

## Short Communication

# Perceived Stress, Physical Activity and Motivation: Findings from an Internet Study

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- Self-efficacy

**Abstract**

Regular performance of sports and physical activity is important for health promotion, including managing stress. The current study therefore tested the relationship of stress and physical activity with body mass index (BMI) as well as the behavioral predictors' intention, barriers, self-efficacy, and plans.

396 individuals participated in the study consisting of filling in an internet questionnaire. Study participants were between 17 and 79 years, and indicated a BMI between 17 and 53.

The minority was physically active (43.3%), and physical activity was related to a lower stress level ( $\chi^2$  (df=1)=4.25,  $p=.04$ ). However, when controlling for gender and BMI, stress was not related to physical activity any more: The higher the BMI, the lower the likelihood individuals were physically active ( $B=0.89$ ;  $CI=0.84, 0.95$ ). Moreover, if people had a higher intention, they were also more likely to be physically active ( $B=1.72$ ;  $CI=1.41, 2.10$ ). Furthermore, an interaction with stress transpired: In physically inactive individuals, stress perception seems to increase the motivation to become active. In already active individuals, the opposite pattern emerged ( $F=4.65$ ,  $p<.05$ ;  $\eta^2=.01$ ).

Implications could be to help active individuals to manage their stress to maintain high intentions and not to give intentions up due to feeling overwhelmed with managing stress and retaining their activity at the same time. Inactive individuals could benefit from becoming aware of their stress level and benefits of physical activity to actually adopt physical activity. While the data are only cross-sectional and findings should be interpreted with caution, the pattern can give important suggestions for designing interventions to increase physical activity and manage stress perceptions.

**ABBREVIATIONS**

TTM: Trans Theoretical Model; PC: Pre Contemplation; C: Contemplation; P: Preparation; A: Action; MA: Maintenance; N: Sample Size; BMI: Body Mass Index; M: Mean; SD: Standard Deviation; CI: Confidence Interval;  $\eta^2/R^2$ : Explained Variance;  $\Delta r^2$ : Change In Explained Variance.

**INTRODUCTION**

Regular sports performance and physical activity are important health promoting factors in the general population, especially in those individuals at risk for cardio-vascular diseases [1] and those with predisposed factors like a high BMI [2]. Recommendations are given regarding how much physical

activity should be performed to maintain and increase health. While people typically know about the benefits of physical activity and are intending to perform regular physical activity, many are not sufficiently active. This is especially true for those with higher levels of stress [3] or a higher body mass index (BMI) [2], with both being major risk factors for the occurrence of cardiovascular diseases (stress: [4]; BMI: [2]). Especially for a higher BMI and body fat percentage, it was found that physical fitness decreases them, which calls for action especially in this target group [5-8].

How people change their behaviors can be described by the stages of change as core constructs of the Trans theoretical Model (TTM; [9]). The TTM proposes five stages of change which individuals move through when deciding and actually changing

their behaviors. In the first stage, the Pre contemplation stage (PC), individuals do not consider behavior change in the near future. In the Contemplation stage (C), individuals consider performing health behavior but have not yet decided to change. In the Preparation stage (P), individuals prepare and plan the actual behavior change. In the Action stage (A), behavior is initiated. When behavior is performed and consolidated for a longer time, the Maintenance stage (Ma) is reached [9]. The question of the current study was: How many internet users are in the different stages? (*Research-Question 1*).

It was found that the stages and physical activity interrelate with perceived stress, showing that higher levels of physical activity are related to lower levels of perceived stress [10-12]. This was also described in the Carry-Over Action Model [13] and the current study aimed at replicating this relationship. In other words: Are the proportions of people who perceive themselves as stressed larger in the inactive stages (PC, C, P) than in the active stages (A, Ma)? (*Research- Question 2*).

When people need to be motivated to become physically active, factors like intention, self-efficacy and plans are of importance as they can be intervened on [14]. So far, only little can be found on the interrelation of stress, BMI, physical activity and its predictors (e.g., [2,15,16]). Therefore, the current study aimed at (a) testing whether physical activity is related with stress when controlling for BMI and (b) evaluating whether intention, barriers, self-efficacy and plans are related with physical activity when controlling for stress and BMI (*Research-Question 3*).

As Armon [17] and other authors found that stress interacted with physical activity, the current study goes a step further and aims at testing whether an interaction of physical activity and stress exists for the mean level of predictors of health behavior (*Research-Question 4*).

## MATERIALS AND METHODS

### Procedure

Online-studies give researchers the potential to reach large samples of persons with diverse socioeconomic status and age, and from different geographic regions [18]. German-speaking internet users were invited to participate in the study via two web-pages (on heart health, university). In addition, press releases were used to recruit study participants. After the study was introduced, participants provided informed consent and followed a link to a self-administered questionnaire.

### Participants

396 study participants indicated that they wanted to participate seriously and responded to the questionnaire. 110 men and 264 women participated, 22 people did not indicate their gender. Study participants were between 17 and 79 years, on average 48.57 years (Mode=50 years; SD=13.65). Individuals were asked to report their body weight and body height, which were used to calculate their BMI. Study participants had a BMI between 17.37 and 53.50 ( $M=25.37$ ;  $SD=4.77$ ), with 5 individuals (1.3%) being underweight, 204 (51.5%) normal weight, 101 (25.5%) overweight, and 60 (15.2%) obese; additionally 26 did not report weight or height.

## Measures

*Stress* was assessed with the binary item asking to indicate whether individuals had increased (occupational) stress. The assessment of *stage* was done asking the participants, "Please think about your typical weeks: Did you engage in physical activity at least five days per week for 30 minutes or more (or 2.5 hours during the week), in such a way that you were moderately exhausted?" Then, the instruction followed: "Please choose the statement that describes you best." Participants responded to a rating scale with the verbal anchors "No, and I do not intend to start" (Pre contemplation), "No, but I am considering it" (Contemplation), "No, but I seriously intend to start" (Preparation), "Yes, but only for a brief period of time" (Action), and "Yes, and for a long period of time" (Maintenance). To determine whether study participants were *physically active*, Action and Maintenance were combined; those individuals categorized as being in Pre contemplation, Contemplation or Preparation were grouped as being inactive.

*Intention* was assessed with the item "I intend to perform physical activities at least five days per week for 30 minutes". *Plans* were assessed with the item "I have already planned where, when and how I will be physically active." *Barriers* were assessed "If I engage in physical activity at least five days per week for 30 minutes, then this cost me a lot". The *self-efficacy* item was worded "I am confident that I can be physically active for 30 minutes, five times a week, even when it is hard sometimes". Answers for intention, plans, self-efficacy and barriers were assessed using seven-point scales, ranging from *totally disagree* (1) to *totally agree* (7). All measures were validated before administration [19].

## RESULTS AND DISCUSSION

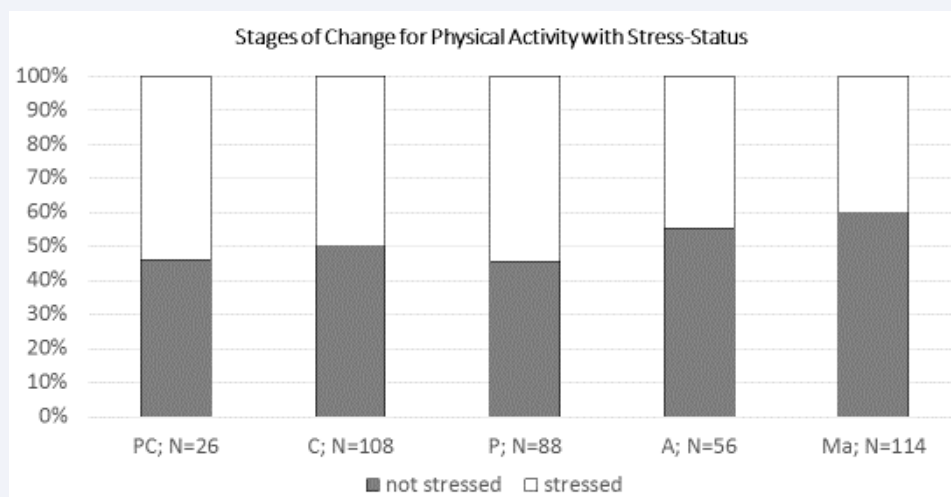
### Numbers of study participants in the different stage groups

Figure 1 indicates the number of study participants in the different stages. Thus, *Research-Question 1* can be answered: 26 individuals (6.6%) were in the Pre contemplation stage, 108 (27.6%) in the Contemplation stage, 88 (22.5%) in the Preparation stage, 56 (14.3%) in the Action stage and 114 (29%) in the Maintenance stage.

If the stages were combined, the majority was inactive (56.7%). This matches previous findings that too many individuals are not physically active while actually knowing about the benefits thereof or already intending to change [e.g., 2-4].

### Association of Physical Activity and Perceived Stress

Individuals in the five stage groups (proportions see Figure 1) were compared regarding their perceived stress. As can be seen, in Figure 1, of individuals in the Pre contemplation stage, Contemplation stage and Preparation stage, every second individual or more perceived high stress levels (on average 52.3% i.e. 116 of 222 individuals). Of those already performing the goal behavior, independently of whether they were in the Action stage or the Maintenance stage, only 41.8% persons (71 out of 170) perceived high stress levels. This difference was significant with  $\chi^2(df=1)=4.25$ ,  $p=.04$ . Thus, *Research-Question*



**Figure 1** Proportion of individuals reporting high stress level (white) versus low stress level (grey) in the different stages of change  
Note. PC=Precontemplation; C=Contemplation; P=Preparation; A=Action; M=Maintenance; N=Sample Size.

2 can be answered with the proportions of people who perceived themselves as stressed being significantly larger in the inactive stages (PC, C, P) than in the active stages (A, Ma). Thereby, previous results [e.g., 6-8,12] could be replicated with the stages of change construct [5], and can provide evidence for certain assumptions of the Carry-Over Action Model [13].

### Prediction of Physical Activity by Perceived Stress and Social-Cognitive Variables

It was tested whether physical activity status could be predicted by stress level while controlling for gender (as one typical socio demographic variable) and BMI (Table 1). Gender was revealed as not significantly related to physical activity. Individuals with a higher BMI were less likely to perform physical activity (Table 1, Model 1). On top of that, stress was not significantly related to physical activity levels (Table 1, Model 2).

In addition, social-cognitive determinants were tested in predicting physical activity in model 3 and 4: When intention was introduced in model 3, those study participants harboring higher intentions were almost two times more likely to be physically active. However, when barriers, self-efficacy and plans were additionally included in model 4, intention was not a significant predictor any more. Individuals with low barriers, high self-efficacy and more plans were more likely to be physically active (see Table 1 for CIs). With the final model, almost half of the behavioral variance could be explained by the predictor variables ( $R^2=.51$ ). Consequently, *Research-Question 3* can be answered with: physical activity is not related to stress when controlling for BMI; intention is predicting physical activity only if barriers, self-efficacy and plans are not included; barriers, self-efficacy and plans are the strongest predictors of physical activity while BMI remains a significant variable.

### Effect of Stress and Physical Activity and Their Interaction on BMI and Social-Cognitive Determinants

Stress did not significantly affect BMI and social-cognitive variables (see Table 2), however, physical activity did, validating the results with the logistic regression. Physically inactive study

**Table 1:** Logistic regression predicting being physically active.

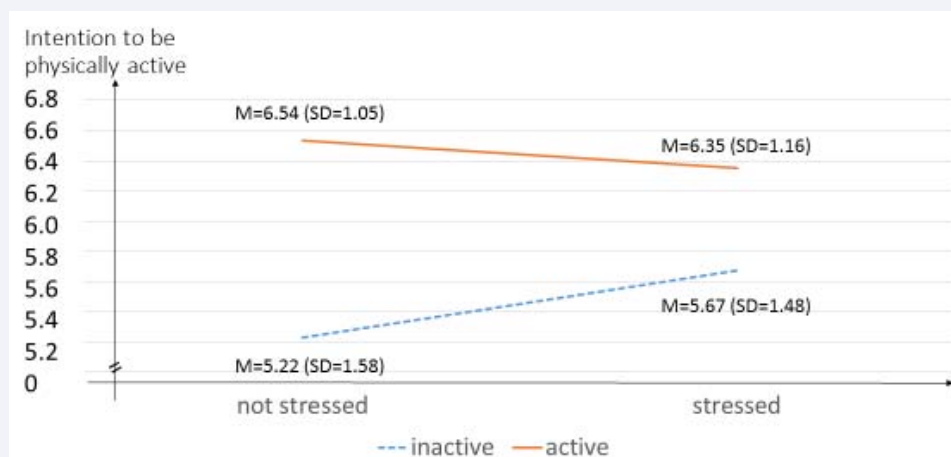
	Model 1	Model 2	Model 3	Model 4
Variable	B [95% CI]	B [95%CI]	B [95%CI]	B [95%CI]
Constant	29.56	30.72	0.99	1.47
Gender	0.89 [0.84, 0.94]	0.72 [0.44, 1.20]	0.72 [0.42, 1.22]	0.85 [0.44, 1.64]
BMI	<b>0.89</b> <b>[0.84, 0.94]</b>	<b>0.88</b> <b>[0.84, 0.94]</b>	<b>0.89</b> <b>[0.84, 0.95]</b>	<b>0.88</b> <b>[0.82, 0.95]</b>
Stress		0.76 [0.48, 1.20]	0.71 [0.44, 1.16]	0.74 [0.41, 1.33]
Intention			<b>1.72</b> <b>[1.41, 2.10]</b>	1.01 [0.78,1.30]
Barriers				<b>0.77</b> <b>[0.66, 0.91]</b>
Self-Efficacy				<b>1.92</b> <b>[1.60, 2.31]</b>
Plans				<b>1.18</b> <b>[1.01, 1.38]</b>
R <sup>2</sup>	.08	.09	.21	.51
ΔR <sup>2</sup>		.01	.12	.30

**Abbreviations:** CI= Confidence Interval; BMI=Body Mass Index; R<sup>2</sup>=Explained Variance; ΔR<sup>2</sup>=Change In Explained variance; Bold indicates statistically significant findings.

**Table 2:** Effects of stress and physical activity and their interaction effect on BMI and predictors of behavior change tested in a 2-factorial ANOVA (stress, physical activity, and stress\*physical activity) with BMI, intention, barriers, self-efficacy, and plans; F-values are reported in the table.

Test Variable	Stress	Physical activity	Stress*Physical activity
BMI	3.21	18.43** Eta <sup>2</sup> =.05	0.16
Intention	0.82	46.29** Eta <sup>2</sup> =.12	4.65* Eta <sup>2</sup> =.01
Barriers	1.13	62.59** Eta <sup>2</sup> =.15	0.47
Self-efficacy	0.06	193.80** Eta <sup>2</sup> =.35	0.68
Plans	1.02	63.96** Eta <sup>2</sup> =.15	1.79

**Abbreviations:** BMI=Body Mass Index; Eta<sup>2</sup>=Explained Variance; \*,  $p<.05$ ; \*\*,  $p<.01$ .



**Figure 2** Interaction effect of physical activity status and perceived stress level for means in intention to perform physical activity.

participants reported a higher BMI, lower intentions, higher barriers, lower self-efficacy and less plans than physically active individuals (Table 3). The interaction of stress and physical activity was significant for intention only, and only explained a low proportion of variance (1%; see Table 2).

Inspecting the mean patterns for physically active and inactive individuals with low or high stress level revealed the pattern in Figure 2 and the following: Not stressed inactive individuals were motivated at a lower level than inactive ones who were highly stressed. The opposite pattern transpired for active study participants: Those who reported being physically active and highly stressed were less motivated to perform physical activity in comparison to those study participants not feeling stressed (Figure 2). Accordingly, *Research-Question 4* could be answered with: An interaction of physical activity and stress exists for the mean level of intention only. This is an important finding for motivating individuals who become inactive and are in need of getting back to physical activity routines to train their fitness and maintain their health and for motivating inactive ones adopting physical activity [5-8].

## CONCLUSION

Individuals not performing regular physical activity were found to be stressed at a higher level than physically active

**Table 3:** Characteristics of study participants being physically inactive or physically active in terms of their reported BMI, intention, barriers, self-efficacy and plans.

	Physically inactive	Physically active
BMI	M=26.24 SD=5.30	M=24.13 SD=3.81
Intention	M=5.46 SD=1.54	M=6.45 SD=1.097
Barriers	M=4.92 SD=1.74	M=3.32 SD=1.99
Self-efficacy	M=3.35 SD=1.77	M=5.86 SD=1.52
Plans	M=3.98 SD=2.29	M=5.78 SD=1.82

**Abbreviations:** BMI=Body Mass Index; N=Sample Size; M=Mean; SD=Standard Deviation.

study participants. Due to the cross-sectional nature of the study, we do not know whether physical activity serves as a stress buffer or whether individuals with high stress levels just do not manage to adopt physical activity [6,13]. Regardless of the direction of this relationship, inactive individuals need help to adopt a healthy lifestyle. Resources in this process are intention, barriers management, self-efficacy and plans, which can easily be addressed in interventions [13,20].

The interaction of perceived stress, intention and behavior directs towards individualized interventions: In inactive individuals stress perception might increase the intention to become active. In already active individuals the opposite pattern transpired. The implication could be that active individuals should manage their stress to still maintain high intentions and not to give them up due to feeling overwhelmed with managing stress. They need to retain their activity which might be difficult when stress levels rise. Effective stress management, like cognitively coping with daily hassles, could therefore help active individuals to maintain activity. On the contrary, in inactive people, physical activity could serve as a stress management strategy. These findings should guide health behavior change programs, as a healthy lifestyle is imperative for promoting health especially in individuals at risk for cardio-vascular diseases.

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