The psychological benefits of recreational running: A field study

Attila Szabo and Júlia Ábrahám

Institute of Health Promotion and Sports Sciences
Eötvös Loránd University

DOI: 10.1080/13548506.2012.701755

This is **a pre-peer reviewed version** of the following article: Szabo, A., & Ábrahám, J. (2013). The psychological benefits of recreational running: A field study. *Psychology, Health & Medicine*, *18*(3), 251-261., which has been published in the final format at:

http://www.tandfonline.com/doi/full/10.1080/13548506.2012.701755

Correspondence concerning this manuscript should be addressed to Attila Szabo, PhD, Associate Professor and Deputy Director, Institute for Health Promotion and Sports Sciences, Eötvös Loránd University, H-1117 Budapest, Bogdánfy u. 10, Hungary.

E-mail: szabo.attila@ppk.elte.hu or drattilaszabo@yahoo.com

Abstract

Running yields positive changes in affect, but the external validity of controlled studies has received little attention in the literature. In this inquiry, 50 recreational runners completed the Exercise Induced Feelings Inventory (Gauvin & Rejeski, 1992) before and after a bout of self-planned running on an urban running path. Positive changes were seen in all four measures of affect ($P < .001$). Multivariate regressions were performed to examine the contribution of four exercise characteristics (i.e., duration of the current run, weekly running time, weekly running distance, and running experience) to the observed changes in affect. The results have revealed that exercise characteristics accounted for 14-30% of the variance in changes in affect in both directions.

Key words: *Exercise, Expectation, Mood, Physical activity, Placebo*

Introduction

Epidemiological research reveals that a physically active lifestyle yields numerous health benefits (Bellocco, Jia, Ye, & Lagerros, 2010; Lee et al., 2011; Blair, Kohl, & Barlow 1993; Powell and Blair, 1994). There is also evidence showing that physical activity is associated with positive mental well-being (Biddle 1995; Biddle, Fox, & Boutcher, 2000; Biddle & Mutrie, 2001; Brown, Mishra, Lee, & Bauman, 2000; Tseng, Gau, & Lou, 2011) and decreased intensity stress-response (Norris, Carroll, & Cochrane, 1990, 1992; Rosenfeldt et al., 2011; Stein & Boutcher, 1992). The psychological benefits of regular exercise are consistently demonstrated (e.g. Anderson & Brice, 2011; Berger & Motl, 2000; Biddle & Mutrie, 2001; Dasilva et al., 2011; Fontaine, 2000; Hoffman & Hoffman, 2008; O'Connor, Raglin, & Martinsen, 2000); Paluska & Schwenk, 2000; Raglin, 1990; Scully, Kremer, Meade, Graham, & Dudgeon, 1998). Since a bout of exercise yields immediate mental benefits, many scholars see exercise as a non-pharmaceutical antidote to stress and various mood disorders.

Research indicates that several forms of exercise trigger psychological benefits: walking (Dasilva et al., 2011), cycling (Petruzzello, Snook, Gliottoni, & Motl, 2009), swimming (Valentine & Evans, 2001), yoga (Lavey et al., 2005), dance aerobics (Rokka, Mavridis, &Kouli, 2010), shadowboxing (Li & Yin, 2008), treadmill running (Hoffman & Hoffman, 2008), etc. Running is one of the most popular leisure exercises because it is inexpensive, can be performed anywhere and at any time. However, in situ investigation of the psychological effects of planned or self-scheduled running has not been investigated to date, which leaves a question mark about the external validity of experimenter-planned studies. Another issue in the area is whether the effects of acute running are dose-dependent, in which case harder or longer exercise could buffer more stress or generate greater acute psychological benefits. This issue was addressed by several authors. Ekkekakis and Petruzzello (1999) reviewed over 200 studies, which at the time did not yield an unambiguous answer to the question. Later, Szabo (2003) reported that the intensity of exercise is not important in disclosing acute psychological benefits as based on planned but self-paced studies on running. His findings were corroborated by a series of other inquiries including some recent inquiries (Minjung, Sungwoon, Jingu, Petruzzello, & Hatfield, 2010; Rokka et al., 2010). In a recent literature review Ekkekakis (2009) has examined over 100 publications and concluded that exercise performed at self-selected intensity may be the most appropriate from a public health perspective. Accordingly, the acute psychological benefits of exercise appear to be dose-independent and runners running slower or faster and shorter or longer distances as part of their running regimen may be expected to report comparable improvements in affect.

In the daily life, recreational runners usually self-select both the duration and intensity of their running. These two characteristics of exercise could be influenced by various factors and, therefore, *in-situ* studies examining the psychological benefits of exercise have greater external validity than studies conducted in a controlled, but artificial, laboratory setting or experimenter-planned field studies in which both the duration and intensity of exercise may be prescribed for the participants (Ekkekakis, 2009).

This *in-situ* study was designed to explore the relationship between changes in affect following a bout of running and four exercise characteristics in recreational runners completing their pre-scheduled run in their naturalistic milieu. Based on information from the literature, it was presumed that there would be no relationship between the changes in affect and duration of run. Further, on an exploratory level, it was of interest to investigate the extent to which running habits, like weekly running time and weekly running distance, as well as history or experience of running could contribute to the anticipated psychological changes in affect.

Method

Participants

Participants were recruited through systematic randomization. Accordingly, every third runner preparing to start her or his run on a specially designated 5-km long public running path was approached by one of the experimenters and asked to take part in the inquiry. Less than 10% of the approached runners have rejected the invitation to participate in the study. The conditions of participation were that the volunteering runners be at least 18 years old, consent in writing to their participation, run for at least 12 months prior to the research, and have planned to complete the path at least once (run at least 5 km). A total of 50 runners (37 males and 13 females), who met the above selection criteria, were recruited in the study. Their mean age was 29.02 (s = 6.55) yrs, ranging from 19 to 45 yrs and mean running experience was 69.64 (s = 48.07) months, that ranged from 12 to 240 months. The volunteers reported running an average of 33.80 (s = 11.19) km/week, ranging from 15 to 65 km, for an average duration of 171.30 (s = 49.57) min/week, ranging from 90 to 280 min.

Materials

In conjunction with a demographic questionnaire assessing running habits, like time and distance of weekly runs and running experience, the Exercise-Induced Feeling Inventory (EFI - Gauvin & Rejeski, 1993) was employed because of its reliability as based on several previous works, proven specificity and sensibility, as well as quick and easy administration. The EFI was used to gauge the changes in affect from pre- to post-run. This tool is a 12-item questionnaire containing four subscales. The 12 items denoting various affective states are simply rated on a five-point scale, ranging from zero (*do not feel at all*) to four (*feel very strongly*), indicating the extent to which the runner feels: 1) positively engaged (*enthusiastic, upbeat, happy*), 2) revitalized (*energetic, refreshed, revived*), 3) tranquil (*calm, peaceful, relaxed*), and 4) physically exhausted (*fatigued, tired, worn out*). To avoid working with zeros (0), in the current study a constant (+1) was added to the ratings scale, making it range from 1 to 5.

The four affective states are conceptually (and psychometrically) distinct. For example, positive engagement gauges the degree of *enjoyment* of the exercise, revitalization measures how *refreshed* the person feels after exercising, tranquility reflects the state of post-exercise *calmness* associated with a bout of exercise, and finally physical exhaustion measures the mental appraisal of *fatigue* resulting from the running (Gauvin & Rejeski, 1993). The EFI has acceptable to good psychometric properties (Bozoian, Rejeski, & McAuley, 1994). The internal consistencies of the four subscales range from .72 to .91 (Gauvin & Rejeski, 1993). Nevertheless, the EFI has been criticized in the past (Ekkekakis & Petruzzello, 2000, 2001), but the developers have defended the instrument with convincing arguments (Gauvin & Rejeski, 2001).

Procedure

After consenting to participate, eligible volunteers completed a demographic and the EFI questionnaires. This task lasted less than 3 min in all instances. Subsequently, the runner set her/his chronograph while the experimenter recorded the time on the file of the participant. The runner was instructed to run as she/he would do it normally, self-determining the pace of the run,

and to stop where the experimenter stood, which corresponded to the start and finish line of the circular 5-km running path. Upon the completion of the run, the elapsed time was recorded again by the experimenter and cross-checked for accuracy with the time measured by the runner. The running times ranged from 23 to 74 min (mean = 39.26, *s* = 11.88). Within five minutes after the run, the participant has rated the EFI again, which marked the end of the testing. At this time, the runner was thanked for participation in the study and in case she/he had any questions or queries they were answered by the experimenter. All test sessions took place during the day, primarily in the week-end, between 10.00h and 16.00h, in dry and sunny weather, with outside temperature ranging between -1^{o} and $+4^{o}$ C.

Data Analyses

Multivariate analysis of variance (MANOVA) was used to examine whether there were statistically significant differences in exercise characteristics between men and women in the sample gathered through systematic randomization. The psychological effects of exercise, as measured with the EFI, were tested with repeated measures multivariate analysis of variance (RM-MANOVA). Finally, multivariate regression analyses were carried out to investigate the relationship between exercise characteristics and changes in affect as a result of running. All statistical calculations were performed with the Statistical Package for Social Sciences (SPSS) software, version 17.

Results

Gender Differences in Exercise Characteristics

The 2 (gender) by 4 (time of the current run, running experience (months), weekly running distance (km), and weekly running time (min)) MANOVA yielded statistically no significant results (Wilks' Lambda = .917, $F_{4, 45}$ = 1.02, P = .41). Therefore, in the subsequent analyses the four exercise characteristics were studied together for men and women.

Changes in Affect from Pre- to Post-Run

The 2 (gender) by 2 (pre- to post-run) by 4 (indices of affect; positive engagement, revitalization, tranquility, and exhaustion) repeated measures MANOVA yielded a statistically significant main effect for time (Wilks' Lambda = .234, $F_{4, 45}$ = 36.9, P < .001), as well as a time by gender interaction (Wilks' Lambda = .705, $F_{4, 45}$ = 4.71, P = .003). Therefore, the interaction was followed up first with the univariate tests (automatically calculated in the SPSS), which have revealed that the multivariate effect was due to a time by gender interaction only in exhaustion because women reported greater exhaustion before the run then men (t_{48} = 2.1, P = .04). No statistically significant interaction effect has emerged for the other three measures of affect. Therefore, the multivariate main effects were also examined. They have revealed that pre- to post-changes in affect have occurred in all four dependent measures: revitalization ($F_{1,48}$ = 145.93, P < .001, partial ETA squared = .75), positive engagement ($F_{1,48}$ = 97.11, P < .001, partial ETA squared = .67), tranquility ($F_{1,48}$ = 85.02, P < .001, partial ETA squared = .64), and exhaustion ($F_{1,48}$ = 32.25, P < .001, partial ETA squared = .40). The means and the standard deviations for these results are summarized in Table 1.

The Connection between Exercise Characteristics, and Changes in Affect

Since all four measures of affect have changed statistically significantly from pre- to post-run, difference (delta) scores were calculated for the psychological measures. The delta scores formed the dependent measures of the multivariate regressions performed using four exercise characteristics (duration of the current run, time (minutes) and distance (km) of the weekly runs, and running experience (months) as the independent variables. The regression analyses yielded significant regression models for three out of four dependent measures, the sole exception being exhaustion. Current running time was the only predictor in the model to explain a statistically significant proportion of variance in changes in tranquility (R^2=.14, $F_{1, 48}$ = 8.04, P < .007, Table 2). The regression model including the duration of the current run and weekly running distance (dulling the effects) have accounted for a significant proportion of the variance in the changes observed in positive engagement (R^2=.21, $F_{2, 47}$ = 6.36, P < .004, see Table 2). Finally, running experience (dulling the effect) and the duration of the current run have comprised the model that explained 30% of the variance in changes in revitalization. (R^2=.30, $F_{2, 47}$ = 10,17, P < .001, refer to Table 2).

Discussion

The findings from this in-situ study are consistent with previous lab and field research showing that an acute bout of exercise has positive impact on affect (Anderson & Brice, 2011; Berger & Motl, 2000; Biddle & Mutrie, 2001; Dasilva et al., 2011; Fontaine, 2000; Hoffman & Hoffman, 2008; O'Connor et al., 2000; Paluska & Schwenk, 2000; Raglin, 1990; Scully et al., 1998, Szabo, 2003). Further, the current results add to the mounting evidence that workload is unimportant in revealing positive changes in affect following exercise (Alfermann & Stoll,1996; Ekkekakis, 2009; Farrell, Gates, Maksud, & Morgan, 1982; Minjung et al., 2010; Parfitt, Rose, & Markland, 2000; Rokka et al., 2010; Szabo, 2003; Zervas, Ekkekakis, Emmanuel, Psychoudaki, & Kakkos, 1993). This conclusion may not be surprising knowing for more than a decade that many physically effortless activities also yield affective benefits similar to exercise (Alfermann & Stoll, 1996; Parente, 2000; Snowball & Szabo, 1999; Szabo, 2003; Szabo, Mesko, Caputo, & Gill, 1998; Wilson, Berger, & Bird, 1981). The gist of these findings lends support to Stoll's (1997) contention that physiological models alone may be insufficient to account for the positive changes in affect following exercise.

The exploration of the relationship between changes in four psychological measures and running characteristics showed that the largest proportion of variance accounting for changes in revitalization was only 30% as predicted by running experience and duration of the current run. However, running experience was inversely present in the model, indicating that runners may become habituated to the invigorating effects of running and report lesser revitalization over time. Two exercise characteristics have predicted 21% of the variance in positive engagement: duration of the current run and weekly running distance. The latter was inversely contributing to the model, indicating that habitually longer running bouts may be associated with lesser positive affect. Finally, only 14% of the variance in changes in tranquility was accounted by the duration of the current run, while exhaustion could not be connected to running characteristics at all. An emerging question is then, what other factors account for more of the variance in the improved affect following running than the studied exercise characteristics? A recent study showing that habitual exercisers responded to acute running with positive changes in affect while no changes were reported by non-exercisers (Hoffman & Hoffman, 2008), may suggest that the former group

"expects" to experience positive changes after the exercise has been fulfilled. They may feel that they *deserve* those feelings after working out. This presumption may be even more applicable in-situ than in the laboratory work reported by the Hoffmans, because in the former the runner plans her/his run whereas in the latter the run is planned for her or him.

Indeed, the acute affective benefits of exercise (and some other passive treatments) may be linked to the mental interpretation (Lazarus, 1988) of the activity that the person is engaged in. In light of this model, desire to engage in an activity should yield positive effects. Consequently, all life-experiences interpreted as pleasant are likely to trigger positive changes theoretically and experimentally (Sandlund & Norlander, 2000). Such an expectation-based effect is a form of self-fulfilled prophecy that matches the expectation model forwarded for the placebo effect (Stewart-Williams & Podd, 2004). This conjecture is strengthened by a recent study in which 10-min bout of jogging improved the mood of the participants and the results were augmented by biased recall of pre-jogging mood (Anderson & Brice, 2011). Based on these findings, the authors concluded that individuals' expectations regarding the psychological benefits of the exercise are influential in the emerging results.

In summary, the current findings from in-situ research agree with the literature about the acute effects of exercise on affect in several aspects. The results suggest that the studied running variables may account little for the observed changes in affect. The psychological benefits may be due, at least in part, to expectations or conditioning through pleasant past experiences, both of which are the bases of the placebo response. Therefore, recreational running - and other leisure exercises - may act as behavioral *placebos* in enhancing one's psychological well-being. Future studies need to address this conjecture directly, and examine the role of the placebo response in the acute psychological benefits of exercise. Indeed, subjective expectations in the improvement of exercise-induced affect should be given more weight in future inquiries. The impact of running characteristics also ought to be addressed in a wider spectrum than in the current work. However, until then, the current results should be interpreted as a robust signal for the lesser-than-presumed contribution of exercise characteristics to the acute psychological benefits of running.

References

Alfermann, D. and Stoll, O. (1996). Befindlichkeitsveränderungen nach sportlicher Aktivität (Mood changes after physical exercise). *Sportwissenschaft, 26(4),* 406-422.

Anderson, R.J., & Brice, S. (2011). The mood-enhancing benefits of exercise: Memory biases augment the effect. *Psychology of Sport & Exercise, 12(2),* 79-82.

Bellocco, R., Jia, C., Ye, W., & Lagerros Y.T. (2010). Effects of physical activity, body mass index, waist-to-hip ratio and waist circumference on total mortality risk in the Swedish National March Cohort. *European Journal of Epidemiology, 25(11),* 777-788.

Berger, B.G. and Motl, R.W. (2000). Exercise and mood: A selective review and synthesis of research employing the Profile of Mood States. *Journal of Applied Sport Psychology, 12,* 69-92.

Biddle, S. (1995). Exercise and psychological health. *Research Quarterly for Exercise and Sport, 66,* 292-297.

Biddle, S.J.H., Fox, K.R. & Boutcher, S.H. (Eds.) (2000). *Physical activity and psychological well-being*. London: Routledge.

Biddle, S.J.H. and Mutrie N. (2001). *Psychology of physical activity*. London: Routledge.

Blair, S.N., Kohl, H.W. & Barlow, C.E. (1993). Physical fitness and all-cause mortality: A prospective study of healthy men and women. *Journal of the American College of Nutrition, 12,* 368-371.

Bozoian, S., Rejeski, W.J., & McAuley, E. (1994). Self-efficacy influences feeling states associated with acute exercise. *Journal of Sport and Exercise Psychology, 16*, 326-333.

Brown, W.J., Mishra, G., Lee, C., & Bauman, A. (2000). Leisure Time Physical Activity in Australian Women: Relationship with Well Being and Symptoms. *Research Quarterly for Exercise and Sport, 71(3),* 206-216.

Dasilva, S.G., Guidetti, L., Buzzachera, C.F., Elsangedy, H.M., Krinski, K., De Campos, W., et al. (2011). Psychophysiological response to self-paced treadmill and overground exercise. *Medicine & Science Sports & Exercise, 43(6),* 1114.-1124.

Dunn, A.L. and Dishman, R.K. (1991). Exercise and the neurobiology of depression. *Exercise and Sport Sciences Reviews, 19,* 41-98.

Ekkekakis, P. (2009). Let them roam free? Physiological and psychological evidence for the potential of self-selected exercise intensity in public health. *Sports Medicine, 39 (10),* 857-888.

Ekkekakis, P., & Petruzzello, S.J. (2001). Analysis of the affect measurement conundrum in exercise psychology: II. A conceptual and methodological critique of the Exercise-induced Feeling Inventory. *Psychology of Sport and Exercise, 2*, 1-26.

Ekkekakis, P., & Petruzzello, S.J. (2000). Analysis of the affect measurement conundrum in exercise psychology: I. Fundamental issues. *Psychology of Sport and Exercise, 1*, 71-88.

Ekkekakis, P. and Petruzzello, S.J. (1999). Acute aerobic exercise and affect: Current status, problems and prospects regarding dose-response. *Sports Medicine,* **28,** 337-374.

Fontaine, K.R. (2000). Physical activity improves mental health. *Physician and Sportsmedicine,* **28(10),** 83-84.

Gauvin, L., & Rejeski, W.J. (2001). Disentangling substance from rhetoric: a rebuttal to Ekkekakis and Petruzzello (2001). *Psychology of Sport and Exercise, 2*, 73-88.

Gauvin, L., & Rejeski, W.J. (1993). The Exercise-Induced Feeling inventory: development and initial validation. *Journal of Sport and Exercise Psychology, 15,* 403-423.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. & Tatham, R.L. (2005), *Multivariate Data Analysis* (6th Edition edition), Pearson Prentice Hall, Upper Saddle River, NJ.

Hoffman, M.D., & Hoffman, D.R. (2008). Exercisers achieve greater acute exercise-induced mood enhancement than nonexercisers. *Archives of Physical Medicine & Rehabilitation, 89(2),* 358363.

Karageorghis, C.I., Jones, L., & Low, D.C. (2006). Relationship between exercise heart rate and music tempo preference. *Research Quarterly for Exercise and Sport 77(2),* 240-250.

Koltyn, K. F. (1997). The thermogenic hypothesis. In W.P. Morgan (Ed.). *Physical activity and mental health* (pp. 213-226). Washington: Taylor and Francis.

Lavey, R., Sherman, T., Mueser, K.T., Osborne, D.D., Currier, M. & Wolfe, R., (2005). The effects of yoga on mood in psychiatric inpatients. *Psychiatric Rehabilitation Journal, 28(4),* 399-402.

Lazarus, R.S. (1988). The psychology of stress and coping. In C.D. Spielberger and I.G. Sarason (Eds.). *Stress and Anxiety* (pp. 399-418). New York: Hemisphere Publishing.

Lee, D., Sui, X., Ortega, F.B., Kim, Y.S., Church, T.S. Winett, R.A., et al. (2011). Comparison of leisure-time physical activity on cardiorespiratory fitness as predictors of all-cause mortality in men and women. *British Journal of Sports Medicine, 46(6),* 504-510.

Li, G., & Yin, J.C. (2008). The effects of shadowboxing on mood and beta-Ep in still condition of female college students. *Journal of Beijing Sport University, 31(3),* 357.

Minjung, W., Sungwoon, K., Jingu, K., Petruzzello, S.J., Hatfield, B.O. (2010). The influence of exercise intensity on frontal electroencephalographic asymmetry and self-reported affect. *Research Quarterly for Exercise & Sport, 81(3),* 349-359.

Morgan, W.P. & O'Connor, P.J. (1988). Exercise and mental health (pp. 91-121). In R. K. Dishman (Ed.*). Exercise Adherence: Its impact on Public Health*. Champaign, IL: Human Kinetics.

Norris, R., Carroll, D. and Cochrane, R. (1990). The effects of aerobic and anaerobic training on fitness, blood pressure, and psychological stress and well-being. *Journal of Psychosomatic Research, 34,* 367-375.

Norris, R., Carroll, D., & Cochrane, R. (1992). The effects of physical activity and exercise training on psychological stress and well-being in an adolescent population. *Journal of Psychosomatic Research, 36,* 55-65.

O'Connor, P.J., Raglin, J.S. and Martinsen, E.W. (2000). Physical activity, anxiety and anxiety disorders. *International Journal of Sport Psychology, 31,* 136-155.

Paluska, S. A., & Schwenk, T.L. (2000). Physical activity and mental health: current concepts. *Sports Medicine, 29(3),* 167-180.

Parente, D. (2000). Influence of aerobic and stretching exercise on anxiety and sensation-seeking mood state. *Perceptual and Motor Skills, 90,* 347-348.

Parfitt, G., Rose, E.A., & Markland, D. (2000). The effect of prescribed and preferred intensity exercise on psychological affect and the influence of baseline measures of affect. *Journal of Health Psychology, 5,* 231-240.

Petruzzello, S.J., Landers, D.M., Hatfield, B.D., Kubitz, K.A., & Salazar, W. (1991). A meta-analysis on the anxiety-reducing effects of acute and chronic exercise. *Sports Medicine, 11,* 143-182.

Petruzello, S.J., Snook, E.M., Gliottoni, R.C., & Motl, R.W. (2009). Anxiety and mood changes associated with acute cycling in persons with multiple sclerosis. *Anxiety, Stress & Coping, 22(3),* 297-307.

Powell, K.E., & Blair, S.N. (1994). The public health burdens of sedentary living habits: Theoretical but realistic estimates. *Medicine and Science in Sports and Exercise,* **26,** 851-856.

Raglin, J.S. (1990). Exercise and mental health: beneficial and detrimental effects. *Sports Medicine, 9***,** 323-329.

Rokka, , S., Mavridis, G., & Kouli, O. (2010). The impact of exercise intensity on mood state of participants in dance aerobics programs. *Physical Culture & Tourism, 17(3),* 241-245.

Rosenfeldt, F., Braun, L., Spitzer, O., Bradley, S., Shepherd, J., Bailey, M., et al. (2011). Physical conditioning and mental stress reduction: a randomised trial in patients undergoing cardiac surgery. *BMC Complementary and Alternative Medicine, 11,* 20.

Sandlund, E.S., & Norlander, T. (2000). The effects of tai chi chuan relaxation and exercise on stress responses and well-being: An overview of research. *Journal of Stress Management,* **7,** 139-149.

Stein, P.K. and Boutcher, S.H. (1992). The effect of participation in exercise training program on cardiovascular reactivity in sedentary middle-aged males. *International Journal of* Psychophysiology, **13,** 215-223.

Stewart-Williams S, & Podd J. (2004). The placebo effect: Dissolving the expectancy versus conditioning debate. *Psychological Bulletin, 130(2),* 324-40.

Stoll, O. (1997). Endorphine, Laufsucht und runner's high. Aufstieg und niedergang eines mythos (Endogenous opiates, "runner's high" and "Exercise Addiction" - The rise and decline of a myth). *Leipziger Sportwissenschaftliche Beitraege, 28 (1),* 102-121.

Szabo, A. (2003). Acute psychological benefits of exercise performed at self-selected workloads: Implications for theory and practice. *Journal of Sports Science and Medicine, 2,* 77-87.

Valentine, E., & Evans, C. (2001). The effects of solo singing, choral singing and swimming on mood and physiological indices. *British Journal of Medical Psychology, 74(1),* 115-120.

.

Table 1

Means and standard deviations (s) in four measures of affect before and after running; The Percent changes are all statistically significant (p < .001).

Measure of Affect	Pre-Run	Post- Run	Change (%)
Revitalization	8,72 (2,33)	12,70 (1,58)	31%
Positive engagement	9,62 (2,47)	12,88 (1,59)	25%
Tranquillity	9,50 (2,03)	12,20 (1,55)	22%
Exhaustion	6,92 (2,55)	4,86 (1,63)	-30%

Table 2

Summary results of the multivariate regression analyses of exercise-induced changes in tranquillity, positive engagement, and revitalization.

Dependent Measure	Components in Model	B (unstandardized coefficients)	Standard error (SE)	Beta (standardized coefficients)	*t*	*p*
Tranquillity	duration of current run	0.06	.02	0.38	2.84	.007
Positive Engagement	duration of current run	0.11	.03	0.58	3.50	.001
	weekly running distance	-0.09	.03	-0.45	-2.72	.009
Revitalization	running experience	-0.03	0.01	-0.54	-4.04	.001
	duration of current run	0.09	0.03	0.47	3.48	.001

Cite this paper as:

Szabo, A., & Ábrahám, J. (2013). The psychological benefits of recreational running: A field study. *Psychology, Health & Medicine*, *18*(3), 251-261.