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OPPOSITE PSYCHOLOGICAL STATES ASSOCIATED WITH RUNNING IN SOLITUDE AND STREET RACE PARTICIPATION

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Abstract:
Running is associated with positive acute psychological effects. However, the context of running, which has received little empirical attention to date, could be expected to mediate the related subjective experiences. In this *in-situ* (real life) cross-sectional study, we compared the subjective psychological states before and after running in solitude and in street race running. Seventy males (n = 31 running alone and n = 39 running in a street race) completed the short version of the Positive Affect and Negative Affect Schedule (PANAS), rated their core affect (conceptualized as the momentarily perceived overall physical and psychological feeling state), and their appraised satisfaction with the completed run. Although the two groups did not differ in satisfaction with their run, except for negative affect which did not change in either of the groups, the results revealed opposite trends in psychological experiences in all measures. Positive affect, mental-, and physical core affect increased after running in solitude while they all decreased after the street race. The current results suggest that peak affective experience occurs *after the run* when people plan and perform their run alone, while the comparable top experience occurs *before the run*, likely due to the excitement of participation and social interaction, during street race running. The current work sheds light on the strong impact of the running situation on the acute psychological states associated running.

Keywords: affect, exercise, expectation, mood, physical activity

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1. Introduction

Epidemiological research reveals that physical activity has numerous health benefits (Lee et al., 2011; Miller et al., 2016). Apart from physical health benefits, regular physical activity has positive effects on psychological well-being (Acevedo, 2012). While numerous forms of exercise yield acute psychological benefits including dance aerobics (Rokka, Mavridis, & Kouli, 2010), cycling (Petruzzello, Snook, Gliottoni, & Motl, 2009), hatha yoga (Lavey et al., 2005; West, Otte, Geher, Johnson, & Mohr, 2004), Bikram yoga (Szabo, Nikházy, Tihanyi, & Boros, 2016), shadowboxing (Li & Yin, 2008), swimming (Valentine & Evans, 2001), walking (Dasilva et al., 2011) and others, running is one of the most popular physical activities, because it is relatively inexpensive, it can be performed almost anywhere and at any time (Szabo & Ábrahám, 2013). However, most studies examining the psychological effects of running emerge from artificially planned studies in artificial research environments, rather than self-scheduled running in a self-selected environment, which decreases the external validity of the experimenter-planned studies (Szabo & Ábrahám, 2013).

Another important issue of debate in the field is whether the psychological effects of running are "dose-dependent", in which case faster and longer running could be expected to yield greater psychological benefits. The dilemma was examined by several scholars. In their review of over 200 studies, Ekkekakis and Petruzzello (1999) could not provide unambiguous answer to the question. Later, Szabo (2003) presented two studies in which the intensity (speed) of running was not related to the acute psychological benefits of exercise. His findings were further corroborated by a series of other inquiries (Minjung, Sungwoon, Jingu, Petruzzello, & Hatfield, 2010; Rokka et al., 2010; Szabo & Ábrahám, 2013). Reed and Ones (2006) based on the meta-analysis of 158 studies concluded that there was no evidence for exercise intensity and/or duration threshold for positive affect to emerge after exercise. Another major literature review of over 100 studies, led Ekkekakis (2009) to conclude that exercise performed at a person-selected work intensity may be the most adequate for acute psychological benefits to occur. Accordingly, the acute psychological benefits of exercise do not appear to be intensity-dependent and runners engaging in faster or slower and shorter or longer runs may be expected to report similar psychological benefits.

In the everyday life, most runners control the duration as well as speed of their run. These two features of the exercise might be mediated by various factors (i.e. food intake, tiredness, time of the day, weather etc.). Therefore, *in-situ* research investigating the acute psychological effects of running have greater external validity than research performed in well-controlled, but artificial, laboratory environments in which the experimenter prescribes both the duration and the speed of the run (Ekkekakis, 2009; Szabo and Ábrahám, 2013). However, to date few *in-situ* studies have examined the psychological benefits of running. One of them is a study comparing the effects of running on a treadmill and ergometer cycling performed by volunteers attending a fitness center. The results revealed that while running was characterized by greater

actual and perceived effort, there were no differences in the acute psychological benefits of the two forms of exercise (Rendi, Szabo, Szabó, Velenczei, & Kovács, 2008). In another *in-situ* investigation of runners completing a self-planned run on an urban running track, acute positive psychological benefits were observed regardless of the distance or the duration of the run (Szabo & Ábrahám, 2013). The authors of the study concluded that running characteristics play a small role in the acute psychological benefits of the exercise, which may be more closely related to expectancy and placebo effects. The latter makes sense, since people approach or avoid behaviors with some (associated) expectancies, and positive expectancies associated with exercise could boost the reported psychological experiences (Szabo, 2013). Indeed, the most recent meta-analysis has revealed that a significant portion of the reported psychological effects of acute exercise could be attributed to expectancy-related placebo effects (Lindheimer, O'Connor, & Dishman, 2015).

While it is generally acknowledged that an episode of running is associated with positive psychological changes, the context of the situation, that was rarely examined to date, may play an important role in the subjectively experienced effects. The context of running impacts *expectancy* associated with the activity. Indeed, in a study of 12 male college distance runners who ran alone or with peers, the authors found that participants enjoyed more running in group than alone, but ran faster alone than in a group (Carnes & Barkley, 2015). Thus, the social aspect of the run did not increase motivation during the self-paced exercise, but it did increase enjoyment. Regrettably, psychological measures, other than reported enjoyment, were not taken in this study. In another experimental design, the researchers found that outdoor running was associated with greater psychological benefits than running on a treadmill, or on an indoor track (LaCaille, Masters, & Heath, 2004), thus clearly demonstrating the mediating role of the context of running in the acute psychological changes associated with the activity. While the above studies have shown that both the physical (i.e. outdoor) and social (i.e. running in group) contextual features of running have impact on the psychological measures, they were performed in experimental rather than natural (*in-situ*) environments. Therefore, the bout of running was planned *for them* and not *by them*. The expectations associated with prescribed and planned activities may generate different results.

This *in-situ* study was designed to explore changes in affect following outdoor running in two different situational contexts. To the authors' best knowledge, the acute psychological effects of street race running were not examined to date, but the unique context of this situation (social and challenge) may be expected to generate different results compared to the running in solitude. Based on the results obtained by Carnes and Barkley (2015) we hypothesized that participation in street-race running will be associated with more positive affect than running alone. Nevertheless, based on Rendi et al.'s (2008) and Szabo's and Ábrahám's (2013) *in-situ* findings, we anticipated that running in solitude will also yield positive changes in affect, but lesser than in the street-race.

2. Materials and Methods

2.1 Participants

Participants were recruited by using systematic randomization. Accordingly, every third runner preparing to start her or his run on a 5-km long public running path (running in solitude group), or during an urban street race (street race participation group), was politely approached by the experimenters and invited to take part in the study. After fully explaining the task involved in participation, less than one in ten (< 10%) of the runners have rejected the invitation to take part in the study. The conditions of participation were that the volunteering runners be at least 18 years old and to consent in writing to their participation. Seventy runners (31 running in solitude and 39 running in street race) took part in the study. The authors set a delimitation for the study, and only collected data from males. The participants' characteristics are shown in Table 1.

Table 1: Characteristics of the participating men in the two groups which differed from one another in several aspects. (Stars denote statistically significant differences between the groups (p value given), while NS indicates no significant differences.)

Measures	Running in Solitude	Street-Race Running	*p*
Number of participants	n = 31	n = 39	NS
Age (years)	30.55 (8.18)	35.74 (6.98)	= .006*
History of running (months)	98.06 (95.24)	81.44 (81.29)	NS
Frequency of weekly running	2.32 (1.11)	3.03 (1.42)	= .027*
Distance of weekly running (km)	39.52 (14.22)	61.67(21.84)	< .001*

2.2 Materials

In conjunction with a short demographic questionnaire assessing the running habits, like frequency of the weekly runs, the average distance of weekly runs, as well as running experience, the Positive and Negative Affect Schedule (PANAS - Watson, Clark, & Tellegen, 1988) was used for measuring momentary psychological states before and after running. In this work we used the 10-item psychometrically validated version of the PANAS (Thompson, 2007), which consists of five positive items (i.e., active) and five negative adjectives (i.e., nervous). The items are rated on a 5-point Likert scale ranging from 1 (very slightly, or not at all) to 5 (very much). A total score is then obtained for both positive and negative items by summing up the respective ratings. The original PANAS comes with excellent psychometric properties (Thompson, 2007; Watson et al., 1988). The internal consistency of the PANAS adopted in the current work (Gyollai, Simor, Köteles, & Demetrovics, 2011) was (Cronbach's alpha) .73 for positive affect subscale and .65 for negative affect subscale, which are on the lower end of the acceptable spectrum of the internal reliability.

To complement the information obtained with the PANAS, we also employed two single-item (Andrews & Withey, 1976) 15-point Likert scales, that ranged from 1 (very bad) to 15 (very good), to determine the level of the momentary *overall* physical- and psychological feeling state, which were conceptualized as "core affect" based on

Russell's (2003) work. Core affect is a basic process of a person's conscious psychophysiological state available as the natural (non-reflective) feeling, such as feeling good or bad, feeling tired or energized (Russell, 2003). Another single-item 15-point Likert scale (1 meaning "not at all" and 15 implying "maximally") was presented after the run to estimate the level of satisfaction associated with the completed run.

2.3 Procedure

After consenting to participation, volunteers selected via the one-in-three randomization method completed the questionnaires at baseline (initial assessment). This task lasted about two minutes in all cases. Subsequently, the runners were instructed to return (after the run) to the experimenter in charge, who was in a fix place, for completing the second assessment within five minutes after the runs. The data collection was identical in both conditions, running alone on the urban running path or taking part in the street-race. After completing the questionnaires for the second-time, runners were thanked for their participation in the study and in case they had questions or queries about the study, they were answered by the experimenters. All tests took place on the week-ends between 10.00 h and 16.00 h, in dry weather.

2.4 Data Analyses

Differences in the participants' characteristics were examined with a multivariate analysis of variance (MANOVA). The pre- and post-run psychological data were analyzed with a group by time mixed model repeated measures MANOVA. The possible differences in the reported level of satisfaction with the completed run was tested with a one-way analysis of variance (ANOVA). All statistical calculations were performed with the Statistical Package for Social Sciences (IBM SPSS, v. 25. IBM Corp., 2017). Due to the arguably low sample size in each group, in addition to reporting the effect sizes, we also report the power (1-β) for the significant results.

3. Results

3.1 Participants' Characteristics

The MANOVA yielded a statistically significant multivariate effect revealing group differences in participant characteristics (Pillai's trace = .322, F[4,65] = 7.72, $p < .001$, effect size, partial Eta squared [η_p^2]) = .322, observed power [1-β] = .996). Accordingly, street-race runners were older, ran more frequently, and completed longer distances than those running in solitude (see Table 1). Therefore, age, weekly frequency, and weekly distance of running were used as covariates in the main analysis consisting of the group by time repeated measures MANOVA of the psychological measures.

3.2 Main Analyses

The 2 (group) by 2 (time) repeated measures MANOVA with four dependent measures (positive affect, negative affect, mental core affect and physical core affect) and the three

covariates (age, weekly frequency of running and weekly distance of running) yielded a statistically significant group by time interaction (Pillai's trace = .229, $F[4,62] = 4.61$, $p = .003$, $\eta_p^2 = .229$, $1\text{-}\beta = .930$). None of the covariates was significant. The univariate tests of the MANOVA showed that the interaction was statistically significant in positive affect ($F[1,65] = 11.73$, $p = .001$, $\eta_p^2 = .153$, $1\text{-}\beta = .921$, Figure 1), mental core affect ($F[1,65] = 11.21$, $p = .001$, $\eta_p^2 = .147$, $1\text{-}\beta = .909$, Figure 2), and physical core affect ($F[1,65] = 13.79$, $p < .001$, $\eta_p^2 = .175$, $1\text{-}\beta = .955$, Figure 3). There were no statistically significant results associated with negative affect. There were no between-group differences before and after running, nor within-group differences from pre- to post-run.

The ANOVA, testing the group differences in the self-reported level of satisfaction with the current run, was not significant (running in solitude group $M = 10.61$ [$SD = 2.80$] and street race running group $M = 10.97$ [$SD = 2.65$]).

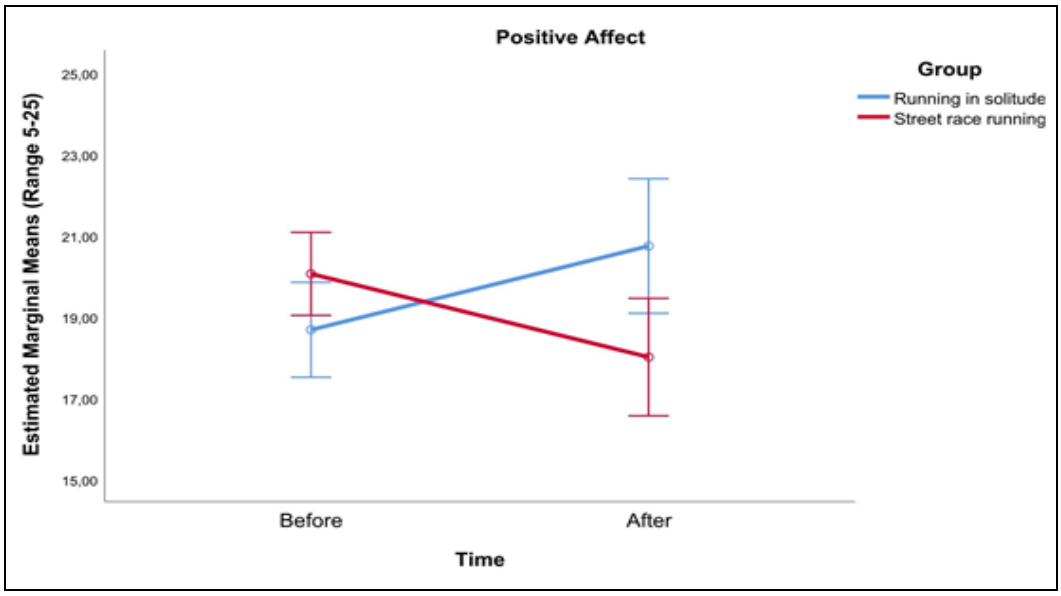

Figure 1: Group by time interaction in positive affect. Means ± 95% confidence intervals

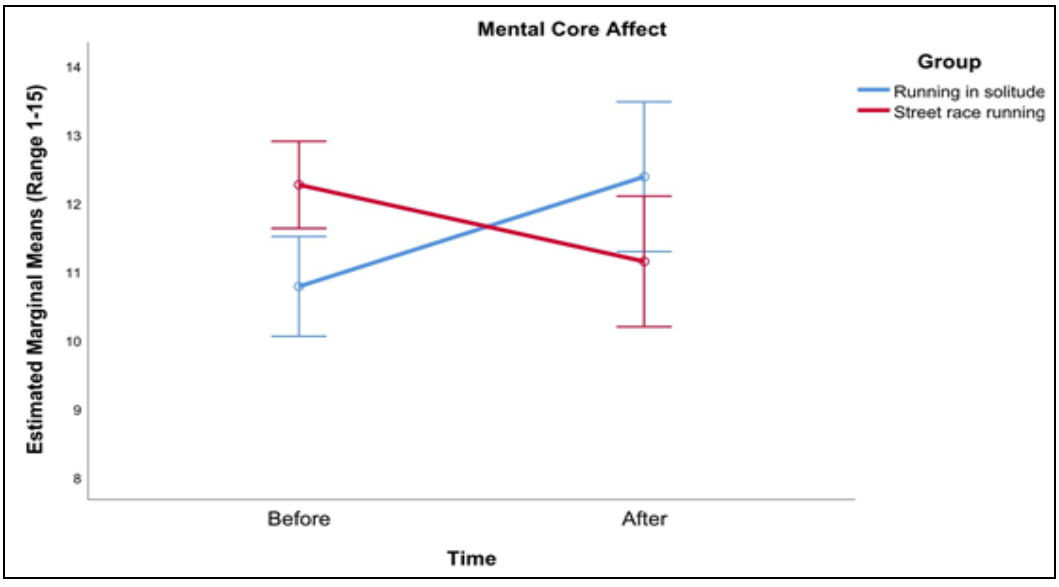

Figure 2: Group by time interaction mental core affect. Means ± 95% confidence intervals

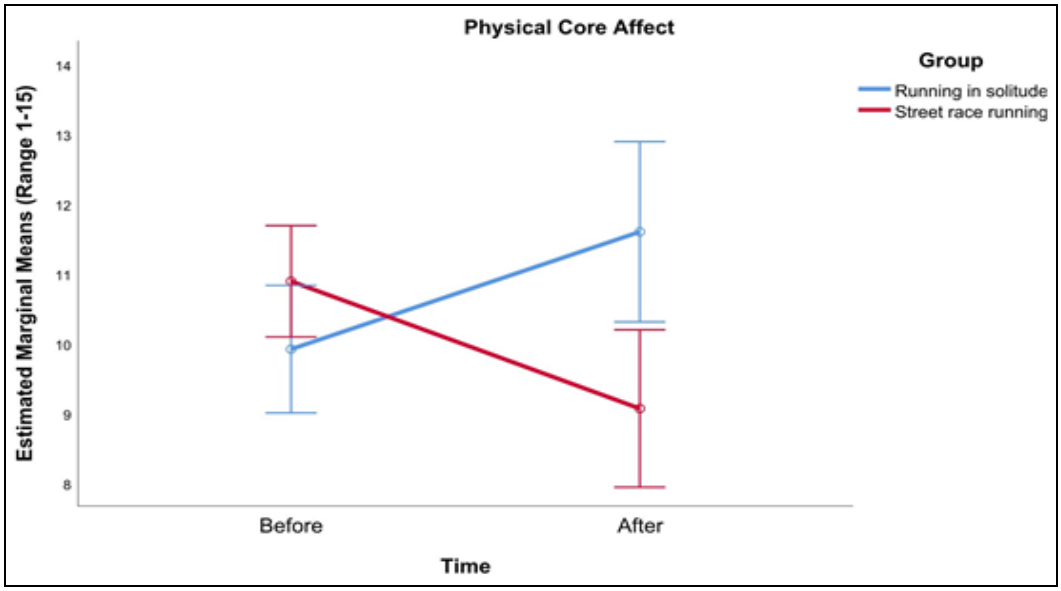

Figure 3: Group by time interaction in physical core affect. Means ± 95% confidence intervals

4. Discussion

The results of the current study support the hypothesis that the situational context of running influences the feeling states, or affect, associated with the activity. The group by time interactions showed opposite trends in the changes in affect during running in solitude and during the street-race. The former, in agreement with past research (Rendi et al., 2008; Szabo & Ábrahám, 2013), showed a trend of increase in positive affect that was strengthened by a similar trend in mental- and physical core affect as well. On the contrary, street race participation was associated with a trend of decrease in these measures over the period of run. These results are unique, because they show that the positive psychological experience surfaces *at the end* of the run when one runs in solitude, while the same experience may be apparent *at the beginning* of the run during a street-race event. One explanation for the findings is that when running in solitude runners expect to gain a reward through the completion of the run. This expectation may surface in their post-run appraisal of affect (Szabo, 2013). On the other hand, street-race may be associated with positive excitement, anticipated challenge, and social interactions (Carnes & Barkley, 2015), some of which may dissipate after the race. Indeed, long-ago it was demonstrated that social interaction, which is an important aspect of the urban street-races, is associated with subjective affective experiences (Berry & Hansen, 1996). Combined with increased pre-race excitement, which is the combination of the anticipated challenge and arousal (Russell, Weiss, & Mendelsohn, 1989), they appear to be responsible for the peak affective experience at the beginning of the race which diminishes towards the end of the run. Therefore, several factors determine a specific running situation, which in turn generate a unique (or idiographic) context that mediates the associated subjective psychological states. The present cross-sectional work provides ecological support for the hypothesis that the acute psychological effects of *in-situ* (real life) running largely depend upon the context of the

running situation, as it was also demonstrated in ecologically less reliable experimental research (LaCaille et al., 2004). The scholastic implication of the findings is that the results of the studies on the acute psychological effects of running cannot be compared unless the context of the running is identical or at least highly similar.

Although the two groups differed in age, the frequency of weekly runs, and the average distance of weekly running, these factors did not influence the results. This finding is consistent with the earlier report of Szabo and Ábrahám (2013), who showed that various characteristics of one's running do not have significant impact upon the acute psychological benefits emerging from a single run. The lack of change in negative affect in either condition may be attribute to the fact that a self-planned run is associated with positive expectations related to a gain, which is may be an anticipated feeling of wellbeing after running in solitude (Lindheimer et al., 2015; Szabo, 2013) or the challenging and/or social aspects of group running (Carnes & Barkley, 2015) during a street-race participation. The finding that the subjectively reported levels of satisfaction with the current run did not differ (in fact the means of the two groups were almost identical) between the two groups, suggest that the running context might not affect personal satisfaction with the completed run.

4.1 Limitations

This study is not without limitations. One limitation is that the current findings with males cannot be generalized to women. Therefore, further research involving women is necessary. The other limitation is the relatively low sample size. The authors tried to address the issue by reporting the power for the analyses, but nevertheless this action does not compensate for lack of power in some further analyses, such as group differences before and after running or changes in the dependent measures from pre- to post-run. Therefore, the replication of the current work with a larger sample, including both men and women, is recommended. Finally, although the literature suggests that running intensity (speed) and distance are not mediators of the post-exercise affect, measuring these variables in support of the claim in the literature would render the results more reliable as well as more robust.

5. Conclusions

The current in-situ cross-sectional inquiry demonstrates that the acute positive affective states show an opposite trend during running in solitude compared to a street-race run. Therefore, while the physical activity is the *same*, the different contexts determine the high (affective) point of the activity. This high point seems to parallel the rewarding *completion of the run*, when one runs in solitude and the exciting and/or challenging group-social *anticipation of the race* before a street-race participation. These results, given the low sample size, are tentative, but the opposite trend in psychological affect during two outdoor running situations, show relatively clearly the effects of the contexts of the

running situations on the psychological outcome that deserves more focused future research attention.

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