Exercising and depression. An effective treatment alternative to the conventional treatment of depression? A narrative review

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Abstract: Purpose

The increasing incidence of depression is regarded as a rising economic problem and is currently the focus of research in medicine [10] [21]. Standard therapy is based on drug therapy with antidepressants and psychotherapy [37]. The conventional treatment methods, in addition to extensive waiting times for a therapy place, do not always lead to the desired therapy success [58] In context of this development urgent action is needed. Attention should be paid to establish a cost-effective and generally accessible treatment alternative. The aim of this work is to investigate the effectiveness of fitness training as a treatment alternative to standard treatments and therapies besides will investigating and briefly reviewing the unmanageable amount of publications on this topic. The subject of investigation is unipolar depression, also referred to as depression. The narrative review of already existing publications provides an overview of the current status of research in regards to whether fitness training, endurance training and / or strength training can be an effective treatment alternative in compared to conventional treatment methods. To assess the research question, published primary studies were considered, critically evaluated, essential information extracted from the studies and corresponding conclusions derived.

Methods:

The present work represents a narrative review of the literature published until 2018 about the therapeutic intervention of fitness training in patients with depressive symptoms. The literature search took place

between 17.01.2018 and 11.02.2018 both via electronic database and conventional methods.

Conclusion:

The evaluated studies show that fitness training has a moderate to high antidepressant effect. The narrative review confirms the current state of knowledge: the effectiveness of fitness training is not different to the effectiveness of standard therapies. Based on the previous data, a 45-60 minute moderate endurance training three times a week seems to be recommended.

Introduction:

'Exercise is the most potent and underutilized antidepressant. And it´s free.' (unknown)

Depression is a serious mental and potentially life-threatening disease, with a steadily increasing incidence [39]. According to the World Health Organization (WHO), affective disorders besides cardiovascular diseases and cancer will be among the three most common diseases in the next few years [57]. Worldwide, approximately 322 million people (4.4% of the world's population) suffer from a depressive disorder [57]. Lifetime prevalence lies around 16-20% worldwide and nationally which means that every fifth person suffers from depression at least once in his/her life [15] [41]. Unipolar depression is one of the most common mental disorders [21] [10]. The consequences of a depressive disease are a considerable burden for those affected, their relatives as well as for the national economy [53] [16]). They are usually treated with standard therapy which includes antidepressants and psychotherapy or a combination of both [37] [15]. However, the therapy and respective treatment do not always lead to the desired treatment success [51]. Given the moderate effectiveness of standard treatments and the increasing number of newly diagnosed cases of depression, it seems essential and necessary to search for further, more effective and / or less costly treatment alternatives [59]. For example, 81.6% of the German population and 88.6% of those affected regard sport as a very suitable method and support to treat depression. But can this opinion be supported by scientific evidence? The positive effects of physical activity on health and its health-promoting effect are well documented, especially for the treatment of chronic diseases [49] [4]). Hence, the focus of physical activity is set on prevention, therapy and rehabilitation in particular in cardiovascular, metabolic and oncological diseases besides diseases of the musculoskeletal system [35]. The positive effect of physical training on depressive symptoms has been demonstrated in numerous studies [12] [30] [47]). However, fitness and physical training are still considered as marginal amongst the common treatment regimens [40]. Consequently, the question arises whether

the potential of fitness training as an effective treatment alternative is still underestimated?

Material and methods: Literature research and research strategy

The present work is a narrative review of the literature published until 2018 on the therapeutic intervention of fitness training in patients with depressive symptoms. The literature research took place between 17th January 2018 and 11th February 2018 both by scouring electronic databases and conventional resources. The main source of suitable primary studies was the PubMed electronic database using database-specific filters. In addition, an independent research on the Internet and in the technical library of the Humboldt University Campus North has been done. Therefore, especially books and journals have been screened. In addition, studies have been identified by manually searching and by reviewing reference lists or similar articles. In same cases, inaccessible sources have been purchased.

Search and Keywords

The basis for the study research in the reference database Pubmed has been topic-specific search and keywords (Tab. 1). The following terms were used as starting points: fitness training, depression and treatment. All three generic terms have a large bandwidth of synonyms and sub-concepts. The subject of this thesis has been built upon the following German and English keywords:

Search strategy and search strings

The search terms were linked by using the boolean operators (AND and OR). In addition, the search was carried out by using the operator [MeSH]. A first selective narrowing of eligible trials was achieved by using filters. Thus, the filters 'randomized controlled trials (RCT)', 'humans and 19 years +' have always been applied. If required (results> 200), the search field was also limited to title/ abstract. Furthermore, duplicates were excluded. A first selection was made by using not only filters in the databases but also in the context of the manual, conventional and independent research. During this research the results were reduced to RCTs and these were continuously checked for suitable titles. Duplicates have been excluded within the respective searches.

Selected literature

The selection of the studies took place by the author herself. First, titles and abstracts of the remaining studies were screened. Subsequently a review of the full texts followed. Benchmark for the inclusion or exclusion of the studies have been the previously defined inclusion and exclusion criteria (Tab. 2).

Evaluation of the studies

To evaluate the methodological quality of

the studies, the PEDro scale was used. The PEDro scale consists of eleven criteria (Appendix 1). A met criterion is allocated to a specfic score. The first criterion of the PEDro scale refers to the assessment of the external validity, criteria 2 until 9 assess the internal validity and the criteria ten and eleven are related to the statistical validity and interpretability of the study (Physiotherapy Evidence Database, PEDro).

Data extraction

After the critical phase of evaluating the quality of the studies, a data extraction both comprehensively and descriptively has been performed. This was followed by a tabular presentation of the individual studies. Subsequently, the following data has been extracted: name of authors, year, title, duration, interventions, intensity / frequency, control / comparison group, survey / measurement instruments, drop-out, results and conclusions.

Results

The selective literature research both in database and conventional resources resulted in a compilation of total 171 randomized controlled trials. After reviewing the abstracts and full texts using the inclusion and exclusion criteria, eight studies were included in the narrative review. As this represents a narrative review, no claim of completeness can be made. In a further step, the studies have been evaluated in regards to relevance to the research question and the respective data extracted (Fig.1).

The clinical picture of depression

‘Depressive disorders are characterized by sadness, loss of interest or pleasure, feelings of guilt or low selfesteem, interrupted sleep or appetite, feelings of tiredness, and poor concentration. Depression can be long lasting or recurrent. Substantially depression impairs an individual´s ability to function at work or school and to cope with daily life. At it´s most severe, depression can lead to suicide [57].

Depression belongs to the group of affective disorders [26]. The term affective disorders is an umbrella term for disorders characterized by an interference of the totality (affectivity), the psychomotor and the impulse [2]. The word depression derives from the Latin word "deprimere" which means "depressed". Depression is different and individualized in terms of symptoms, course and severity and therefore difficult to define in a consistent way [5].

Mental and somatic comorbidity

In addition to depressive diseases, there are often other psychological and / or somatic disorders [45]. For example, depressive diseases have a high degree of psychological comorbidity with other mental illnesses. The most common comorbidities include anxiety disorders, substance abuse, eating and personality disorders, and an obsessive-compulsive disorder [34]). Cardiovascular

diseases such as diabetes mellitus, the metabolic syndrome (risk factors for coronary heart disease), Parkinson's disease and Alzheimer's disease are particularly prominent in the field of somatic comorbidities [45]. On the one hand, somatic diseases can cause depression, on the other hand, depression can also be the cause of further somatic diseases [15].

Epidemiology and respective consequences for Germany

In Germany, approximately 4.1 million people (5.2% of the population) currently suffer depression [57]. The 12-month prevalence in the German general population (age: 18- 65 years) is 10.1%, which means that about 5-6 million people suffer depression in Germany every year [55]. Women suffer twice as often as men [55] [10]. Depression occurs in every age group with the highest prevalence between 18 and 29 years of age [10]. The increased comorbidity with other mental and somatic diseases is not only correlated to an increased mortality and morbidity and higher costs, but also has a negative effect on the treatment efficacy and the quality of life of those affected [15]. For example, depression is associated besides others with a shortened life expectancy and an increased mortality rate but also with increased suicidality [33] [58]. Not only those affected and their relatives are struggling with the consequences of depression. Depression causes high indirect and direct costs for the German economy, in particular for the health care system [8] [33] [58]. In addition to musculoskeletal disorders and diseases of the respiratory system, more than half of all sick leave days are due to mental diseases [28]. The incapacity for mental diseases ranges from an average of 34.3 days to 40.1 days in men and 44.5 days in women [28]. The cost of the inability to work in the context of the gross value totals to approximately 16.8 billion euros whereas the costs caused by production loss amount for approximately 9.5 billion euros [42]. Unipolar depression is one of the top causes of early retirement [15]. These figures illustrate the economic need for effective and cost-effective treatment alternatives for those affected. The currently available treatment concepts for depression consist of pharmacotherapy with antidepressants and psychotherapy.

Problems of conventional treatment methods

Due to the increasing number of newly diagnosed patients suffering depression and those in need of treatment, the healthcare system in Germany faces major financial challenges [36]. In psychotherapeutic care, the main problem besides a very delayed rapid response, is especially a lack of treatment places and the resulting long waiting times [58]. Thus, the waiting period to get admission to a therapy place can be up to six months. The number of antidepressants prescribed to patients has

doubled in the last ten years which not only raises the question of adequacy and treatment choice [36]. The latency period of antidepressants is at least two weeks [40]. 60% of those affected respond positively to their treatment only six weeks after the intake [34]. One third of patients do not respond at all or just insufficient to the pharmacotherapy [15]. Another critical factor to consider is the possible occurrence of side effects [25]. The most common side effects relate in particular to the cardiovascular system, the nervous system and sexuality [58]. The main problem however is that many side effects may occur before the actual treatment effect [34]. This mainly negatively influences the willingness (compliance) of those affected to take the drug on a regular basis [58]. The rate of therapy discontinuation in pharmacological therapy amounts for approximately 50% [50]. Another argument which reinforces and contradicts the use of antidepressants is a strong association to prejudices [21].

Given the negative stigmata of both treatment options leads to the assumption that depressive patients do not consult their healthcare professionals [11]. With that said, the need to develop other effective, unbiased and cost-effective treatment alternatives gets reinforced.

Fitness training as a treatment alternative

The positive effect of physical activity in general is accepted [49]. Regular physical activity can help to reduce the risk of cardiovascular diseases, obesity, musculoskeletal disorders, and consequently mortality [32]. In addition, it strengthens the mental well- being, the development and establishment of social contacts and leads to an improvement of the physical fitness [32]. In view of these facts, the WHO recommends for adults, for example, to move at least 150 minutes a week (moderate intensity) or 75 minutes a week (high intensity), in addition to performing muscle-strengthening activities two days a week [57] . Physical activity also has a positive effect on the healing process in various diseases and is used in particular in the treatment regimen of chronic diseases for prevention and / or therapy [4] [35]. Additionally, physical training is increasingly being integrated into the treatment plan of inpatients as a supplementary accompanying treatment of unipolar depression [33]. In this context, sports and exercise therapy are based on the approach of salutogenesis (health development) and clearly unfolds its effects in the psychomotor, cognitive and emotional areas [23]. In the outpatient setting, however, prescription and reimbursement of sports therapy by the health insurance is still very limited [41]. In Germany, physical training as a potential therapy alternative is increasingly coming to the fore. Several official recommendations regarding physical training as a treatment alternative for depression already exist [38]. The S3 Guideline defines physical training according

to the guidelines of the American College of Sports Medicine (ACSM) as a 'planned, structured and repeated physical activity to maintain or improve one or more areas of physical fitness' [43]. The American recommendations regarding intensity and duration focus on aerobic endurance training of moderate intensity for at least 30 minutes on five days per week or intensive training for at least 20 minutes on at least three days per week, or a combination of both. The aim is an energy consumption of at least 500 to 1000 metabolic units (1 MET = 1.2 kcal / min) per week. In addition to this endurance training, weight training for all major muscle groups as well as balance and coordination training should be integrated into the therapy concept of physical training on two to three days per week [18].

Results

Subsequently, the eight studies included in the literature review are tabulated. In order to further process these, the studies are numbered consecutively. The studies are divided in regards to their conventional treatment method which have being used for the comparison (Tab.3 and Tab.4).

Evaluation of study quality

The studies included in the review for subsequent data extraction were evaluated as per the PEDRO-scale validity (Tab. 5).

Descriptive summary of the results

In a randomized controlled trial, five studies (Studies 1, 2, 3, 4, and 5) examined the effects of fitness training compared to pharmacological treatment. Additonal three studies (Studies 6, 7, and 8) looked into the effects versus psychotherapeutic treatment. These investigations took place in the years 1999 to 2015. During the period between 2015 and 2018 no further studies could be found focusing the above mentioned topic and complying with the defined inclusion and exclusion criteria. However its worth mentioning, that in the summer of 2018, a new study under the research title "Sports therapy for depression STEP.de", has been initiated focusing on the same issues. The objective of the study (480 subjects) is to investigate whether sports in mild to moderate depression can be a complementary or alternative treatment option for psychotherapy (STEP.De).

Population / participant

A total of 1,783 individuals were randomized and 1,512 individuals included in the efficacy analysis. The subjects consisted of both male and female participants. Participants of studies 1-4 had a diagnosed major depression. Study 7 had mild to moderate depression and study 8 included only depressive symptoms. Only in study 6, the subjects showed an additional somatic disease. All subjects were over 18 years old. Most studies compared two or more treatments and had no control group. All

participants were treated on an outpatient basis. Two studies (study 2 and 4) described the same participants in a follow-up study as the baseline studies (study 1 and 3). Exclusion criteria included other mental diseases, drug abuse and additional contraindications that would interfere with physical training.

Intervention: fitness training

The majority of studies (Studies 1-4, 6-8) describe aerobic intervention in terms of endurance training (Studies 1-4, 6 and 8). The focus of the intervention in study 7 was an aerobic exercise program, whereas only in study 5 a combination between endurance and strength training has been described as the subject of investigation. Walking and jogging were the most common choices. Training took place as individual training as well as in groups. Training frequency of all three studies has been three times a week. The training time varied between min. 45 minutes and 60 minutes. Intensity was 70-85% of maximum heart rate (max HR) in studies 1-4 and 50-85% of max. HF whereas study 6 and 8 described moderate speed / exercise. Only in study 7 no information regarding exercise intensity was available. The interventions lasted from 10 up to 16 weeks.

Comparison with conventional treatment methods

In 5 studies (studies 1-5), the interventions were compared with the psychotropic drug "sertraline". In Study 6 and 8, the effects of exercise and physical training have been compared with cognitive behavioral therapy.

Measuring instruments / survey procedure

All studies included a pre-post comparison. The effects of fitness training on the depressive symptoms and the depressive mood were examined with different measuring instruments and survey methods. The most frequently used was the Hamilton rating

scale (HAM-D) followed by the Beck Depression Inventory (BDI). Only study 7 and study 8 leveraged other survey methods. For example, study 7 examined the impact using the Patient Health Questionnaire (PHQ-9) and study 8 applied the Geriatric Depression Scale 15 (GDS-15).

Drop-Out

Drop-outs have been observed across all studies. The drop-out rate in the training groups showed a variability of 4-26% between the different studies. Exceptions have been study 6, which showed no drop-outs in the training group and study 8 which did not mention any drop-outs at all. The drop-out rates in the training interventions in group training were higher compared to the drop-out rates of conventional treatment methods. The self-paced drop-out rates of individual training were with rates of 0% and 4%, respectively (Study 3 and 6) lower in comparison to the other studies.

Outcomes / Results

All studies reported a decrease in depressive symptoms through fitness training. Studies 1 and 8 even spoke of a significant decrease in depressive symptoms. There was no significant difference to the conventional treatment methods. Only Study 8 came to the conclusion that fitness training can influence depressive symptoms better than cognitive behavioral therapy. All studies conclude that fitness training can be an effective alternative in the treatment of depression.

Discussion: Methodological criticism of one's own approach

The disease pattern of depression and its treatment is a very complex and highly discussed subject these days. There are numerous studies that differ in terms of quality, objectives, survey and measurement tools and the resulting outcomes. Since this work is a narrative review, no claim of completeness of the data can be made. However, in contrast to a purely narrative review, inclusion and exclusion criteria were chosen for the literature research which built the basis of this work. As a result, the disadvantages of the risk of bias were minimized and, as a benchmark, the methods of a systematic review were used to ensure a high quality of the included studies [46]. Given the restriction to focus on studies which are aligned with the selected inclusion and exclusion criteria and which complied with scientifically high standards only eight studies remained. These 8 studies have been served as the basis of defining the the objective of the work as well as answering the research questions. Furthermore, it can not be excluded that studies were not found. The reason to only include randomized and controlled trials in the research should preserve the validity of the therapeutic interventions. For example, only abstracts were accepted for further full-text review if these had used a comparison treatment with a standard therapy. Thus, studies were excluded that looked at a standad or GP treatment only. In addition, it must also be critically noted that more electronic databases for research could have been leveraged. For the present research. However, it is questionable whether the methodology of a systematic literature search would have widened the selection of studies. The problem of the low number of high-quality studies was already raised and demonstrated in 2012 by the group around Rimer et al. described in a meta-analysis. Rimer et al. which descriebed the phenomena in a meta-analysis. Rimer et al included 30 interventional studies in their own study. After applying the criteria for assessing qualitative studies, only four studies complied with the criteria and could be included in the evaluation [48].

Review of the research question

To compare fitness training and drug therapy, five studies (studies 1 - 5) were

included in the evaluation. For the means of comparing psychotherapeutic therapy three studies (studies 5-8) could be found. Taking into account current research, this narrative review shows that in all studies the symptoms of depression could be reduced by a training program. Two studies (studies 1 and 8) reported a significant improvement in depressive symptoms. A difference to conventional treatments could not be determined. Exercising is therefore not more or less effective than the standard treatments.

Study criticism: Time of Intervention

All studies included in the analysis have a duration of intervention of more than ten weeks and correspond to the period indicated in the literature for effective intervention; Interventions of more than nine weeks show stronger effects [13].

Member

The question arose whether the recruitment process had an influence on the motivation of the subjects and thus a distortion of the results could be possible result. In the studies of Blumenthal et al. (Studies 1-4) subjects responded to public announcements and call- ups and social media based on their personal interest. In the studies (Studies 5-8), the subjects were recruited through direct contact by telephone, mail or the supervising family doctors and therapists. One could consequently assume that the subjects of the studies 1-4 showed a higher motivation in to consider a trainings program as their therapy choice thereby strengthen the belief in the effectiveness of such a measure.

Intervention: frequency and intensity

The consistency across the majority of the studies in terms of intensity and frequency of the exercise load, which has been defined defined in all underlaying studies as three times a week with a moderate load (à 45-60 minutes), allows for a good comparability. Studies comparing strength training to one of the standard therapies could not be found. However, strength training can also reduce depressive symptoms. Thus, Krogh et al. found no significant difference between strength and endurance training, in the reduction of HAM-D scores compared to the placebo group [31].

Comparison / control group

The inclusion and exclusion criteria were based on the implementation of a randomized controlled trial. However, Blumenthal et al. (1999) conducted their study (Study 1) without a placebo control group [7]. They compared the results of the intervention group that performed aerobic endurance training with a comparison group treated with a drug therapy and a second comparison group which has been treated with drug therapy plus endurance training. Due to the absence of the placebo control group the bias of possible independent spontaneous recovery in the study could not

be considered. The bias was confirmed in a study in 2007 by Blumenthal himself [6]. In this study (study 3 [6]), the positive effect of aerobic exercise on the efficacy of aerobic endurance training ould not be confirmed in comparison to antidepressants and a placebo group in patients suffering major depression. Compared to the placebo group, the intervention groups (aerobic training in the group versus individual endurance training versus antidepressant medication) did not achieve a significant better result. The lack of a significant difference between physical intervention and drug therapy group was also demonstrated by Brenes et al. 2007 [9] (study 5); i.e. this study also confirms the comparable efficacy of the therapeutic effects of antidepressants and athletic intervention. Klein argued that studies comparing non-pharmacological interventions with antidepressants should include a comparison group with placebo therapy [27]. This is necessary to ensure that the investigated patient population is responding to drugs that go beyond the effects of a placebo [27]. Walsh et al. argued in a similar way and concluded that studies that investigate new treatment options have no scientific credibility if no placebo collective is included. The only evidence of treatment efficacy is a response that is statistically indistinguishable from the response to an established drug [56]. The evaluation of an reinforcement of social effects caused by group training, which is used as an explanation for the improvement of symptoms, can not be evaluated in study 1 based on the underlying study design [7], since the comparison to fitness training outside the group has not been conducted. However, this group effect has been shown in recent studies by Blumenthal et al. and Singh et al. [6] [54]. In these studies, no difference between in the antidepressant effect of exercise in groups and the effect of individual training could be observed [6] [54].

Survey / measuring instruments

Overall, the influence of the measuring and survey instruments themselves and in the context of the comparability of the studies with each other have to be looked at critically. In the analysed studies, the external evaluation scale HAM-D (studies 1-6) and the self- assessment procedures BDI (studies 1 and 2), GDS-15 (study 8) and PHQ 9 (study 7) were used to evaluate the symptoms. The analysis whether the self- or external assessment shows advantages can not simply be answered as both have their relevance for the diagnostic assessment. The self-assessment scales (BDI, PHQ 9 and GDS-15) are subject to a high risk of bias given their dependence on the truthful response of the person concerned. Depressive sufferers, however, often tend deceptions of self and others [44]. A third party assessment procedure can minimize potential bias caused by the subject. On the other hand, negative potential of bias by the assessor exists [36]. Distortion of the results can

therefore not be completely ruled out in regards to this point. Currently, HAM-D and BDI are probably the most validated scales for the quantitative assessment of response to treatment [1]. Studies 1-4 combined the procedure of HAM-D and BDI. The combination of both methods offers good assurance in order to minimize the risk of bias [36]. Studies with the comparative intervention psychotropic drugs (studies: 1-5) all used the HAM-D (study 1-2 additionally BDI) and thus have a good comparability concerning this aspect. The GDS-15 is a questionnaire developed especially for elderly, geriatric people, and is just to a limited extent suitable for follow-up observations [17]. The PHQ-9 has promising benefits in terms of accurate evaluation in specialized therapies, especially in patients with coronary heart disease. It should be noted that each study has used questionnaires corresponding to the enrolled patient to evaluate intervention in the context of these. Nevertheless, uniformity of use would be an advantage while comparing the results and would increase the quality.

Drop-Out

After evaluating the drop-out rate reported in the selected studies, a large discrepancy between the individual studies can be found. The drop-out rates in the study groups of sports intervention range from 0% up to 26.4%. This bandwidth can not be explained comprehensibly. Blumenthal et al. report in their study (study 3) a drop-out rate of 20%

for the patients of the group collective, but only 4% for the patients of the individual training collective [6]. The follow up study shows a contrary picture: no dropouts in the group training collective, but 6% dropouts in the individual training collective have been observed. It can be concluded that the social effect of group training during the therapy initiation shows no advantage; however, after a long period of therapy, a group training can have a positive effect on the motivation. Blumenthal et al. showed a higher drop-out rate in the sports groups in all studies (studies 1-4) than in the group treated with drug therapy or placebo [6] [7] [22]; this observation underlines the difficulty of motivating a depressed person to undergo physical activity. Hence failure bias should be taken into account which is caused by a selective default.

Study review

The quality of the studies on the PEDro scale ranged from 4/10 to 8/10 points. It should be noted that in all studies the criteria regarding blinding (criteria 5 and 6) havent been met. An exception is study 3, in which blinding of the sertraline and placebo groups took place [6]. However, the lack of blinding in the other studies does not lead to a reduction in quality due to possible data distortion, as neither the subjects nor the therapists can be blamed for intervention through physical training. In regards to the blinding in the

outcome measurements by external judgment (HAM-D), however, a blinding of the investigator / evaluator however took place, which prevents a bias by subjective attitudes of the evaluator [52].

Results / conclusion

Blumenthal et al. asked (Study 2) the successfully treated study participants of the first study (study 1) to continue the intervention or to switch to another group [6] [7]. Follow- up after six months shows the lowest relapse rate in the patient population performing endurance training. Satisfaction of the patients can also be deduced from the low fluctuation of the athletes to another treatment alternative [7]. Blumenthal et al. showed

in their study (study 1) a highly significant improvement ($p < 0.0009$) in depression through regular aerobic exercise (independent of drug intake) [7]. The study concludes that sports as part of a combination therapy does not achieve a better therapeutic effect. This outcome is explained by the authors as a lower effect on self-esteem. Treatment success in this intervention group is not based solely on one's own performance but it is also attributed to the drug [7]. Gary et al. analysed in their study (study 6) the comparison of the effectiveness of an aerobic endurance training alone at home compared to cognitive behavioral therapy and cognitive behavioral therapy plus endurance training for routine treatment [19]. Additionally, this study shows an improvement in depression across all groups, but no significant difference between the group with exercise stress and the group with cognitive behavioral therapy. In contrast, the combination of endurance training plus cognitive behavioral therapy has achieved the best therapeutic success. This effect was also confirmed by Hallgren et al. and Huang et al. [20] [24]. However, Huang et al. (2015) described a stronger decline in depressive symptoms in the training group compared to cognitive-behavioral therapy [24]. A comparison of the three studies is only possible to a limited extent due to the different measuring and survey instruments. Gary et. al. used the HAM-D, Hallgren et. al. PHQ-9 and Huang et al. GDS-15 methods [19] [20] [24].

Conclusions, recommendations and outlook

Although this narrative review analysed and studied relatively few studies with partially small patient collectives and different study designs, an effectiveness of fitness training on the depressive symptoms can clearly been observed. The present studies suggest that fitness training can be at least as effective as psychotropic and / or psychotherapeutic treatments. Whether the evidence of eight studies is sufficient to provoke a change of thinking in regards to the treatment concepts and to drive a paradigm shift in the treatment concept, remains questionable. The extent to which

fitness training can be used scientifically as the sole therapeutic alternative in the treatment of unipolar depression must be evaluated in further studies. Based on the patient's perspective the availibility of a therapy with fitness training would be very

welcome and would minimize gaps in care, bottlenecks and side effects of psychotropic drugs and psychotherapy. In addition, a therapy including fitness training is not prejudiced and causes positive reactions to outsiders [11]. The patient has the opportunity of a self-determined alternative. In addition, fitness training is a cost-effective and widely available treatment option [33]. Besides the aspects fitness training should be provided at least as additional therapy by the health insurance companies. The mode of action is based on various theories. The positive results and basic conditions of physical activity such as increased attention, more frequent contacts, social impulses, the satisfaction of one's own expectations and self-directed successes contribute positively to the therapeutic effectiveness [4] [14]. Additionally, physical training with its cardiovascular, immunological, metabolic, neurobiological and brain physiological effects leads to an improvement in somatic symptoms and comorbidities and thus can only be supportive [33]. In the studies included in the narrative review, aerobic endurance training appears to be most effective if done three times a week for 45-60 minutes at moderate speed. In order to answer the question concerning correct dose-response relationship, further research with heterogeneous research design and objective measuring instruments is required [16]. In particular, the focus must be set on the right motivation and stress to ensure long-term training [33]. Also, weight training seems to be as effective as endurance training [31].

Conclusion:

In addition to the somatic symptoms and various comorbidities, depressed people have significantly reduced life expectancy [29]. In view of the increasing number of diagnosed depressions and the problems of standard therapies (drug therapy and psychotherapy) and care, it is essential to look for alternatives and cost-effective treatment methods [36] [58]. Studies show that fitness training has a moderate to high antidepressant effect. The narrative review confirms the current state of knowledge that effectiveness of fitness training is not different from the effectiveness of standard therapies. However, further qualified studies with a heterogeneous study design should be carried out to improve the data situation. In order to be able to derive a concrete treatment recommendation further research efforts are necessary. Based on the previous data, a 45-60 minute moderate

endurance training three times a week seems recommendable. It remains to be noted that fitness training is a treatment alternative which is related to low-side-

effects and represents a cost-effective alternative. As a result, there should be a rethinking and shift in treatment options in the outpatient and inpatient setting for the treatment of depression.

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