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## SYSTEMATIC REVIEW

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# The Effect of Stress Management Techniques on Persons with Addictive Behaviors: a Systematic Review

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**ABSTRACT**

**Background:** According to the current state of knowledge, addictions are often developed as a maladaptive coping response to elevated stress levels. Stress management has a beneficial effect on various mental health problems. Yet, there is no strong evidence concerning the effect of stress management on stress levels of individuals with addictive behaviors, although such an effect might benefit their addictive symptoms. **Objective:** To investigate the effect of stress management on stress levels of persons with addictive behaviors. **Methods:** A systematic review of the literature was carried out on Biomed Central, PubMed, Scopus and Web of Science searching for relevant trials investigating the effect of stress management techniques, specifically of Progressive Muscle Relaxation (PMR), Autogenic Training (AT) and Guided Imagery (GI), on stress levels of individuals with addictive behaviors. In order to be included, the studies had to be randomized trials using an intervention and a non-intervention or a placebo control group, to apply PMR, GI or AT, to include a sample with addictive behaviors, to be published in English, to involve a baseline and at least one subsequent measurement, to be published in peer-review journals and to measure stress through instruments or biochemical assessments. The trials' quality was assessed by the use of the Jadad Scale. **Results:** A total of four studies met the inclusion criteria and were further analyzed. The findings indicated that PMR might lead to a reduction of stress levels, while no such evidence is found concerning GI and AT. The quality of all trials was low. **Conclusion:** Progressive Muscle Relaxation and GI might have a divergent effect on persons with addictive behaviors. Yet, the low number of the studies and their poor quality debar drawing reliable conclusions for potential beneficial effects.

**Keywords:** Addiction, Autogenic Training, Guided Imagery, Intervention, Progressive Muscle Relaxation; Stress.

**1. BACKGROUND**

Addictions refer to a wide range of behaviors, all of which lead to feeling a pleasure, associated with the development of a maladaptive coping response to stressful situations experienced by individuals. In order to fulfill the criteria of addictive behaviors, it is necessary that the person cannot control its behavior, which leads to significant negative impacts in several aspects of his life (1). According to the latest version of the Global Burden of Disease Study referring on addictive behaviors, the prevalence of several addictions (e.g. concerning opioids) has increased compared to the relevant 1990 data (2).

Stress is involved in the onset and disease course of various mental health disorders (3, 4). As for addictions, it has been supported that there are pathways between stress and the onset and persistence of those behaviors. Brain corticotropin-releasing factor (CRF) systems are significantly involved in behavioral and physiological manifestations of drug withdrawal, as well as in relapse to drug-taking behavior, which might be triggered by environmental stressors. In addition, hypothalamic CRF, via its action on the hypothalamic-pituitary-adrenocortical axis (HPA), is involved in the reinforcing effects of cocaine and alcohol, and the locomotor activating effects of psychostimulant drugs (5).

Current evidence indicates that improving the patients' mental health through psychosocial interventions might have an influence on their addictive behaviors (6). To decrease the mental health burden and the addiction

severity, a significant proportion of patients use Complementary and Alternative Medicine (CAM) (7). In general, techniques such as Progressive Muscle Relaxation (PMR), Guided Imagery (GI) and Autogenic Training (AT) have demonstrated significant effects on patients with several somatic and psychiatric disorders (8). However, there is no strong evidence supporting the efficacy of those interventions on persons with addictive behaviors.

## 2. OBJECTIVE

The aim of the present study was to expand our knowledge regarding the effect of stress management on stress levels of persons with addictive behaviors.

## 3. MATERIAL AND METHODS

### Study design

The study design was systematic review (SR). According to Rys et al. (9) the appropriate way to come to a conclusion about a treatment's efficacy is to conduct a SR of the literature. Therefore, applied to review all relevant trials investigating the effect of stress management techniques, specifically of PMR, GI and AT in addictive behaviors.

### Literature Search

The literature search was carried out by the first author and cross-checked by the last. The database search process was carried out from inception till 04.10.2018 in Biomed Central, Pubmed, Scopus and Web of Science. The combination utilized in this study was the following: (stress OR strain OR distress) AND ("progressive muscle relaxation" OR "relaxation response" OR "autogenic training" OR "mental imagery" OR "guided imagery" OR "guided visualization") AND (marijuana OR cocaine OR heroin OR opioid OR ecstasy OR crack OR LSD OR "drug abuse" OR "drug-seeking behavior" OR "drug dependence" OR "drug addiction" OR nicotine OR smoking OR smoker\* OR tobacco OR alcohol OR alcoholic\* OR "problem drinking" OR "substance abuse" OR "video game addiction" OR "web addiction" OR internet OR gambling OR addiction OR craving OR bingeing OR purging OR eating OR sex OR sexual\* OR overtraining OR "excessive training"). In addition, a snowball search process was carried out on the reference lists of the included studies, as well as on studies citing those papers. The flow of information of record identification till study inclusion was carried out in accordance with the PRISMA statement (10).

### Inclusion and exclusion criteria

The inclusion criteria of the potentially relevant studies were the following: a) randomized trials including an intervention and a non-intervention or a placebo control group b) applying PMR, GI or AT c) including a sample with addictive behaviors d) being published in English e) involving a baseline and at least one subsequent measurement f) being published in a peer-review journal g) measuring stress through instruments or biochemical assessments. No specific exclusion criteria were set.

### Data extraction and quality assessment

The data extraction process and quality assessment was carried out by the first author and cross-checked by the second. Disagreements between the two authors were resolved through discussion, also by the use of the third author.

The extracted data regarded: study, country, the number of participants, type of addictive behavior, medical treatment of the addictive behavior, type of stress-management intervention, potential combined interventions, intervention program details, suggested frequency of practice, measures of stress, time intervals of the assessments and main findings.

The quality of the trials was appraised by the use of the Jadad Scale (range 0-5). In this scale, randomization and double blinding are given two points, while reporting participants' withdrawal and dropout reasons is given 1 point (11).

## 4. RESULTS

### Overview of the findings

A total of 569 unique publications were identified. After screening those records, 519 were considered as irrelevant with the study and 50 were full-text accessed, since they were considered as potentially relevant. Of those, 46 didn't meet the inclusion and exclusion criteria. Therefore, 4 studies meeting the necessary criteria were further analyzed (12-15). The flow of information can be found in detail in Figure 1.

As indicated in Table 1, two studies were carried out in the United States, one in Greece and one in Germany. The sample size ranged from 20 to 75 participants. One study included patients with Night Eating Syndrome (NES), one with binge eating disorder (BED), one with food craving (FC) and one with pathological gambling (PG). In three of the four studies the participants did not receive any other treatment for their addiction. Half of the studies applied PMR and the other half GI. Half of the studies applied those interventions as part of overall integrative programs, while the others applied those techniques as a sole intervention. The suggested frequency of practice ranged from once to twice per day, while no suggested frequency of practice was recorded in one of the studies, since all sessions were instructed by the researchers. All studies measured stress through self-reported instruments, specifically through the Perceived Stress Scale (PSS), the Perceived Stress Questionnaire (PSQ) and the Depression Anxiety and Stress Scale-21 (DASS-21), while a single study also used biomarkers (salivary cortisol). The endpoint assessments ranged from 6 weeks to three months. Two of the studies, those applying PMR, found statistically significant benefits in favor of the intervention group, while no differences were found at the other two studies, applying GI. One study scored 1 point on the Jadad Scale and three studies scored 2 points.

Due to the small number of studies, pooling the results was not sensible. Therefore, the results of the studies are normatively presented flowingly.

### Summaries of the included studies

Pawlow et al. (12) investigated the effects of PMR on patients with NES. The sample consisted of 10 intervention and 10 control group participants, randomly assigned to the two groups. The intervention consisted of two face-to-face sessions, while the control group participants received no sham or other intervention. Prior to the sessions, measurements were carried out by the use of the PSS and salivary cortisol. Afterwards, the intervention group par-

Study	Country	Number of Participants	Type of addictive behavior	Medical treatment of the addictive behavior	Type of stress-management intervention	Combined interventions	Interventional program details	Suggested frequency of technique's practice	Measures of stress	Time point of the assessments	Main findings	Jadaad Scale Scoring
Giacobbi et al, 2018	United States	48	Food craving	None	GI	Health education- workbook	Information about diet, exercise and stress management and GI scripts administered at an initial assessment. The participants recorded their process in the workbook given during the study period	Every day	PSS	Baseline and after 6 weeks	No statistically significant effect on stress	2 points
Linardatou et al., 2014	Greece	45	Gambling	The sample participate at an anonymous group therapy intervention	PMR	Psychoeducation concerning healthy lifestyle and stress management	At the first week, all participants were taught PMR and provided an instructional audio CD. In addition, they received verbal and written psychoeducation concerning healthy lifestyle and stress-coping behaviors	Twice a day	DASS-21 stress subscale	Baseline and after 8 weeks	Statistically significant differences were recorded at the endpoint assessment ( $p<0.00$ ), which were in favor of the intervention group. A strong effect size was also recorded ( $r=0.77$ ).	1 point
Pawlow et al., 2003	United States	20	NES	None	PMR	None	20 minutes of PMR, instructed face-to-face and practiced afterwards through an audio CD	Once per day	PSS and salivary cortisol	Pre- and post intervention at day 1, pre and post-intervention and day 8	Lower PSS scores for the intervention group compared to the control at the first post-session assessment ( $p<0.05$ ) and at the second pre-session assessment ( $p<0.01$ ). Significant decreases in PSS over time in the intervention group ( $p<0.01$ ). A statistically significant effect was also recorded between the pre and post assessment of salivary cortisol in the intervention group ( $p<0.05$ ).	2 points
Schmidt & Martin, 2016	Germany	75	Binge eating	None	Mental Imagery	None	10 sessions of approximately 35 minutes each	NA	PSQ	Pre-intervention, post-intervention and after 3 months	No significant effects were noted for stress ( $p=0.052$ )	2 points

Abbreviations: DASS-21, Depression Anxiety and Stress Scale 21; GI, Guided Imagery; NES, Night Eating Syndrome; PMR, Progressive Muscle Relaxation; PSQ, Perceived Stress Scale

Table 1. Extracted data and quality appraisal

ticipants were instructed to practice a 20 min PMR session, instructed by a member of the research team. The same assessments were carried out post-intervention. The intervention group participants were provided an audio CD and were instructed to practice PMR once per day for the next week. At the end of the week, an additional session was performed, replicating the methods of the original session that was carried out, also involving a pre and post-intervention assessment, although the post-intervention assessment was carried out only for the control group participants. Regarding scores on the PSS, the intervention group participants scored significantly lower than the control group participants in the first post-session assessment ( $p < 0.05$ ) and in the second pre-session assessment ( $p < 0.01$ ). There was also a significant decrease in PSS over time for the intervention group ( $p < 0.01$ ), while not for the control group. A statistically significant effect was also recorded between the pre and post assessment of salivary cortisol for the intervention group ( $p < 0.05$ ). This study scored 2 points on the Jadad Scale, since randomization and participants' dropout and withdrawal reasons were mentioned.

Schmidt and Martin (13) investigated the effects of GI, compared to neurofeedback and a control group through a three-arm randomized controlled trial, involving three equal groups of 25 participants each. All patients have received a BED diagnosis. The GI participants practiced 10 sessions of approximately 35 minutes each. The intervention consisted of 10 sessions of 35 minutes, administrated through face-to-face instructions by the researchers. The data were collected through the PSQ at baseline, post-intervention and after 3 months. No significant effects were noted on PSQ for the GI group in comparison to the control group, although the absence of significant differences was marginal ( $p = 0.052$ ). This study received 2 points on the Jadad Scale, since randomization and dropout reasons were reported.

Linardatou et al. (14) investigated the effects of an 8-week stress management and health promotion program, including a 15 minute PMR session, as well as healthy lifestyle instructions (e.g. increase in physical activity, healthy diet etc.) on a sample of PG ( $N = 42$ ). The PMR session included 10 minutes of relaxation breathing and 15 minutes of PMR. This study included 22 intervention and 20 control group participants, randomly assigned to the two groups. The intervention group participants were instructed to practice the PMR sessions twice daily during the 8 weeks period, while the intervention group participants received no intervention. Stress was assessed by the use of the DASS-21 Stress subscale and baseline and after 8 weeks. After the intervention, a statistically significant effect was found in favor of the intervention group ( $p < 0.000$ ), denoting a strong effect size ( $r = 0.77$ ). Analysis of the participants' adherence indicated that the mean frequency of practice was 74 times during the 8 weeks period, out of 112 proposed times. This study scored 1 point on the Jadad Scale, since the partici-

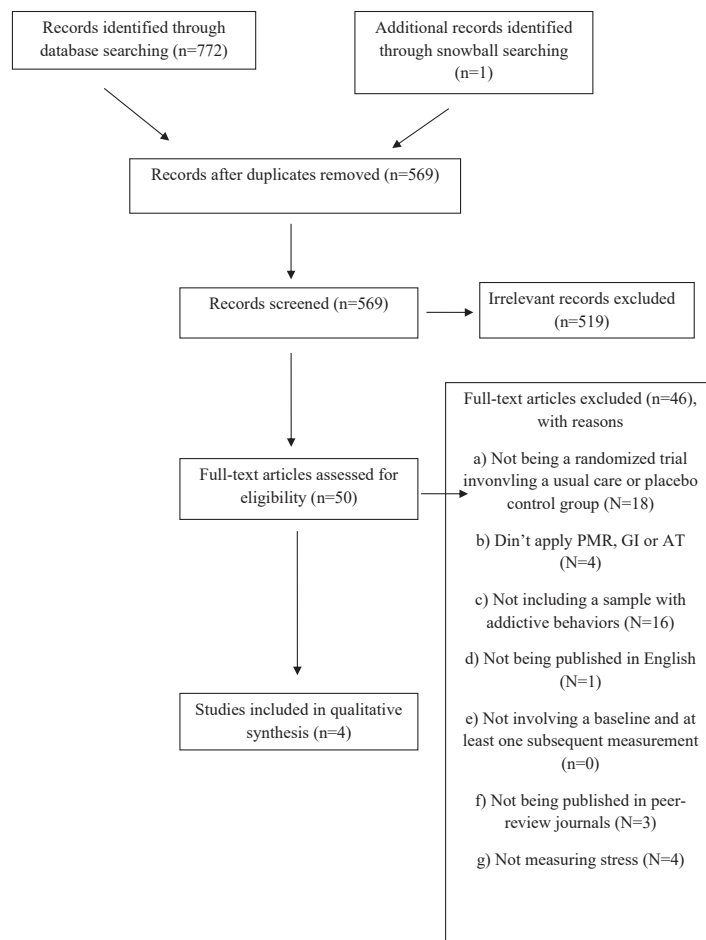


Figure 1. The flow of information of the study

pants were randomized, but an appropriate randomization method was not mentioned.

Giacobi et al. (15) investigated the effects of GI on stress levels of 48 persons with FC behaviors, assigned to an intervention group ( $N = 21$ ) and to a wait-list control group ( $N = 27$ ). The intervention included three written guided imagery scripts, taught to the participants at a single meeting by an instructor, while the control group received no intervention. The scripts targeted food-craving behaviors. The participants were to practice GI using the scripts at least once daily for the next 35 days. At the same session, the participants received an educational workbook on healthy lifestyle behaviors. Stress levels were assessed by the use of the PSS at baseline and at the end of the 35 day period. No statistically significant differences were recorded between the two groups at the endpoint assessment. This study received 2 points on the Jadad Scale, since randomization and reporting participants' withdrawal and dropout reasons were reported.

### 5. DISCUSSION

This study aimed to investigate the effect of PMR, GI and AT on persons with addictive behaviors. As indicated by the findings, the two studies applying PMR (12,14) lead to statistically significant differences in favor of the intervention group, while the other studies applying GI (13, 15) did not lead to significant benefits for the intervention group

participants, although in one of the studies marginal differences were reported (13). Hence, it could be supported that PMR leads to an effective control of stress levels for the patients, while GI doesn't. One possible explanation for this divergent effect might be that PMR, as stated by Grafam and Johnson (16), is more positively appreciated and preferred than GI, as PMR to more active practice. Thus, a difference in compliance due to a difference in technique preference might be responsible for these differences.

Nevertheless, this study faces a variety of limitations which downgrade the reliability of the findings. First, the number of the studies was quite small, leading to the inclusion of samples with specific addictive behaviors, not including samples with other types of addictions. More specifically, three out of four studies included samples with food-related addictions. Therefore, the number of the included studies was small, while only some of the addictive behaviors are examined.

An additional limitation concerns the quality of the included studies. As indicated by the relevant analysis, the quality was quite low, which poses a bias risk. In addition, there were other methodological omissions in those studies that have to be reported. The most serious concern regards the absence of a sample size calculation process during the design of the studies', a limitation which can lead to type I and type II errors (17, 18). Another concern of the methods used in the trials included has to do with the use of biomarkers applied to assess stress only in one of the trials. The analyses of psycho-endocrine covariance in previous studies, including a variety of stressors and participants' characteristics, have yielded inconsistent results between self-reported measures and cortisol (19). Therefore, cortisol might be a more reliable measurement of stress levels, contrarily to self-reported assessments, in line with the general superiority in the validity of biomarkers compared to questionnaires (20).

A further limitation regards the absence of studies investigating the effects of AT. Even though the study purpose was to investigate the effects of this technique as well, no relevant trials were found. Hence, no conclusions can be drawn about the effect of AT on stress levels of people with addictive behaviors.

In general, the limitations of the present study do not allow making strong recommendations for clinical implications. Yet, setting stress under control is of most importance in behavioral addiction treatment, due to the strong relationship between stress and addictive behaviors (21). Due to the necessity to come to such conclusions, future research on that field is essential. At first, future studies should investigate the effect of stress management techniques on samples with other types of addictive behaviors, such as nicotine, alcohol or internet addiction. Indeed, research on those addictions is necessary in order to come to conclusions about a potentially more general effect of stress management on a wide range of addictive behaviors.

It is also necessary for future studies to use sham interventions in order to increase their methodological quality, since none of the studies used blinding. In that context, the aim of future trials should be to establish the effect of stress management techniques on stress compared to

placebo-controlled groups, a major challenge for all CAM interventions (22). Sham sessions of similar time frame could be developed by teaching participants to inhale and exhale at a usual pace and continuously repeating an exercise, such as tensing the same muscle or making any other body part move, instead of tensing all muscle groups in a specific order. This type of pseudo-session resembles the fake placebo needles used to equalize the placebo effect between different study arms in acupuncture research (23) and could effectively result to patient blinding.

Finally, another suggestion for future studies has to do with assessments of participant adherence. Measuring the responders adherence could lead to dose-response conclusions concerning the effects of the applied techniques. Hence, research could lead to more useful clinical implications, promoting the adoption of those techniques in clinical settings.

## 6. CONCLUSION

Studies applying PMR on stress levels of persons with addictive behaviors have recorded benefits on their stress levels, while studies applying GI have not lead to significant benefits. Based on this divergent effect, it could be supported that those two different techniques might have a different impact on stress levels of persons with addictive behaviors. Nevertheless, drawing conclusions from those studies is in question due to the small number of the studies and their poor methodological quality. Due to the importance of stress management for persons with addictive behaviors, future studies are necessary in order to further investigate the effect of stress management techniques on stress levels of persons with addictive behaviors.

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