



Inquiries in Sport & Physical Education
Volume 12 (3), 226 - 233
Released: October 2014

www.pe.uth.gr/emag

ISSN 1790-3041

Exercise as a Means for Smoking and Alcohol Cessation: New Trends in Research

Υ., Theodorakis, Μ., Goudas, Ν., Zourbanos, Α., Hatzigeorgiadis, & Α., Jamurtas

School of Physical Education and Sports Sciences, University of Thessaly, Trikala, Hellas

Abstract

The aim of this paper is to explore a new theoretical and applied framework for research on smoking and alcohol cessation. The effects of important physiological and biochemical mechanisms which are activated during exercise in smokers and alcoholics, as well as the effects of psychological mechanisms, such as self-control, mood, pleasure and the feelings of euphoria, are discussed. Future studies in the area should examine the effects of different exercise intensities on the psychological, physiological and biochemical factors contributing to smoking and alcohol cessation. Furthermore, exercise programs coupled with counseling and psychological support techniques in order to encourage exercise engagement and discourage cigarette smoking and alcohol consumption are suggested. Finally, respective health education programs for prevention and cessation of alcohol consumption and smoking, both for adolescents and adults are discussed.

Key words: *Exercise, smoking, alcohol, intervention, cessation, psychological mechanism, physiological mechanism, biochemical mechanism, health education*

Introduction

There is abundant evidence for the positive effect of physical activity on health. Regular physical activity is associated with greater resistance to infections, weight control, protection and prevention, of heart-related diseases, control of hypertension, and prevention of osteoporosis, diabetes, back pain, respiratory and musculoskeletal problems, metabolic, and neurological disorders (Dishman, Washburn & Heath, 2004). Also, depression and anxiety can be reduced through exercise (Faulkner & Taylor, 2005; Theodorakis, 2010).

Psychological theories suggest that the benefit of exercise on mental health stems from increased self-

Corresponding address : Dr, Marios Goudas
University of Thessaly, School of Physical Education & Sport Science
42 100, Karies, Trikala, Hellas
e - mail: mgoudas@pe.uth.gr

This research has been co-financed by the European Union (European Social Fund - ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: **THALES**. Investing in knowledge society through the European Social Fund.

esteem, enhanced abstinence, improved body image, heightened self-confidence, pleasure, relaxation and stress control (Biddle & Mutrie, 2007). In the same light, theories of physiology and biochemistry suggest that exercise can regulate a series of physiological mechanisms, such as secretion of endorphins, changes in body temperature and changes in neurotransmitters (Goldfarb & Jamurtas 1997; Landers & Arent, 2007). However, the interplay between psychological and physiological mechanisms that contribute to this positive effect is under researched.

Nevertheless, in addictive behaviors the role of exercise has not been examined satisfactory. In Greece, one of the main observations of large scale surveys is that there is a link between alcohol, tobacco and other unhealthy behaviors, and that people generally adopt an overall healthy or unhealthy profile, in which the exercise plays an important role (Papaioannou, Karastogiannidou, & Theodorakis, 2004; Theodorakis, et al., 2002; Theodorakis, et al., 2003; Theodorakis, Papaioannou, Hatzigeorgiadis, & Papadimitriou, 2005). Thus, one promising area of study is to identify the most suitable forms of exercise and psychological support that function in a more beneficial way for people who smoke or over-consume alcohol, or other unhealthy behaviors.

Smoking and Health

Research has shown that smoking exacerbates the prevalence of various functional problems and leads to serious diseases and that smoking is responsible for the increased mortality rate in smokers. According to the World Health Organization, half of regular smokers will die from diseases that are directly attributable to smoking, and according to Eurostat (2008) the percentage of Greek smokers are among the highest in Europe. Greece has the highest proportion of smokers among Western European countries (37.6 %) (WHO, 2009) and has the highest number of cigarettes consumed per person in Western Europe.

The use of various forms of exercise as a means of prevention, rehabilitation and treatment in a variety of physical and mental illnesses, confirms the importance of their contribution to health. A study with a sample of 40.708 men aged 45-79 years indicated a negative relationship between mortality from cancer and participation in daily physical activity. The higher participation rates reported on physical activities, like walking or cycling, correlated with fewer events of cancer and mortality and better chances of survival rates in patients (Orsini, Mantzoros, & Wolk, 2008).

Various theories have been developed regarding the etiology of smoking. These can be classified as follows: (a) Psychosocial motivation, sensory-motor stimulus, and stimulation theories, (b) Neuro-chemical and neuro-biological theories of addiction (secretion of dopamine, norepinephrine, and beta-endorphin that produces feelings of well-being), which postulate that people smoke to reduce their bad mood, or depression through substances secreted due to nicotine (beta-endorphin, serotonin) (c) Theories of relief and calmness, such as the theories of personality, the arousal and emotion regulation (Lujic, Reuter, & Netter, 2005). All the above theories indicate the complexity of the problem and leading to a call for a psychobiological research approach.

Exercise and Smoking: Psychophysiological mechanisms

Many forms of exercise and physical activity are associated with increased psychological well-being, strength and vitality, and a sense of 'feeling better'. This feeling is attested to be stronger immediately after an exercise bout where people feel pleasant mood changes. Following exercise participation people often report that they have an increased capacity to manage stress, depression, anger and fatigue, as well as increased vigor. These pleasant feelings, according to some researchers, last 2 to 4 hours after exercise (Berger & Tobar, 2007).

Based on the premise that participation in physical activity and exercise can be considered as an alternative form of therapy for smoking cessation, we suggest that adults who participate regularly to physical activity will be less likely to smoke. The mechanisms through which physical activity may affect smoking cessation seem to be both physiological and psychosocial. In particular, physical activity participation may increase individuals' confidence to quit smoking and might lead to reductions in withdrawal symptoms (e.g., stress, depression, irritability, restlessness, poor concentration), and might help people cope better with abstinence. In addition, regular physical activity increases caloric expenditure, and therefore may increase the metabolic rate and reduce the weight gain associated with smoking cessation (Taylor & Kato-meri, 2007; Taylor & Ussher, 2005). In a relevant study of our research team (Hassandra et al., 2012) participants stated that they perceived exercise as a means that helped them manage their feelings of stress and

tension during their effort to quit smoking, and as a way to improve their life by adopting a healthier lifestyle. Most of them reported walking and running as their most favorite physical activities whereas several of them found pedometers to act as motivating tools increasing their attachment to exercise. Overall, it could be suggested that people who try to quit smoking should be encouraged to be more physically active. The results of the aforementioned study are in accordance with those of other respective studies attesting that exercise can be an aid to smoking cessation programs (Jung, Fitzgeorge, Prapavessis, Faulkner, & Maddison, 2010). Thus, physical activity could be promoted as a cessation aid and as part of a holistic lifestyle change consistent with a non-smoker's identity (Everson-Hock et al., 2010). Although the application of exercise and physical activity has been widely recommended in smoking cessation programs the mechanisms through which exercise affects smoking have not been yet explained scientifically.

Empirical evidence suggests that there are several benefits of exercise for smokers. Firstly, the low fitness levels usually act as a barrier when they try to exercise and not smoke. Interestingly, the effect of different levels of exercise intensity has not been examined. Secondly, exercise might be considered as beneficial to people if perceived as a mechanism of attention distraction (Bahrke & Morgan, 1978). Thirdly, it has also been suggested that during therapy, the combination of appropriate exercise intensity and the use of techniques dealing with negative psychological situations are necessary in order to avoid interrupting the quitting efforts (Irvin, Bowers, Dunn, & Wang, 1999). Finally, counseling may also help people in organizing their everyday life activities, and direct people to participate in physical activity. Counseling techniques can be implemented to help deal with the desire for smoking and all the associated symptoms, such as sleeping problems, lack of concentration, depression and irritability. Within this approach, the aim of exercise does not necessarily focus on fitness improvement but rather on substituting attachment to smoking with attachment to physical activity, which offers a valuable and healthier alternative for smokers who try to quit (Taylor & Ussher, 2005).

The most popular psychological theories examining the relationship between psychological variables and smoking behavior include: the Social Cognitive Theory (Bandura, 1986), the Theory of Planned Behavior (Ajzen, 1988), the Goal-setting Theory (Locke & Latham, 1990), the Health Belief Model (Rosenstock, 1974) the Thranstheoretical model (Pochaska & DiClemente, 1983), and the Self - Determination Theory (Deci & Ryan, 2000). The most effective intervention programs, for smoking cessation, are based on these theories (Murray-Johnson, Witte, Boulay, Figueroa, Storey, & Tweedie, 2002). According to other theories, exercise helps deal with stress and hypertension (Landers, 1994) and can thus satisfy the motives of those who declare that they smoke to feel relaxed and calm. Furthermore, during exercise several substances (neurotransmitters) that cause a euphoric feeling (e.g., beta-endorphins, serotonin) are secreted which could potentially satisfy the motives of people who claim up that they drink or smoke in order to feel good. Additionally, people who exercise report fewer symptoms of depression (Biddle & Mutrie, 2007), so exercise can act as a substitute for smokers who use tobacco in order to cope with depression feelings. Finally, exercise improves the sense of control, the sense of self-efficacy, self-image and self-esteem and promotes more positive social relationships (McAuley, Mihalko, & Bane, 1997). Consequently, exercise may provide the psychosocial motives for most of smokers.

Based on the above, it seems that understanding the psychological, biochemical, and physiological factors during smokers' exercise could lead to the development and implementation of an intervention program that combines exercise with applied counseling techniques aiming at smoking cessation.

Alcohol and Health

Several epidemiological studies (e.g.: Corrao, Bagnardi, Zambon, & La Vecchia, 2004), have shown that most of the negative effects of alcohol are not confined only to alcoholics but to heavy drinkers too. Heavy drinking is most likely to cause psychosomatic problems or risky and antisocial behaviors (Anderson & Hilbell, 2007). In Greece, according to the Institute of Mental Health (EKTEFIN, 2006) almost all Greeks (12-64 years) have tried alcohol at least once in their lifetime, 65.8% of them had drunk at least once in the last month, while 10% of them consumed at least five drinks each time they drunk during the last month.

Excessive alcohol consumption can modulate cell function in the brain, heart, liver, muscle, lead to various forms of cancer, problems in the nervous system, liver cirrhosis, pancreatitis and malnutrition (Gossop et al., 2007). Moreover, alcoholics are characterized by poor physical conditioning, reduced skeletal muscle and bone mass. A study on a sample of Danish people showed that alcohol consumption may predict long-term alcoholism. Specifically, researchers found that men who drink more than 21 drinks per

week are more likely to become alcoholics, while the risk for women to become alcoholics is higher and is predicted by lower weekly consumption ranging between 1 and 7 drinks (Flensburg-Madsen, Knop, Mortensen, Becker, & Gronbaek, 2007). Substance abuse, such as alcohol, is associated with specific personality traits such as neuroticism (Kotov et al., 2010). Many people drink because they cannot handle the stress of everyday life (Monti, Rohsenow, Colby, & Abrams, 1995). Alcohol consumption helps them feel relaxed and transiently forget stress and further problems. Also, alcohol consumption contributes toward improved mood (Kuntsche, Knibbe, Gmel, & Engels, 2006) and act as a means of relaxation during social interactions of individuals. Health therapists suggest that substance users should adopt a general healthier lifestyle. At the same time, they have been exploring alternative methods, such as exercise and physical activity, of tackling dependency issues such as smoking or excessive alcohol consumption (Donaghy & Mutrie, 1999; Read, Brown, & Kahler, 2004).

Exercise, alcohol and psychophysiological mechanisms

Even though there are reports signifying the beneficial effects of exercise in alcoholics, this treatment modality has been undervalued and has not been sufficiently employed. Beneficial effects of exercise include the release of endorphins, which can generate feelings of pleasure, improve mood, and reduce depression, control stress, increase self-efficacy and social support (Read et al., 2004). For example, beta endorphin (i.e., an endogenous opioid) levels are elevated during exercise (Goldfarb, Hatfield, Sforzo, & Flynn, 1987), are associated with the intensity and duration of exercise (Farrell, Kjaer, Bach, & Galbo, 1987; Goldfarb, Hatfield, Potts, & Armstrong, 1991), and relate to euphoric feelings during and after exercise.

Research indicates that beta endorphin levels are lower during the first phases of abstinence from alcohol (Inder, Livesey, & Donald, 1998) whereas analysis for beta endorphin and ACTH in the cerebrospinal fluid shows markedly reduced levels of beta endorphin and elevated levels of ACTH. Furthermore, the effects of acute and chronic alcohol consumption on binding abilities of opioid receptors and on the transcription, translation and secretion of opioid peptides are expressed through the increased levels of β -endorphin (Gianoulakis, 2004). It seems that from all the molecules released by the brain beta endorphin is the one most affected by alcohol. However, beta endorphin is not only affected by alcohol but by exercise as well and it appears that it could represent the decisive link between exercise and alcohol dependence.

Research on exercise and alcohol dependence is very scarce. There are only a few methodologically sound studies employing a randomized control trial design that have tried to elucidate the role of exercise on alcohol dependence with equivocal results. The only study that addressed the issue of exercise training (12 weeks of moderate intensity aerobic exercise) on alcoholics revealed positive results since patients drunk fewer drinks during the exercise program and three months after the intervention program (Brown et al., 2009). The hypothesis can be summed in that exercise will result in elevated levels of beta endorphin which in turn will cause a euphoric feeling avoiding the intake of alcohol. To our knowledge, there is no research that has examined the effects of exercise on alcohol abstinence and at the same time the biochemical pathway that connects exercise and abstinence seems promising and warrants further investigation. Finally, the inclusion of physical activity in a counseling program for substance users, as a cessation aid, might help them develop abstinence and empower them to deal with their addiction problem (Jung et al., 2010).

Exercise as a means for alcohol and smoking cessation

There is an apparent interaction between those three behaviors. Since beta endorphin is released during exercise and it appears to be the factor that results in a euphoric feeling after smoking or alcohol consumption it would be reasonable to assume that this opioid peptide could be the link between exercise, smoking cessation and alcohol abstinence.

Among alcoholics, smoking rates are very high. The effects of smoking on alcoholics' health are cumulative. For example, evidence indicates that smoking reduces the chances of cognitive recovery in alcoholics. Researchers postulate that alcoholics who try to quit smoking can also be helped in their effort to abstain from alcohol (Kalman, Kim, DiGirolamo, Smelson, & Ziedonis, 2010). An integrated multidisciplinary approach will provide a better understanding of the complexity of this problem. In general, many forms of exercise and physical activity are associated with increased psychological well-being, vitality and a sense of 'feeling better' (Berger & Tobar, 2007; Ekkekakis, Hall, Van Landuyt, & Petruzzello, 2000). This sense of pleasure and wellness, caused by psychological and/or physiological changes, will likely have

beneficial effects in smokers and alcoholics who agree to participate in the program.

Appropriate forms of exercise

But which type of exercise is the most appropriate for this purpose? Aerobic exercise (i.e. walking, running etc) is a common mode of exercise. There is evidence that aerobic exercise is effective in reducing anxiety and depression and increasing positive mood (Landers & Arent, 2007). Furthermore, aerobic exercise of sufficient intensity and duration has been shown to elevate significantly β -endorphin levels in healthy young adults (Goldfarb & Jamurtas 1997). However, it is still unknown which is the optimal intensity can maximize β -endorphin levels in smokers and alcoholics. Different intensities need to be compared to elucidate the proper intensity and through a mechanistic approach establish a possible relationship between β -endorphin, and smoking.

Health education theories and awareness of the general population

The main objective of health education programs is to change attitudes in order to avoid unhealthy behaviors like smoking and promote health-related behaviors such as exercise (Glanz, Rimer, & Viswanath, 2008). The efficacy of health education programs addressing a single behavior is questionable, as most people usually adopt multiple unhealthy behaviors (Theodorakis, et al., 2005). Therefore, targeting more than one behavior in interventions may be more effective than focusing only in one.

Several studies for smoking prevention by the Exercise Psychology and Quality of Life group of the University of Thessaly (Hassandra et al., 2009; Kosmidou, Theodorakis, & Chroni, 2008; Kosmidou, & Theodorakis, 2007; Theodorakis, Kosmidou, Hassandra, & Goudas, 2008). A review of these studies showed that the implementation of the interventions had a stronger positive effect mainly for elementary school children, but when additional activities for smoking cessation were added, positive results in high school students were also reported (Theodorakis, et al., 2008). There is a dearth of successful and scientifically sound intervention studies for dealing with many other unhealthy behaviors (both in terms of prevention and treatment).

Future research directions

There are no studies that have tested different exercise protocols on psychological variables and specific biochemical factors (beta-endorphin, catecholamine, etc.) in smokers and alcoholics. Additionally, there are no studies that have examined the influence and association of psychological techniques (such as, goal setting, self-talk, self-efficacy) on motivation for exercise participation and motivation for change or control the behavior of smoking and alcohol. We consider these ideas to be an important step forward to a promising area of research that addresses critical health problems such as smoking cessation and alcohol consumption. Psychophysiological unexplored mechanisms, will lead to the development of a program that will truly contribute to public health and quality of life.

Relevant research should inform practical intervention. Greece has the highest proportion of smokers among Western European countries. Respective research findings would be of interest to smoking cessation clinics, as well as all specialists on training clinical populations. At the same time, the preventive and awareness intervention programs concern all students and adults. Such programs can cover the educational needs of the community and health services with modern, workable and effective materials for these critical health areas. The applicability of these programs will maximize the target population who will benefit. The development of these programs could help smokers on their quitting efforts and the general population by the dissemination of information gained from the project.

Relevant projects (treatment, preventive and awareness programs) are expected to have an effect on the reduction of the cost of treatment of patients suffering from diseases related to alcohol and cigarette consumption both in local and international level. Therefore, this research is expected to be beneficial to a large number of the population, both in local and the international level.

Conclusion

To sum up, the challenge of the suggested research directions is the multi-disciplinary approach that will be adopted. The innovations of these proposals are the following: The use of exercise as an additional mean to achieve both prevention and cessation from the unhealthy behaviors of smoking and alcohol, the

integration of different scientific approaches like psychology, physiology and exercise physiology, and the addition of self-regulatory strategies, emotional support and the exercise and awareness programs for smokers and alcoholics. Finally, through the above research directions, is anticipated the development of new knowledge on a complex and multi-factorial phenomenon, like smoking and alcohol addiction.

References

- Ajzen, I. (1988). *Attitudes, personality and behavior*. Milton Keynes Open University Press, UK.
- Andersson, B., & Hibell, B. (2007). *Drunken behaviour, expectancies, and consequences among European students*. In Järvinen, M. & Room, R. (Ed), *Youth drinking cultures: European experiences*. England: Ashgate Publishing Ltd, Hampshire; 2007.
- Bahrke, M.S., & Morgan, W.P. (1978) Anxiety reduction following exercise and meditation. *Cognitive Therapy and Research*, 2, 323–333.
- Bandura, A. (1986). *Social foundations of thought and action: A Social Cognitive Theory*. Englewood Cliffs, N.J.: Prentice-Hall.
- Berger, B., & Tobar, D. (2007). Physical activity and quality of life. In In G. Tenenbaum, & R. Eclund (Eds.) *Handbook of sports Psychology* (pp. 598-620). New Jersey. John Wiley & Sons, Inc.
- Biddle, S.J.H., & Mutrie, N. (2007). *Psychology of physical activity: Determinants, well-being and interventions*. Routledge.
- Corrao, G., Bagnardi, V., Zambon, A., & La Vecchia, C. (2004). A meta-analysis of alcohol consumption and the risk of 15 diseases. *Preventive Medicine*, 38, 613-619.
- Deci, E.L., & Ryan, R.M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11, 227–268.
- Dishman, R.K., Washburn, R.A., & Heath, G.W. (2004). *Physical activity epidemiology*. Champaign, Ill: Human Kinetics.
- Donaghy M.E., & Mutrie N. (1999). Is exercise beneficial in the rehabilitation of the problem drinker? A critical review. *Physical Therapy Reviews*, 4, 153–166.
- Ekkekakis P., Hall E.E., VanLanduyt L.M., & Petruzzello S.J. (2000). Walking in (affective) circles: can short walks enhance affect? *Journal of Behavioral Medicine*, 23(3), 245-275.
- Εθνικό Κέντρο Τεκμηρίωσης και Πληροφόρησης για τα Ναρκωτικά (2006). Ετήσια έκθεση του ΕΚΤΕΝΠ για την κατάσταση των ναρκωτικών και των οινοπνευματωδών στην Ελλάδα 2005. Αθήνα. ΕΠΙΨΥ.
- Eurostat (2008). Eurostat regional yearbook 2008. available at: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-HA-08-001/EN/KS-HA-08-001-EN.PDF
- Everson-Hock, E.S., Taylor, A.H., & Ussher, M. (2010). Readiness to use physical activity as a smoking cessation aid: a multiple behaviour change application of the Transtheoretical Model among quitters attending Stop Smoking Clinics. *Patient Education and Counseling*, 79(2), 156-159.
- Faulkner, G., & Taylor, A.H. (2005). *Exercise as therapy: emerging relationships between physical activity and psychological well-being*. Abingdon, Oxon, UK, Routledge Press.
- Flensborg-Madsen T., Knop, J., Mortensen, E.L., Becker, U., & Gronbaek, M. (2007). Amount of alcohol consumption and risk of developing alcoholism in men and women. *Alcohol* 42(5), 442-447.
- Gianoulakis C. (2004). Endogenous opioids and addiction to alcohol and other drugs of abuse. *Current Topics in Medicinal Chemistry*, 4(1), 39-50.
- Glanz, K.K., Rimer, B.K., & Viswanath, K. (2008). *Health behavior and health education: theory, research, and practice*. John Wiley and Sons.
- Goldfarb, A.H., & Jamurtas, A.Z. (1997). Beta-endorphin response to exercise. An update. *Sports Medicine*, 24(1), 8-16.
- Goldfarb, A.H., Hatfield, B.D., Potts, J., & Arm-strong D. (1991). Beta-endorphin time course response to intensity of exercise: effect of training status. *International Journal of Sport Medicine* 12(3), 264-268.
- Goldfarb, A.H., Hatfield, B.D., Sforzo, G.A., & Flynn, M.G. (1987). Serum beta endorphin levels during a graded exercise test to exhaustion. *Medicine & Science in Sports & Exercise*, 19(2), 78-82.
- Gossop, M., Domingos N., Radovanovic, M., et al. (2007). Physical health problems among patients seeking treatment for alcohol use disorders: A study in six European cities. *Addictive Biology* 12(2), 190-196.
- Hassandra, M., Kofou, G., Gratsani, S., Zisi, V., & Theodorakis, Y. (2012). Initial evaluation of a smoking cessation program incorporating physical activity promotion to Greek adults in anti-smoking clinics. *Evaluation & the Health Professions*, 35(3) 323-330.
- Hassandra, M., Theodorakis, Y., Kosmidou, E., Grammatikopoulos, V., & Hatzigeorgiadis, A., (2009). I do

- not smoke – I exercise: A pilot study of a new educational resource for secondary education students. *Scandinavian Journal of Public Health*, 37, 372-379.
- Inder, W.J., Livesey, J.H., & Donald, R.A. (1998). Peripheral plasma levels of beta-endorphin in alcoholics and highly trained athletes and the relationship to a measure of central opioid tone. *Hormone and Metabolic Research*, 30(8), 523-525.
- Irvin, J.E., Bowers, C.A., Dunn, M.E., & Wang, M.C. (1999). Efficacy of relapse prevention: A meta-analytic review. *Journal of Consulting and Clinical Psychology*, 67, 563-570.
- Jung, M.E., Fitzgeorge, L., Prapavessis, H., Faulkner, G., & Maddison, R. (2010). The getting physical on cigarettes trial: Rationale and methods. *Mental Health and Physical Activity*, 1, 10.
- Kalman, D., Kim, S., DiGirolamo, G., Smelson, D., & Ziedonis, D. (2010). Addressing tobacco use disorder in smokers in early remission from alcohol dependence: The case for integrating smoking cessation services in substance use disorder treatment programs. *Clinical Psychology Review*, 30(1), 12-24.
- Kosmidou E., Theodorakis, Y., & Chroni, A. (2008) Smoking attitudes among adolescents: Effect of messages varying on argument quality and source's expertise. *Journal of Social, Behavioral, and Health Sciences*, 2, 83-95.
- Kosmidou, E., & Theodorakis, Y. (2007). Examining differences in smoking attitudes between adolescents and young adults. *Psychological Reports*, 101, 475-481.
- Kotov, R., Gamez, W., Schmidt, F., & Watson, D. (2010). Linking "big" personality traits to anxiety, depressive, and substance use disorders: a meta-analysis. *Psychological Bulletin*, 136, 768-821.
- Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2006). Who drinks and why? A review of socio-demographic, personality, and contextual issues behind the drinking motives in young people. *Addictive Behaviors*, 31, 1844-1857.
- Landers D., & Arent, S. (2007). Physical activity and mental health. In In G. Tenenbaum, & R. Eclund (Eds.) *Handbook of sports Psychology* (pp. 469-491). New Jersey. John Wiley & Sons, Inc.
- Landers, D.M. (1994). Performance, stress and health: Overall reaction. *Quest*, 46, 123-135.
- Lujic, C., Reuter, M., & Netter, P. (2005). Psychobiological theories of smoking and smoking motivation: a review. *European Psychologist*, 10, 1-24.
- McAuley, E., Mihalko, S.L., & Bane, M.S. (1997). Exercise and self-esteem in middle-aged adults: multidimensional relationships and physical fitness and self-efficacy influences. *Journal of Behavioral Medicine*, 20, 67-83.
- Monti, P.M., Rohsenow, D.J., Colby, S.M., & Abrams, D.B. (1995). Smoking among alcoholics during and after treatment: Implications for models, treatment strategies and policy. In: Fertig, J.B. and Allen, J.P., Editors. *Alcohol and tobacco: From basic science to clinical practice. Research Monograph* vol. 30, National Institute on Alcohol Abuse and Alcoholism, Rockville, MD, pp. 187-206.
- Murray-Johnson, L., Witte, K., Boulay, M., Figueroa, M.E., Storey, D., & Tweedie, I. (2002). Using health education theories to explain behavior change: A cross-country analysis. *International Quarterly of Community Health Education*, 20, 323-345.
- Orsini, N., Mantzoros, C.S., & Wolk, A. (2008). Association of physical activity with cancer incidence, mortality, and survival: A population-based study of men. *British Journal of Cancer* 98, 1864 - 1869.
- Papaioannou, A., Karastogiannidou, C., & Theodorakis, Y. (2004). Sport involvement, sport violence and health behaviours of Greek adolescents. *The European Journal of Public Health*, 14(2), 168-172.
- Prochaska, J.O., & Di-Clemente C.C. (1983). The stages and processes of self-change in smoking: Towards an investigative model of change. *Journal of Consulting and Clinical Psychology*, 51, 390-395
- Read, J.P., Brown, P.J., & Kahler, C.W. (2004). Substance use and posttraumatic stress disorders: Symptom interplay and effects on outcome. *Addictive Behaviors*, 29, 1665-1672.
- Rosenstock, I. (1974). Historical Origins of the Health Belief Model. *Health Education Monographs*. Vol. 2 No. 4, 324-473
- Taylor, A.H., & Katomeri, M. (2007). Walking reduces cue-elicited cigarette cravings and withdrawal symptoms, and delays ad libitum smoking. *Nicotine and Tobacco Research*, 9, 1183-1190.
- Taylor, A., & Ussher, M. (2005). Effects of exercise on smoking cessation and coping with withdrawal symptoms and nicotine cravings. In G. Faulnkner, & A. Taylor, (Eds.), *Exercise, Health and Mental Health* (pp. 135-158). London. Routledge.
- Theodorakis, Y., Natsis, P., Papaioannou, A., & Goudas, M. (2002). Correlation between exercise and other health related behaviors in Greek students. *International Journal of Physical Education*, XXXIX, 30-34.
- Theodorakis, Y. (2010). Exercise, psychological health and quality of life. Thessaloniki: Xristodoulidis Publications.

- Theodorakis, Y., Kosmidou, E., Hasandra, M., & Goudas, M. (2008). Review of the applications of a health education program "I do not smoke I exercise" to elementary, junior high school and high school students. *Inquiries in Sports and Physical education*, 6, 181-194.
- Theodorakis, Y., Natsis P., Papaioannou A., & Goudas M. (2003). Greek students' attitudes toward physical activity and health-related behavior. *Psychological Reports*, 92, 275-283.
- Theodorakis, Y., Papaioannou, A., Hatzigeorgiadis, A., & Papadimitriou, E. (2005). Patterns of health-related behaviors among Hellenic students. *Hellenic Journal of Psychology*, 2, 225-242.
- WHO (2009). World Health Statistics. Available:
<http://www.who.int/whosis/whostat/2009/en/index.html>