the levels of HCC in association to long-term interpersonal conflict, where participants reported their level of perceived conflict throughout 11 weeks corresponding largely with the HCC accumulation period. By

using repeated weekly measurements, we increased the quality of the questionnaire data (Stalder et al., 2017), allowing to assess phenomena closer to the moment when they occur, and minimizing retrospection bias. Also, we employed a sample of real high-performance start-up team members in a real-life setting, thereby increasing ecological validity.

Some limitations warrant a cautious interpretation of the results of this study. First, in this study we used a global score for HCC during the three months instead of analyzing separate HCC segments for each month. We suggest future studies should employ fine-grained monthly HCC measurements to allow for an analysis of the long-term dynamics of the conflict-HCC relationship. Second, the startups studied did on average not show high conflicts levels. Instead, the range of perceived conflict over 11 weeks is restricted. This range restriction of the perceived conflict is reflecting a common trend in conflict research of rather low mean conflict scores (Dijkstra et al., 2005; Greer et al., 2008; Jehn et al., 2008). Also, it can reflect some of the characteristics of the sample, as Belgium is known for a more conflict avoiding approach (Euwema & Verbeke, 2009). To increase the variability in the perceived conflict over time, future studies should expand the sample to include startup teams from other countries. Also, researchers in the domain of conflict should take utmost care of building trust in the research, so participants are willing to share deeper concerns.

In sum, our study shows that when assessing the relation between prolonged stress exposure and HCC in working population, it is important to consider specific sources of stress, such as interpersonal conflicts and to study the effects of prolonged exposure to it. Also, this study contributes to the literature on interpersonal conflict by exploring unmapped physiological effects of long-term conflict, that are often unavoidable in the day-to-day work of high-performing teams (Amason, 1996). Overall, the knowledge on the physiological effects of interpersonal conflict over longer time periods raises awareness

about the associated risks. This new knowledge can open new avenues for research that will arm high performing team members against the adverse effects of conflicts on their health and ensure a positive environment that would allow them to thrive.

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Table 1.

Descriptives and correlations among study variables.

Variable	M(SD)/n	correlations										
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Age	29.02(5.51)	1										
2. Sex (female/male)	19/44	-.16	1									
3. BMI	24.27(3.76)	-.05	.41**	1								
4. SES	6.78(1.13)	.09	.02	-.07	1							
5. Contraceptives (yes/no)	13/50	.13	-.78**	-.22	-.00	1						
6. Hair wash	4.33(2.13)	-.04	.09	.03	-.22	.03	1					
7. Hair treatment (yes/no)	10/53	-.09	-.28*	-.07	-.15	-.01	.03	1				
8. Status (top team/employee)	49/14	-.20	-.15	.06	-.41**	.01	.11	.08	1			
9. Stress	46.97(20.59)	.09	.04	-.08	-.09	-.10	-.24	-.12	-.12	1		
10. Perc. conflict	1.61(0.84)	.07	-.10	-.10	.05	-.03	-.12	.05	-.01	.21	1	
11. HCC_LN	7.04(5.90)	-.16	-.20	-.12	-.19	.11	.16	.11	.11	.09	.27*	1

Note. N = 63; ** $p < .01$, * $p < .05$; Sex: 1=women, 2=men; BMI: Body Mass Index; SES: Socio-Economic Status; Contraceptives: use of hormonal contraceptives (0=no, 1=yes); Hair wash: Hair wash frequency per week; Hair treatment: use of hair treatment (0=no, 1=yes); Status: Status in the startup (1=top team member, 2=employee); Perc. Conflict: Perceived conflict in startup top team; HCC: Hair Cortisol Concentration.

Table 2. Linear regression models

Dependent: HCC	Beta	<i>p</i>	95% CI	
			LL	UL
Model 1				
Perc. Conflict	.270	.032	.020	.432
Model 2				
Perc. Conflict	.271	.039	.011	.411
Age	-.218	.101	-.061	.006
Sex	-.281	.297	-1.231	.383
BMI	-.012	.931	-.055	.050
SES	-.142	.325	-.265	.089
Contraceptives	-.069	.767	-.910	.675
Hair wash	.209	.123	-.019	.156
Hair treatment	-.014	.922	-.584	.529
Status	-.040	.789	-.557	.426
Perc. stress	.085	.533	-.006	.012

Note. $N=63$, $R^2=.073$, $p=.032$. Perc. Conflict: Perceived conflict with startup team; Sex: 1=women, 2=men; BMI: Body Mass Index; SES: Socio-Economic Status; Contraceptives: use of hormonal contraceptives (0=no, 1=yes); Hair wash: Hair wash frequency per week; Hair treatment: use of hair treatment (0=no, 1=yes); Status: Status in the startup (0=top team member, 1=employee); Perc. Stress: Perceived stress.