Effects of yoga on mental health in chronic physical conditions: A meta-analysis

Masterthese Geestelijke Gezondheidsbevordering

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Abstract

Introduction

In the last years, a new view on mental healthcare has been formed on mental healthcare, called positive psychology. This new view states, that mental health is not solely comprised of a reduction of negative symptoms, such as stress or depression, but positive experiences as well, such as emotional well-being, happiness and self-realization. Yoga, among other activities, is in line with this new view, in the sense that it practices key aspects of positive psychology. More and more research has been conducted on the effects of yoga on mental health in the last years, but little have physical, chronic conditions been the focus of this research. In the form of a master thesis, a meta-analysis is conducted to study the effects of yoga on mental health in physical, chronic conditions.

Methods

30 studies have been selected out of an existing systematic search (carried out by Kruese and ten Damme (2013) at the University of Twente, Enschede) in both Scopus and Cochrane, focusing on physical, chronic conditions. This meta-analysis analyses the effect of yoga on mental health in physical, chronic conditions. Three moderators were included in the analysis, which were (1) the type of condition, (2) type of control group and (3) type of outcome. Two mediators were also included, namely (1) the score of the quality assessment of the pool of studies.

Results

30 studies were included and 26 remained after removal of outliers. A medium effect size (Hedges g) with a value of 0.572 was found, which is significant. This effect size shows a general effect of yoga on mental health over all the conditions and outcomes. These results are an indication that yoga might have a substantial effect on mental health in physical, chronic conditions. Moderator analyses showed that the type of condition was significant, which means there are significant differences between what effect yoga has on which physical, chronic conditions. In the subgroup of cancer studies, the effects of yoga were significant and positive. Mediator analyses showed that generally the more yoga was practiced in the study, the higher the effect size.

Conclusion

This meta-analysis shows that yoga can be effective in reducing negative symptoms, such as depression, fear and stress and can promote an individual's well-being. In other words, not only are negative symptoms reduced, yoga also can also have a positive effect on the positive functioning of a person. This meta-analysis shows that yoga can be effective for cancer patients and might be for other physical, chronic conditions as well. Yoga may well be a good addition for the list of positive interventions for the promotion of mental health, seen its promising effects.

Abstract (Dutch)

Introductie

In de laatste jaren is er een nieuwe visie op de geestelijke gezondheidszorg ontstaan, de zogeheten positive psychologie. Deze nieuwe visie stelt dat geestelijke gezondheid niet slechts bestaat uit een reductie van negatieve symptomen zoals stress of een depressie is, maar ook positieve ervaringen zoals emotioneel welbevinden, blijdschap en zelfrealisatie. Onder andere yoga sluit aan op deze nieuwe visie in de zin dat het belangrijke aspecten van positieve psychologie beoefent. Meer en meer onderzoek wordt gedaan naar de effecten van yoga op de geestelijke gezondheid in de laatste jaren, maar nog relatief weinig onderzoek is gedaan naar fysieke, chronische condities. In de vorm van een master these is er een meta-analyse uitgevoerd om de effecten van yoga te onderzoeken op de geestelijke gezondheid in fysieke, chronische aandoeningen.

Methoden

30 studies zijn geselecteerd uit een bestaande systematische review (uitgevoerd door Kruese en ten Damme aan de Universiteit Twente, Enschede) in zowel Scopus als Cochrane, zich richtend op fysieke, chronische aandoeningen. 26 bleven over na verwijdering van uitschieters. Drie moderatoren zijn opgenomen in de analyse, namelijk (1) de type aandoeningen, (2) type controle groep en (3) type uitkomstmaat. Twee mediatoren zijn ook geïncludeerd, namelijk (1) de kwaliteitsscore van de artikelen en (2) de hoeveelheid beoefende yoga in de studies.

Resultaten

Een gemiddelde effect size (Hedges g) met een waarde van 0.572 was gevonden, hetgeen significant is. Dit effect laat een algemeen positief effect zien van yoga op de geestelijke gezondheid in fysieke, chronische aandoeningen. Moderator analyses laten zien dat de type aandoening significant was, hetgeen betekent dat er significant verschillen zijn tussen welke effecten yoga heeft op verschillende fysieke, chronische aandoeningen. In de subgroep van kanker studies waren de effecten van yoga significant en positief. Mediatoren analyses laten zien dat in het algemeen gesteld het effect van yoga sterker wordt naarmate het meer is beoefend.

Discussie

Deze meta-analyse laat zien dat yoga effectief kan zijn in het reduceren van negatieve symptomen en het welzijn van een individu kan versterken: niet alleen negatieve symptomen worden verminderd, maar het het positief functioneren van een individu kan ook versterkt worden. Deze meta-analyse laat zien dat yoga een positief effect kan hebben op kankerpatiënten en ook goed kan zijn voor andere fysieke aandoeningen. Yoga kan een goede toevoeging zijn op de lijst van positieve interventies voor het verbeteren van de geestelijke gezondheid, gezien de veelbelovende effecten.

INTRODUCTION

Throughout history, there has been a point of view in both mental and physical health care, which emphasizes repairing the negative symptoms of a condition; a medical model of human functioning. Contrary to this model, a new view on mental healthcare has been developed over the last years, which is called 'positive psychology'. This branch of psychology seeks to find and nurture genius and talent so to make normal life more fulfilling rather than merely treating mental illness (Seligman & Csikszentmihalyi, 2000). This new view complements, with no intention of ignoring or replacing, the traditional areas of psychology. By adding an important emphasis to use scientific methods to study and determine positive human development, this view fits well with the investigation of how human development can falter. This view also brings attention to the possibility that focussing only on disorders could result in a partial and thus limited understanding of a person's condition (Seligman et al., 2000). Furthermore, Seligman (2000) states that positive psychology is concerned with three issues: (1) positive emotions (being content with the present of being), (2) positive individual traits (one's strengths and virtues) and (3) positive institutions (are based on strengths to better a community of people).

Influences of positive psychology can be found in a variety of practices, for example mindfulness therapy, meditation and yoga. These practices are in line with the view of positive psychology. For example, more and more it has become clear through positive psychology, that focusing on the present instead of the past and/or future, and being non-judgemental could affect mental health in a positive way (Seligman et al., 2000). Also, the goal of yoga exercises is to be present and not to judge. Yoga on the other hand could also be beneficial for physical conditions specifically, because it concerns physical exercises which' goal is to improve the physical state. To this day, it has become clear that patients suffering from physical, chronic conditions are still a high risk group: they report a lower overall quality of life, suffer from negative moods states such a depression and stress and have the need for other forms of therapy (Büssing et al., 2012). Researching this positive view on mental health has been done increasingly the last years, on both mental and physical conditions, though few meta-analyses have been carried until this day and more meta-analyses are needed to confirm the hypothesis that specifically yoga could improve mental health in physical conditions (Büssing, Michalsen, Khalsa, Telles & Sherman, 2012). This study will be conducted to see whether yoga has a positive effect for physical chronic conditions, and distinguishes itself from other studies by exerting a meta-analysis on the effects of yoga on mental health in physical, chronic conditions. Furthermore, a combined view of positive psychology and the medical view on mental health will be used in this study.

Yoga and its relation to positive psychology

In particular, the practice of yoga is crucial to this study. The foundation of yoga is in line with the recent shift of focus to positive psychology, since the development of awareness and stillness is a key point in yoga (Büssing et al., 2012). Whereas a purely medical perspective (which was the main focus before positive psychology arose) focused on merely reducing negative symptoms, positive psychology and yoga seek to accept the current situations and stimuli as they come and not to evaluate. Yoga fits with this approach, because it is a way of practicing these traits. Yoga for example focuses on the contemplative practice of focused attention and controlled breathing. Also, reducing external stimuli and viewing emotions as being temporary (Kabat-Zinn, 1994).

The conceptual background of yoga has its origins in the philosophy of ancient India. There are multiple schools of yoga, all of which have their unique way of practice (i.e., Iyengar, Viniyoga, Sivananda). The schools differ in elements of yoga, such as physical postures (*asanas*), breathing techniques (*pranayama*), relaxation and meditation which ultimately cultivates ‘higher states of consciousness' (Büssing et al., 2012). It is often important to see the meditation and yoga practices outside the context of the eastern philosophy. Practically seen, the physical exercises (*asanas*) is associated with patient's physical flexibility, coordination and strength, whereas the breathing practices and meditation calm and focus the mind to develop greater awareness and diminish anxiety. Other reported beneficial effects are reduction of distress, improvements in resilience, mood and metabolic regulation (Büssing et al., 2012; Harder, Parlour & Jenkins, 2012).

The aforementioned dynamics of yoga consists of three key components that have known general effects on mental health, which are intention, attention and attitude. Exerting these three factors in yoga practice, it can increase muscular strength, range of motion, flexibility and sleep quality (Pilkington, Kirkwood, Rampes & Richardson, 2005). Furthermore, it has been found that yoga can relieve stress and conditions of anxiety that impact physical and mental health conditions, primarily depression (Long, Huntley & Ernst, 2001). Especially for physical conditions, the effects of increasing muscular strength, flexibility and range of motion could be important since they impact the physical part of an individual.

More and more it is stated that negative mental symptoms are overlooked in the treatment of physical diseases (Klein Woolthuis, 2012; Lagace, Perruccio, DesMeules & Badley, 2003; Conaghan, 2008; Carson, J.W., Carson, K.M., Jones, Bennett, Wright & Mist, 2010; Kovavic & Kovavic, 2010). Because of the physical nature of the disease, the physical cause and symptoms draw most of the attention. Because of this reason, interventions with the aim of improving mental health have been overlooked as well (Klein Woolthuis, 2012). Though there is often relatively too little attention for mental health in physical conditions, there are clues that

improving mental health in physical condition is rather important. The aforementioned studies in this section have put forth some thoughts that the experience of the physical condition could be less painful and troublesome (Klein Woolthuis, 2012; Lagace et al., 2003; Conaghan, 2008; Carson et al., 2010; Kovavic et al., 2010).

Mental Health

To be able to clarify what the effects of yoga are on mental health in physical, chronic conditions, one must first determine what 'mental health' actually is. The most common definition of 'mental health' is given by the World Health Organisation. They postulate it as the following: "mental health is a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully and is able to make a contribution to his or her community". As can be seen, in this definition multiple factors come forward, which are well-being, effective functioning and being able to contribute to the near outside world (WHO, 2005, p.2)

In line with the medical perspective on mental health as discussed in the sections above, mental health was purely seen as the absence of mental illness. Positive psychology postulates that this view does not do justice to the whole meaning of 'mental health'. Although negative symptoms such those of anxiety and or depression have a crucial impact on the individual, mental illness represents only part of a person's functioning and mental health (Westerhof & Bohlmeijer, 2010; Keyes, 2005). Keyes (2005) states that the main focus of the medical perspective is aimed at negative symptoms and to reduce these in order to bring forth the positive mental health of the individual. Seligman et al. (2000) join this statement by concluding that this medical perspective isn't capable of fully preventing mental disorders. Thus, it can be stated that, for an individual to be happy, not only should there be an absence of negative symptoms, but the presence of positive experiences as well. Furthermore, it is important to define these 'positive experiences'. As to be seen in figure 1, positive experiences in this sense can be divided into two philosophical approaches, namely hedonia and eudemonia.

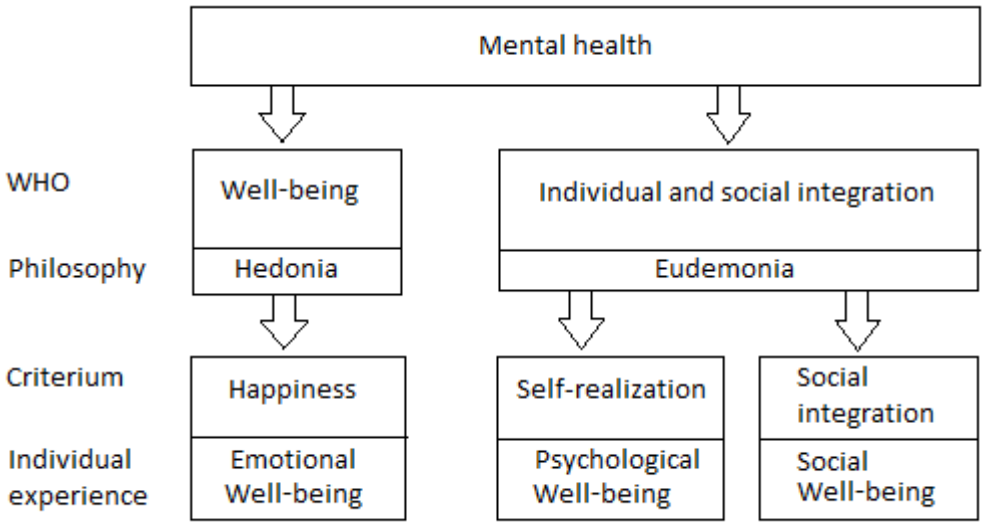

Figure 1. Components of mental health (Westerhof & Bohlmeijer, 2010, pag. 50)

The hedonic approach consists of emotional well-being, which is defined as the amount of positive feelings that are present, the amount in which negative are absent and the amount in which people are satisfied with their lives (Westerhof & Bohlmeijer, 2010). Whereas the hedonic approach concerns optimal experiences and emotional components of mental health, the eudaimonic approach focuses on optimal functioning and meaning in both the individual life (psychological well-being) as well as the social life (social well-being) (Lamers, 2012). The eudaimonic approach states that well-being is self-realization through the fulfilment of one's own personal potential (Lamers, 2012). Westerhof & Bohlmeijer (2010) state that six criteria are important in this self-realization, which are purpose in life, personal growth, autonomy, environment control, self-acceptation and positive relations.

In sum, mental health according to positive psychology isn't just the mere absence of negative experiences, but the presence of positive ones as well. The positive ones can be divided into emotional, psychological and social well-being. Concluding, this view on mental health will be employed: 'improvement of positive experiences based on the hedonic and eudaimonic approaches, and a decrease in negative symptoms such as negative mood states (e.g. anxiety or depression) and illness'.

Known effects of yoga on mental health in chronic diseases

As mentioned above, this study focuses on chronic, physical conditions. The studies for this meta-analysis include osteoarthritis, fibromyalgia, rheumatoid arthritis, chronic lower back pain, multiple scleroses and breast cancer. All these conditions are viewed as chronic conditions which

share a physical nature. Disorders/diseases are thought of as chronic (1) when they impact an individual's life tremendously in several aspects and (2) exist longer than 3 months (Dhruva et al., 2012). To this day, several effects of yoga on mental health have already been found. Several systematic reviews show the positive effects of yoga on depression for example (Cramer, Lange, Klose, Paul & Dobos, 2012; ten Damme, 2013; Mehta & Sharma, 2010). Yoga has also been found to positively affect anxiety and fear conditions (Carson et al., 2010; Dhruva et al., 2012; Raghavendra et al., 2009; Rao et al., 2009). For the condition multiple sclerosis, it has been found that patients scored significantly higher after a 6 month course on the SF-36 (Short Form health-related quality of life) for the scales of emotional well-being, overall quality of life and the mental health composite (Ahmadi, Nikbakh, Arastoo & Habibi, 2010). Furthermore, breast cancer patients reported an overall significant higher quality of life, an improvement in emotional functioning and less disturbed mood states (Culos-Reed, Carlson, Daroux & Hately-Aldous, 2006).

Present Study

To this day, there is still relatively little known about the effects of yoga and meditation on mental health in different physical conditions or diseases. There are multiple reasons why there should be more attention for yoga and its effects. Several articles and meta-analyses recommend a meta-analysis for an overall effect of yoga on physical conditions (Badsha, Chhabra, Leibman, Mofti & Kong, 2009; Raghavendra et al., 2009; Büssing et al., 2012; Harder et al., 2012). Therefore, in form of a master thesis, a meta-analysis will be conducted concerning the effects of yoga on mental health in chronic, physical conditions. This study distinguishes itself in that it uses a broader definition of mental health, which includes both the medical and positive psychology perspective. Furthermore, this study focuses not on diseases in general, but specifically on physical, chronic conditions.

Concluding, it can be said further research is needed in the field of yoga effects on mental health in physical, chronic diseases. In this study, this will be done using several articles from a systematic search focusing on yoga impacting psychological outcomes and specified to chronic physical conditions. The primary question is: "What effects can be found of yoga on mental health in physical, chronic conditions?". This will be attempted to answer with the following foci: (1) What is the overall effect of yoga on mental health in all conditions? (2) Some moderators could play a role, and the following will be checked: 1. the type of condition, 2. the type of control group and 3. the type of outcome (being able to make a distinction between types of outcomes is important because of the definition of mental health, which incorporates both the medical and positive psychology perspective). Furthermore, two mediators will be taken into consideration, namely 4. the total amount of yoga practice (because there might be a learning

effect) and 5. the quality assessment score (there might be an effect that generally the lower the quality of the article, the higher the reported effect size and vice versa). And lastly, there might be publication bias. This will be checked in the analyses.

METHODS

Selection of studies

This research is conducted as a meta-analysis. Firstly, several articles concerning effects of yoga have been selected out of a systematic search, which was formed in earlier research (Kruese & ten Damme, 2013). Ten Damme (2013) and Kruese (2013) systematically searched on Cochrane library using 'yoga' in the record title. Cochrane searches for effect studies and randomized controlled trials. This resulted in 253 articles. On Scopus, they state, they also searched in the following way: *(TITLE(**yoga**) AND TITLE-ABS-KEY((**effect*** OR **rct** OR (**random* controlled trial**) OR **efficacy** OR **intervention**)))*, which resulted in 617 articles. In total, this resulted in 870 articles and 672 after having removed double articles. These remaining articles have been screened on the following inclusion criteria: (1) it concerns a primary study (in other words, no meta-analyses or systematic reviews), (2) the intervention described in the article involved yoga mainly, (3) the measure outcome used in the study was of a psychological nature. The psychological measure, in this case, is described as a measure which looks at psychological functioning, including both healthy and unhealthy states. Examples are anxiety, stress, fear, issues in attention and negative mood states. Physical measure outcomes such as weight, bloodpressure, parameters of rheumatic conditions and diabetes were excluded. Furthermore, (4) the instrument of measure looks at psychological factors. Though the SF-36 instrument has a partial focus on physical symptoms as well (some items concern physical aspects), this instrument was included in this study, since the focus of this study is on physical conditions too. Only the mental health score was taken into consideration in this study. (5) It concerns a randomized, controlled clinical trial and (6) full articles were used solely. Until this point goes the systematic search performed by Kruese (2013) and ten Damme (2013).

Specifically, 164 studies remained to be selected for this meta-analysis. The following inclusion criteria were used to narrow down further for this meta-analysis: (1) the title and/or abstract mentions a physical condition, which is the focus of the study; (2) the condition must be viewed as chronic (existing from 3 weeks to 6 months or longer and causing physical and/or emotional pain in several aspects of a person's life). Eventually, this resulted in a total amount of 30 articles that were found to be suited for the meta-analysis. In this study, instruments and subscales were included that measure mental health, as described in the relevant section of the introduction. The questionnaires were looked at for face validity and included in the analysis based upon the judgment of the researcher when found to be fitting for this meta-analysis. This meant that the instrument must look at psychological outcomes and have evaluations exists on the instruments, stating that they are valid. In other words, the instruments should focus on

psychological outcomes and be scored as methodologically adequate. In Appendix I the list of the studies and characteristics can be found.

Quality assessment

For the quality assessment, eleven studies were used and independently checked by another reviewer (abbreviated name SK). The methodological quality of the studies was assessed using a short scale of seven criteria tailored to yoga studies and criteria established by the Cochrane collaboration (Higgins & Green, 2005). The quality checklist consisted of the follow questions: (1) Adequate subject randomization: randomly done by computer or an independent, blinded source, (2) Baseline comparability: were study groups comparable at the beginning of the study and was this explicitly assessed or were baseline imbalances appropriately corrected, (3) Power analysis: is there an adequate power analysis and/or are there at least 50 participants in the analysis, (4) Completeness of attrition follow up data: an explicit attrition analysis or the loss of follow up <50%, (5) Handling of missing data: the use of intention-to-treat analysis (as opposed to an analysis based on mere completers), (6) Study integrity: is the study design followed and exerted as planned and (7) Quality of yoga: does the yoga trainer have an official yoga certification and the required experience to give lessons (which is at least a thousand hours). When the study meets a criterion, the study was rated as a 1 and was rated 0 when the criterion wasn't met. Furthermore, the studies were assessed as having a high, medium, low or poor quality. High was assessed when the study met six or seven criteria, medium when four or five were met, low when two or three were met and lastly poor when one or none were met. In Table 1 the quality assessment of the studies can be found. Disagreements were resolved by consensus. This was the case with two of the 77 ratings. Interraterrreliability (Cohen's kappa) was 0.93.

Data extraction

The data was collected on design, target group, the total amount of yoga sessions and amount of minutes per week and total, the control group, outcome measures and effect sizes. The primary outcome measures in this meta-analysis are several, which all are viewed as mental health and illness, in line with the section in the introduction on the definition on mental health. In this sense, mental health can be viewed as "improvement of positive experiences based on the hedonic and eudaimonic approaches, and a decrease in negative symptoms such as negative mood states (e.g. anxiety, fear or depression) and illness'. In the analyses, both the views will be separated so that both components of the mental health view will be taken into consideration independently.

Meta-analysis

In a meta-analysis, the effects found in the selected studies are converted into a standardized effect size. These effect sizes can be compared with measures from other measurement scales. The Hedges g was chosen to be the effect size for the relevant constructs of the studies, which were calculated using the tool 'Comprehensive Meta Analyses' (CMA, version 2.2.064). A Hedges g is calculated by subtracting the mean score of the experimental group from the mean score of the control group, and dividing this outcome by the pooled standard deviations from both groups. According to Hedges & Olkin (1985), the magnitude of the Hedges g effect size can be interpreted using the conventions of the Cohen's d effect size. An effect size of around 0.2 is small, around 0.5 is medium and around 0.8 can be interpreted as a large effect size (Hedges et al., 1985). These conventions are used for this meta-analysis as well.

Heterogeneity

As one tries to use the meta-analysis to estimate a combined effect from a group of studies which are similar in one or more ways, there needs to be a check that the effects found in the individual studies are similar enough, so that one can be confident that a combined estimate will be a proper reflection of the set of studies. Although, the individual estimates will vary by chance, some variation is to be expected. To check whether there is more variation than would be expected based on chance alone (which is called statistical heterogeneity), this must be checked. Heterogeneity was tested in this meta-analysis using the following two indicators. The Q-statistic, which rejects the null-hypothesis of homogeneity when Q is significant, indicates that true effect sizes probably vary from study to study. The second indicator is the I^2-statistic. The percentage of this statistic shows the study-to-study dispersion because of true difference, above and over random sampling error. When the value is a percentage of zero, there is no indication of dispersion. 25% will be considered as low, 50% as moderate and 75% as high (Lipsey et al., 1993). When heterogeneity is significant, a random effect model will be chosen in the analysis. In this random model, effect sizes may differ, giving right to true variation in effect sizes between studies. This way, the likelihood of type-II errors is reduced.

Outliers which are outside the confidence interval of the pooled effect size are advised to be removed when a common effect size is assumed. All studies were taken into account and outliers were considered and not automatically removed from this study, though the removal of Hedges g > 2.5 was planned.

Subgroup analyses and meta-regression

Subgroup analyses were performed by testing the pooled effect sizes between subgroups. Several moderators were tested, which are the following: (1) type of physical, chronic condition, (2) control group type (waiting List, Treatment As Usual or another type of intervention for example health seminars) and (3) the type of outcome. By using a meta-regression method, (3) the quality ratings and (4) The impact of the amount minutes of practiced yoga and the quality ratings were calculated.

Publication bias

Not all bias is inherently problematic (for example, a bias against publishing lies in studies is a desirable bias), but one which is problematic is the publication bias. Publication bias concerns results being biased due to the fact that studies with non-significant or negative results are less likely to be published in peer-reviewed journals. This issue was tackled by computing a funnel plot, the Egger's test and the failsafe number. When there is no publication bias, the studies are expected to be found relatively symmetrical around the pooled effect size. When asymmetry is found, high standard errors (small studies) would be associated with larger effect sizes. Egger's linear regression method is used to quantify the amount of bias that can be seen in the funnel plots. It uses the value of the effect size and their precision: the standard normal deviate is regressed on precision, defined as the inverse of the standard error. The intercept in this regression corresponds to the slope in a weighted regression of the effect size on the standard error.

RESULTS

Description of the studies

The selection process can be viewed in Figure 2. The first step, identification, shows that 617 articles were retrieved from the Scopus database and 253 from the Cochrane database. After reviewing titles, 198 duplicates were removed and 672 records remained. All these were screened on five aforementioned criteria, after which 93 were eligible for full-text assessment. 30 studies met the inclusion criteria.

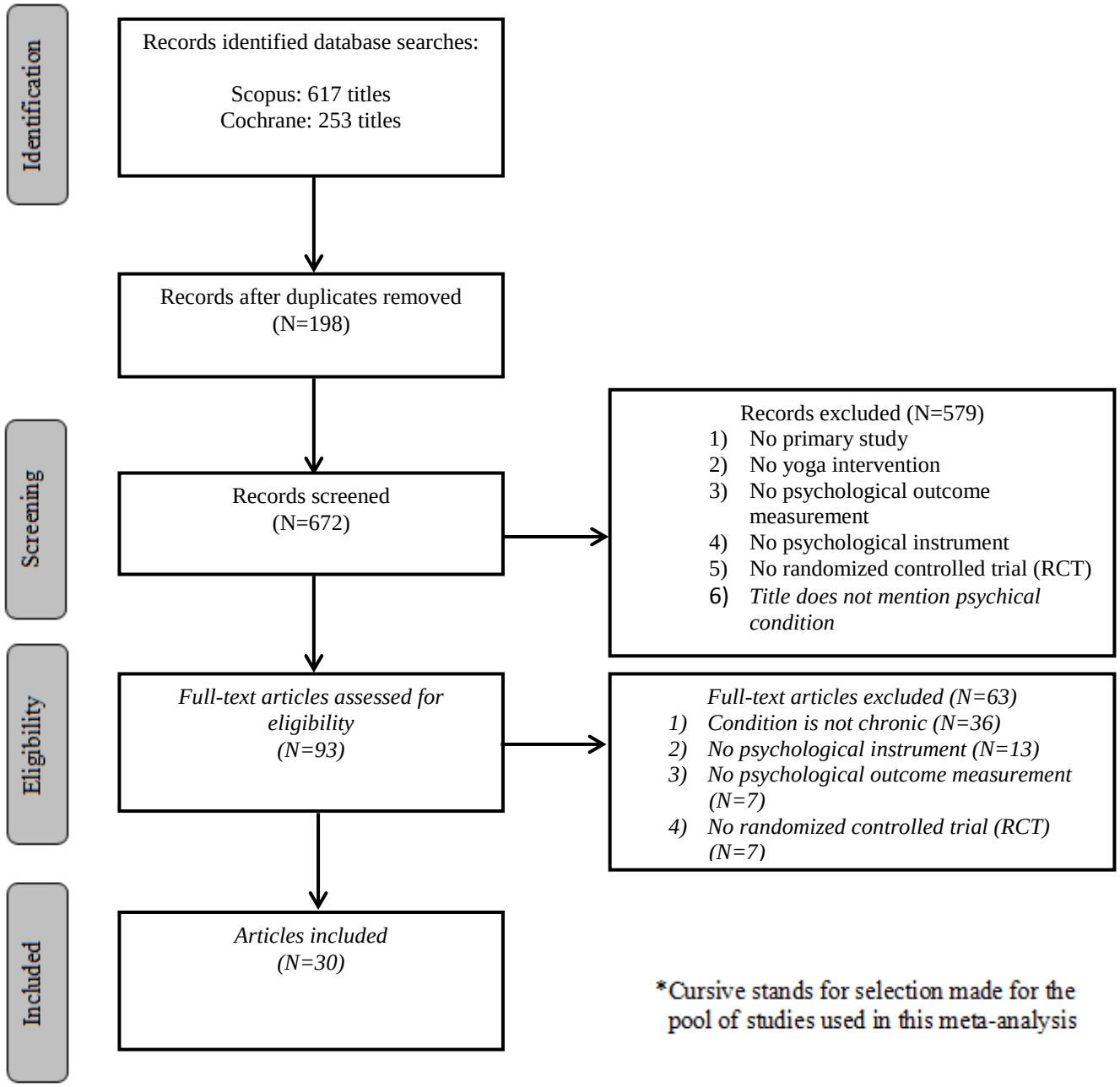

Figure 2 Flow chart of the study selection

Characteristics of the studies

The characteristics of the studies are shown in Appendix I. After the selection, 30 studies remained with 30 effects of yoga on mental health in physical, chronic conditions. The total amount of participants of all studies is 1387. 10 (33,3%) of the outcomes were on depression, 7 (23,3%) on mental health, 5 (16,6%) on fear, 4 (13,3%) on stress, 2 (6,6%) on quality of life and 2 (6,6%) on emotional well-being.

One finding was that the studies focused on different types of chronic, physical conditions. 13 out of 30 studies (43,3%) focused on cancer, whereas 3 (10%) focused on multiple sclerosis, 2 (6,66%) on chronic low back pain, 2 (6,66%) on COPD, 1 (3,33%) on fibromyalgia, 1 (3,33%) on metabolic syndrome, 1 (3,33%) on restless legs syndrome, 1 (3,33%) on chronic tinnitus, 1 (3,33%) on irritable bowel syndrome, 1 (3,33%) on chronic asthma, 1 (3,33%) on arthritis, 1 (3,33%) on chronic migraines and 1 (3,33%) on chronic pancreatitis.

Another finding was that studies used different types of control groups in their design. 11 out of 30 (36.6%) studies compared their experimental group with a Treatment As Usual (TAU) group, whereas 9 (30%) compared with a waiting list control group, 5 (16.6%) compared with a control group that received information on health (in different forms, such as brochures, seminars and/or movies) and 5 studies (16.6%) compared with a group that did some other activity (e.g. physiotherapy or sports climbing).

Furthermore, it was found that a variety of instruments was used with a total of 16 instruments in 30 studies. 5 (16.6%) times the Short Form-36 (Jenkinson, Coulter & Wright, 1993) was used, 4 (13.3%) times the Hospital Anxiety and Depression Scale (Snaith, 2003) was used, 3 (10%) times a version of the POMS (Terry, Lane & Fogarty, 2003) was used, 2 times (6.6%) times the BDI-II (Beck, Ward, Mendelson, Mock & Erbaugh, 1961) was used, 2 times (6.6%) the STA-I was used and 10 times (33.3%) another instrument.

What also emerged was a lot of types of yoga in this pool of studies. Some of the types are Asanas, Iyengar, Pranayama and Shevasana. Asanas was used in 13 (43,3%) of the total pool of studies, Pranayama was used in 15 (50%) of the studies, in 7 studies (23,3%) Iyengar was practiced, Shevasana was practiced in 6 (20%) of the studies and lastly in 5 studies (16,67%) Hatha yoga was practiced. The average time of yoga per study is 1476 minutes, ranging from 315 minutes to 4800 minutes with a standard deviation of 997 (Dhruva, 2012 and Kuttner, 2006 were not taken into account due to missing data).

Quality of the studies

The quality of the studies was scored with a value of 0 or 1 on specific criteria, as can be seen in Table 1. The total scores ranged from 3 to 7 with an average of 5,6. Two (6,66%) of the studies

were rated as low, 11 (36,66%) were rated as medium and 17 (56,66%) as high. Every study met the criterion of having used a high quality yoga trainer. Six studies met all criteria, thus having a total score of 7. 25 (83%) of all studies used adequate randomization. Baseline comparability was often mentioned or corrected through analyses in 26 (86,66%) of all studies. The average amount of participants was rather low, only 13 (43,33%) of all studies had enough participants to meet the criterion for power N (>50 participants. There was no significant attrition in 16 studies (53,3%), and 9 studies (30%) mentioned follow-up data on attrition. In only 19 (63,33%) studies the intention-to-treat analysis was properly described. Almost every study met the criterion of study integrity (study was carried out as planned), namely 28 out of 30 (93,33%).

Table 1 Quality Score per Study

Study Name	Randomization	Baseline	Power	Completeness follow up data	Intention-to-treat	Implement. Integrity	Quality Trainer	Total
Ahmadi et al., 2010	1	1	0	1	1	1	1	**6**
Badsha et al., 2009	0	1	0	0	0	1	1	**3**
Banerjee et al.,2007	1	0	1	1	1	1	1	**6**
Bower et al., 2011	0	1	0	1	1	1	1	**5**
Bower et al., 2012	1	1	0	1	1	1	1	**6**
Carson et al., 2010	1	1	1	1	1	1	1	**7**
Cohen et al., 2008	0	0	0	1	1	1	1	**4**
Culos-Reed et al., 2006	1	1	0	1	1	1	1	**6**
Danhauer et al., 2008	1	1	1	1	0	1	1	**6**
Dannhauer, 2009	1	1	0	1	0	1	1	**5**
Dhruva et al., 2012	1	1	0	0	1	1	1	**5**
Donesky et al., 2009	1	0	0	1	0	1	1	**4**
Fulambarker et al., 2012	0	1	1	1	0	1	1	**5**
Innes et al., 2012	1	1	1	1	1	0	1	**6**
John et al., 2007	1	1	1	1	0	1	1	**6**
Kovacic et al., 2011	1	1	0	1	1	1	1	**6**
Kroner-Herwig et al., 1995	1	0	0	0	0	1	1	**3**
Kuttner et al., 2006	1	1	0	0	1	1	1	**5**
Littman et al., 2012	1	1	0	1	1	1	1	**6**
Oken et al., 2004	1	1	1	1	1	1	1	**7**

Raghavendra et al., 2009	1	1	1	1	1	1	1	**7**
Rao et al., 2009	1	1	1	0	0	1	1	**5**
Ülger et al., 2010	0	1	0	1	1	1	1	**5**
Vempati et al., 2009	1	1	1	1	0	1	1	**6**
Saper et al., 2009	1	1	0	1	0	1	1	**5**
Sareen et al., 2007	1	1	0	1	0	1	1	**5**
Satyapriya et al., 2009	1	1	1	1	1	1	1	**7**
Tekur et al., 2012	1	1	1	1	1	1	1	**7**
Vadiraja et al., 2009	1	1	1	1	1	0	1	**6**
Velikonja et al., 2010	1	1	0	1	1	1	1	**6**

Post-test effects

The effect of yoga in mental health will be displayed in the following order. Firstly, the effect of yoga of all studies together will be displayed showing a complete effect of yoga on mental health in physical, chronic conditions. Further in this chapter the subgroup analyses and publication bias will described and illustrated. The effect sizes are displayed in Table 2.

The main effect analysis consists of a total of 30 studies with 30 individual outcomes on mental health. In this sense, a positive effect on mental health would be an increase in positive experiences and a decrease in negative experiences. The forest plot shows 4 substantial outliers that match the 2.5 criteria for removal. These studies are (1) Banerjee (2007) with an effect size of 7.570 on fear, (2) Kovavic (2011) with an effect size of 4.862 on stress, (3) Satyapriya (2009) with an effect size of 4.396 on stress and finally (4) John (2007) with an effect size of 4.075 on depression.

The analysis pointed out, that 20 studies (66,67%) of the studies reported a positive effect, 5 studies (16,67%) showed no effect and 1 study (3,33%) showed a negative effect. Only one study of the total pool of 30 studies mentioned a follow up measurement, which was the study of Kroner-Herwig et al. (1995). He did a follow-up measurement three months post-intervention and reported that the follow-up effect of yoga on depression was significant with a small effect size of 0.344 and a p-value of <0.05.

First the overall effect size of yoga on mental health will be calculated including the outliers, and subsequently the overall effect size without the outliers. In the pool of 30 studies, including outliers, the heterogeneity was high and significant (Q-value: 336.202 and I^2: 91.377 with a p-value of 0.00). Therefore, a random model was chosen. A large and statistically

significant effect size (Hedge's g) was found for all studies (N= 30): Hedges g = 1.108 (95% CI [0.70, 1.51], Z = 5.343, p<0.01).

Next, a calculation of the effect size was exerted without the outliers. In this pool of 26 studies, excluding outliers, the heterogeneity was, again, high and significant (Q-value: 62.14 and I^2: 59.77 with a p-value of 0.00). Therefore, a random model was again chosen. A medium effect size with a value of 0.572 was found, which is significant. This effect size shows a general effect of yoga on mental health over all the conditions and outcomes. These results are an indication that yoga might have a substantial effect on mental health in physical, chronic conditions.

Table 2 Overall effect sizes

Study name	Statistics for each study							Hedges's g and 95% CI
	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2,00 -1,00 0,00 1,00 2,00
Banerjee	7,570	0,751	0,564	6,098	9,043	10,079	0,000	
Bower,	-0,257	0,556	0,310	-1,348	0,833	-0,462	0,644	
Bower,	0,769	0,363	0,132	0,057	1,481	2,116	0,034	
Carson,	0,466	0,275	0,076	-0,072	1,005	1,697	0,090	
Cohen,	0,159	0,395	0,156	-0,615	0,933	0,403	0,687	
Culos-Reed	0,533	0,332	0,110	-0,117	1,184	1,607	0,108	
Dannhauer,	1,450	0,422	0,178	0,622	2,278	3,433	0,001	
Dhruva,	0,713	0,464	0,216	-0,197	1,623	1,536	0,125	
Innes, 2012	2,082	0,285	0,081	1,524	2,641	7,309	0,000	
Kovavic,	4,787	0,691	0,477	3,434	6,140	6,932	0,000	
Kroner-Her	0,344	0,396	0,156	-0,431	1,119	0,870	0,384	
Kuttner	0,070	0,367	0,135	-0,650	0,789	0,190	0,849	
Littman,	0,098	0,249	0,062	-0,390	0,586	0,393	0,694	
Oken, 2004	0,014	0,299	0,090	-0,573	0,601	0,046	0,963	
Raghavend	0,538	0,215	0,046	0,116	0,959	2,498	0,012	
Vempati,	0,767	0,264	0,070	0,249	1,285	2,902	0,004	
Rao, 2009	0,357	0,203	0,041	-0,041	0,754	1,760	0,078	
Satyapriya,	4,396	0,389	0,151	3,634	5,158	11,311	0,000	
Tekur, 2012	0,456	0,224	0,050	0,017	0,896	2,034	0,042	
Vadiraja,	0,301	0,232	0,054	-0,153	0,755	1,301	0,193	
Velikonja,	0,152	0,429	0,184	-0,689	0,993	0,355	0,723	
Ahmadi,	0,834	0,439	0,192	-0,026	1,694	1,900	0,057	
Badsha,	1,631	0,400	0,160	0,847	2,414	4,080	0,000	
Dannhauer,	0,925	0,387	0,150	0,166	1,684	2,390	0,017	
Donesky,	0,022	0,306	0,094	-0,578	0,623	0,072	0,942	
Ulger, 2010	0,927	0,453	0,205	0,039	1,814	2,047	0,041	
Fulambarker	0,375	0,416	0,173	-0,439	1,190	0,903	0,367	
Sareen,	0,669	0,282	0,079	0,117	1,221	2,375	0,018	
Saper, 2009	0,638	0,365	0,133	-0,077	1,353	1,750	0,080	
John, 2007	4,075	0,433	0,188	3,225	4,924	9,402	0,000	

Subgroup analyses

Some moderators might have played a role in the sense that they could explain variation between effects in this meta-analysis. An extensive look will be taken at the moderators, which' results are displayed in Table 3 of this section, to get a better insight in the effect of yoga on mental health. The following moderators were taken into consideration: (1) the type of physical, chronic condition, (2) control group type, (3) the type of outcome . Two mediators were also checked, namely (4) the quality score of the study and (5) the total minutes of yoga practice. An important note worth mentioning here is that some conditions were mentioned in only 1 or 2 studies in the pool of studies of this meta-analysis. The results of the mediators are displayed in Table 4.

For the first moderator (the type of physical, chronic condition) the test for subgroup differences was significant, which means there are significant differences between what effect yoga has on which physical, chronic conditions. In the subgroup of cancer studies, a significant yoga effect was found (Hedges g: 0.51; p-value <0.001). The other conditions have too few studies to make a reliable conclusion what the effect of yoga has on the type of condition.. Appendix I shows which results were found for which type of condition

For the second moderator (control group type), the test for subgroup differences does not show significant results. Concluding, which control group type was used does not explain variation between the effects of yoga. For the third moderator (type of outcome), the test for subgroup differences does not show a significant result. What type of outcome was measured in the study thus can not sufficiently explain the differences in the yoga effects.

The first mediator (total quality score of the studies) also showed no significant subgroup analysis result. This means the lower the quality, the higher the effect size does not apply to this pool of studies. The second mediator (the total amount of yoga practice) does show a significant result for the subgroup analysis. This means there is a significant difference between studies that had a relatively lower and higher total amount of yoga practice. The test for subgroup differences was a meta-regression. This analysis shows if the outcome variable (yoga effect) changes with a unit increase in the explanatory variable (amount of yoga practice). The significant result shows a linear relationship between the explanatory and outcome variable. In general, the more yoga was practiced in the study, the higher the effect size.

Table 3 Moderator results for the effect of yoga, subgroup analysis (post-test)

Moderator	**Subgroup**	**N**	**Hedges g (95% CI)**	**Test for subgroup differences**
Condition	Broncial Asthma	1	0.77 (0.25-1.29)**	Q=44.24, df=11 (p=0.000)
	Cancer	11	0.51 (0.29-0.73)***	“
	Chronic Low Back Pain	2	0.50 (0.13-0.88)**	“
	Chronic Tinnitus	1	0.34 (-0.43-1.12) ns	“
	Chronic Pancreatitis	1	0.67 (0.18-1.22)*	
	COPD	2	0.15 (-0.34-0.63) ns	
	Fibromyalgia	1	0.47 (-0.07-1.01) ns	
	Irritable Bowel Syndrome	1	0.07 (-0.65-0.79) ns	
	Metabolic Syndrome	1	0.16 (-0.62-0.93) ns	
	Multiple Sclerosis	3	0.26 (-0.21-0.74) ns	
	Restless Legs Syndrome	1	2.08 (1.52-2.64)***	
	Rheumatoid Arthritis	1	1.63 (0.85-2.41)***	
Control Group Type	Treatment As Usual (TAU)	9	0.41 (0.21-0.62)***	Q=3.43, df=3 (p=0.329)
	Waiting List	9	0.55 (0.27-0.84)***	
	Receiving Health Info	4	1.18 (0.28-2.09)**	
	Other	4	0.38 (0.13-0.64)**	
Type of	Depression	9	0.59 (0.36 – 0.81)***	Q=3.411, df=5 (p=0.637)

outcome				
	Emotional well-being	2	0.52 (0.06 – 0.97)*	
	Fear	4	0.46 (0.18 – 0.75)**	
	Mental Health	7	0.73 (0.03 – 1.44)*	
	Quality of Life	2	0.17 (-0.25 – 0.59)ns	
	Stress	2	0.50 (0.02 – 0.98)*	

*p<0.05; **p<0.01; ***p<0.001; ns: not significant

Table 4 Mediator results for the effect of yoga, subgroup analysis (post-test)

Mediator	**Subgroup**	**N**	**Hedges g (95% CI)**	**Test for subgroup differences**
Total Quality Score	Low (3)	2	0.99 (-0.28-2.25) ns	Q=1.134, df=2 (p=0.567) Slope= -0.019, Z= -0.338 (p=0.735)
	Medium (4-5)	11	0.45 (0.21-0.70)***	
	High (6-7)	13	0.60 (0.31-0.89)***	
Total Yoga Practice	M=1476, SD=997	24		Slope= -0.00023, Z= -2.117 (p=0.034)*

*p<0.05; **p<0.01; ***p<0.001; ns: not significant
Note: two studies have not been taken into account for the moderator total yoga practice due to missing data, which are Dhruva (2012) and Kuttner (2006).

Publication Bias

For the effect of yoga on mental health in physical, chronic conditions (N= 26) the Egger's regression test intercept value (b) is 0.82, with a 95% confidence interval of -1.63 to 3.27 and a p-value of 0.25. The failsafe N is also computed. This data shows the number of additional 'negative' studies (studies in which the intervention effect was zero) that would be needed to increase the p-value for the meta-analysis to be above 0.05. The failsafe N was 740 when using a one-tailed criterion (or 514 when using a 2-tailed criterion), which pleads against publication bias. The funnel plot seems symmetrical (figure 3). There is no indication of publication bias in the pool studies measuring the effect of yoga on mental health in physical, chronic conditions.

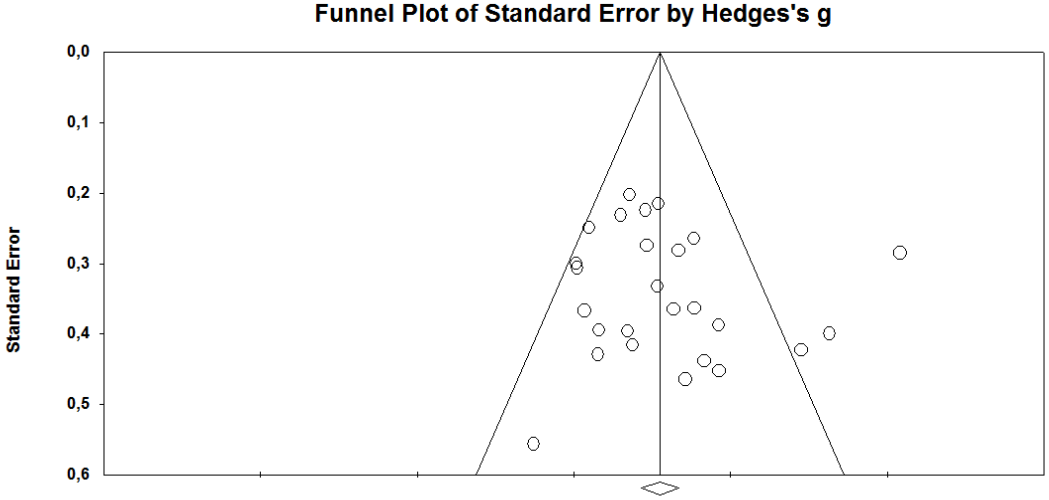

Figure 3 Funnel plot of all studies measuring the effect of yoga on mental health in physical, chronic conditions

DISCUSSION

Main findings

This meta-analysis in the form of a master thesis was exerted to find out whether studies measuring yoga effects on mental health would have significant effects in physical, chronic conditions. This study has distinguished itself from other studies by focusing on physical conditions which are chronic. Moreover, a definition of mental health was used that incorporates a dual perspective: the medical- and the positive psychology perspective. This mental health definition was used, since Westerhof & Bohlmeijer (2010) found that a model that positive mental health comprises of two factors (mental health and mental illness), which are not on the same dimension, but related. Several articles recommend further research focusing on yoga effects on mental health in physical, chronic conditions (Badsha et al., 2009; Raghavendra et al., 2009; Büssing et al., 2012; Harder et al., 2012; Klein Woolthuis, 2012). This meta-analysis gives a better insight into the effects yoga has on mental health in physical, chronic conditions. Based upon a systematic literature search, 30 studies were included and analyzed for an overall effect of yoga on mental health. For further analyses 4 outliers were removed, leaving a total of 26 studies. This final pool of studies included 20 positive effects.

Results show that yoga can have a substantial effect on mental health in physical, chronic conditions, shown with an overall effect size of 0.572. This medium effect size is line with earlier research, postulating that yoga can have a positive effect on mental health in physical, chronic conditions (Field, 2011; Sherman, Cherkin, Erro, Miglioretti & Deyo, 2005; Garfinkel, Schumacher, Husain, Levy & Reshetar, 1994; Büssing et al., 2012; Evans, et al., 2010). The found effect size of 0.572 is a general effect of yoga on all the conditions and outcomes. This finding shows that yoga can be beneficial for multiple conditions. A possible explanation for the variety of conditions is put forth by Büssing et al. (2012), stating that yoga influences a large variety of many different aspects. These aspects are both physical and psychological, for example hypertension, flexibility, depression, pain, anxiety, mood disturbances and so on. This variety could be an explanation for the fact that significant effects are found for different conditions .

Furthermore, the findings of this meta-analysis also confirm statements put forth by Long et al. (2001). They postulated that yoga can relieve stress and conditions of anxiety that impact physical and mental health conditions, primarily depression. Table 3 also shows positive effects of yoga on stress and depression. As for follow-up effects, a reliable conclusion can not be made based on the pool of studies of this meta-analysis, since only one study (Kroner-Herwig et al., 1995) mentioned a significant lasting effect of yoga on depression on a physical, chronic condition.

The found effects of yoga specifically on physical, chronic conditions seem to be in line with many other studies described in the clinical research review put forth by Field (2011). In this review, it is mentioned low back pain decreased after a course of yoga, where adults were randomly assigned to a yoga group (12 weekly sessions of yoga), a therapeutic exercise group or a self-care group (assigned to read and practice exercises in a book). After the course, low back pain was reduced and back-related function was superior in the yoga group as compared to both control groups (Field, 2011). For cancer, Field (2011) mentions a study where women with breast cancer experienced less anxiety following yoga. In this study, stage II and III breastcancer outpatients were randomly assigned to yoga or brief supportive therapy prior to surgery. Decreases were reported both in state and trait anxiety. In other studies, women with breast cancer reported less fatigue and increased relaxation after one year of weekly yoga, improved quality of life and reduced anxiety (Field, 2011). However, these studies lack in some factors, namely there is the lack of randomization in some studies leading to groups that differ in baseline characteristics. Also, there is the lack of good physical activity/attention control or comparison groups (Field, 2011). This meta-analysis differs from the current reviews and meta-analysis by having conducted a proper quality assessment.

Several moderator results were found in this study. Firstly, in the subgroup analyses it became clear that studies focusing on cancer reported high positive effects. This too is in line with existing meta-analyses that support the hypothesis that yoga can have a positive effect on cancerpatients (Büssing et al., 2012; Field, 2011; Speed-Andrews, Stevinson, Belanger, Mirus & Courneya, 2010). As mentioned before, it must be taken into account that the amount of studies that postulate positive effects on mental health was low, except for those focusing on cancer.

The results for the moderator ‘Type of outcome’ show us that there are no significant differences between yoga effects based on which type of outcome was measured. This means, that both the outcomes of the medical- and the positive psychology perspective show positive yoga effects. On the one hand, it could be stated with caution that both perspectives are important in the definition of mental health. This is in line with what Westerhof & Bohlmeijer (2010) postulated regarding the definition of mental health. On the other hand, it remains unknown how the outcomes measures are exactly interrelated. Further research is needed on this precise subject.

Another finding that emerged was, that the more yoga was practiced, the higher the effect size of yoga effect on mental health. This could be due to the reasoning that effective yoga techniques require some practice in order to have a substantial effect. This does not mean that yoga can not have a positive effect when it is practiced minimally, seen as for example Dannhauer (2008) shows a positive effect on mental health with a relatively lower total amount of yoga practice time.

Although very little research has been conducted on potential underlying mechanisms for the effects of yoga, two mechanisms could be explanatory for the found results in this meta-

analysis. Firstly, functional studies indicate that yoga stimulates the activation of the vagus nerve, resulting in higher vagal activity. This activity is associated with reduced cortisol in depressed patients, improving the mental health of these patients (Field, 2011). Secondly, the Gate Theory, the mechanism that has most frequently been used to explain massage therapy effects on conditions in which pain is prominent, could also be applicable to yoga. This theory, brought forth by Melzack and Wall (1965) postulates that the central nervous system is capable of modulating (increasing and reducing) the pain experience, might also pertain to yoga inasmuch as yoga is a form of self-massage. Massage has a positive effect on pain experience, in the way that it can reduce the pain symptoms. Self-massage, in theory, can thus reduce pain experience (Melzack & Wall, 1965). Another train of thought was postulated in the article of Büssing et al. (2012). This meta-analysis postulates that the beneficial effects of yoga might be explained by an increased physical flexibility, by calming the mind and focusing the mind to develop greater awareness and diminish anxiety. Because patients may recognize that they are able to be physically active, even despite of persisting symptoms, they may therefore experience higher self-competence and self-awareness, which contributes to higher quality of life.

Strengths and limitations

A strength of this study lies in the definition of mental health. By combing the medical- and positive perspective on mental health, a broader and more insightful view is given on the effect of yoga on mental health. This definition allows for the study to show, that yoga is not only capable of curing and/or reducing symptoms, but also strengthening positive parts in people and thus improving mental health. Another strength is that there was no publication bias found in this study. The analyses for publication bias and funnel plots do not give a definitive guarantee of the absence of publication bias, but they do imply that the found effect is close to the real effect size. This study also included several types of conditions and socioeconomic groups, which is a considerable strength of this study.

However, there are also limitations to this study, namely that the number of studies focusing on other conditions than cancer was considerably low. Results of the subgroup analyses for these other conditions are therefore more uncertain and unreliable. Another limitation is that there was a significant result for the heterogeneity in the pool of studies. Therefore, a random model had to be chosen. In contrast to the fixed effects model, the random effects model includes more errors. Also, the power N quality criterion was often not met by the studies. Furthermore, significant differences were found between conditions, in which the number of studies certainly contributed as a factor. More balanced subgroups are needed to be able to make reliable statements. Also, the SF-36 was used in this meta-analysis. This measure instrument contains few items which are specifically focused on mental health, and is more focused on physical outcomes.

Implications for practice

Seen as that yoga can improve mind and body, it is broadly suggested to practice by many people. This study shows that certain types of physical, chronic conditions can especially benefit from the positive effects on mental health. It is therefore suggested that health professionals and clinics mention the suggestion to practice yoga to their patients for their own benefit. Also, from a public health perspective, yoga is a cheap and fairly easy way to promote mental health. Yoga can be taught practically in every place and does not require expensive materials (other than the possible costs of a qualified teacher). Large groups of people can be reached with yoga: the young, the ill and the healthy. Generally seen, the fact that yoga is cheap could be a huge benefit in the sense that, people would rather first tend to a self-management method than to pay much money for another form of care.

Recommendations for further research

This study gives rise to the recommendation to study which underlying mechanisms play a role in the effect of yoga on mental health in physical, chronic conditions. Furthermore, other possible crucial factors might be the exact forms of yoga (this was not studied in this meta-analysis as a moderator) and to which extent these different forms of yoga might be beneficial for mental health. Also, since there was only one study mentioning follow-up effects, a recommendation would be to take a better, extensive look at the lasting effects of yoga over time. Also, a meta-analysis with more balanced amount of studies for different types of conditions would be recommended. A final recommendation would be with regard to the mental health definition used in this meta-analysis, which includes the perspective of positive psychology. This meta-analysis implies that both the medical and the positive psychology perspective could be important, but the effects of yoga on the positive outcome measures would perhaps not exist when corrected for the reduction of stress. A recommendation would be to conduct further research, which includes multiple outcome measures in one study specifically, to be able to get more insight in the interaction between outcome measures.

Conclusion

This meta-analysis shows that yoga can have a positive effect on mental health in different physical, chronic conditions. This positive effect entails a possible reduction of negative symptoms such as pain, fatigue and stress and an increase of positive symptoms, such as

happiness, self-awareness and self-realization. This study gives rise to the thought that yoga could be a good addition to positive interventions aimed to improve mental health.

APPENDIX I Effect Sizes Table

Study	Participants	Design (I: Intervention/yoga; C: control group)	Drop-out and method of analysis	Type of yoga	Duration of intervention (weeks)	Post measure (months)	Duration yoga per week and total (minutes)	Instrument	Effects (I: intervention; C: control group)	Conclusion
1. Ahmadi et al., 2010	N=21 Multiple Sclerosis Inclusion: (1) diagnosis MS with EDSS score of 1 till 4, (2) No physical exercise in the last 3 months, (3) uses MS medication	Recruitment: Unmentioned Groups: I: yoga (N= 11) C: waiting list (N= 10)	Drop-out None Analysis: Intention-to-treat-analyse	Hatha	8	8	Per week: 180 Total: 1440	MSQOL-54	I: baseline aver. 56.12 (SD 9.7) I: end aver. 74.3 (SD 15.34) C: baseline aver 60.5 (SD 15.53) C: end aver. 65.54 (SD 14.89) P<0.00	Mental Health +
2. Badsha et al., 2009	N=47 Rheumatoid Arthritis Inclusion: (1) >18 years of age, (2) have to meet the RA criteria of the ACR, (3) can participate in yoga activities	Recruitment: email in RA database Dubai Groups: I: Yoga (N= 26) C: Info en educatie (N= 21)	Drop-out: None Analysis: Completers	Raj Yoga	8	2	Per week: 120 Total: 960	SF-36	I: baseline aver. 62 I: end aver. 64 C: baseline aver.64 C: end aver. 63 P<0.01	Mental Health +
3.Baner-jee et al. 2007	N=68 Cancerpatients Inclusion: (1) recently had surgery for cancer, (2) 30-70 yrs, (3) Zubrod Performance Score 0-2, (3) completed High School, (5) treatment for radiotherapy or combi. radio- and chemotherapy	Recruitment: via posters in 3 hospitals Groups I: yoga en counseling (N=35) C: counseling (N=33)	Drop-out: N=10 in C Analyse op basis van intention-to-treat	Asanas, Pranayama, Nidra	6	6	Per week: 90 Total: 540	HADS	I: baseline aver. 8,5 (SD 1,6) I: end aver. 4,2 (SD 1,0) C: baseline aver. 8,2 (SD 1,1) C: end aver. 10,5 (SD 1,8) P<0,001	Fear +
4. Bower et al., 2011	N= 12 Cancerpatients Inclusion: (1) 45-64 years of age, (2) diagnosed with stage II breastcancer, (3) has received therapy, (4) in remission	Recruitment: Telephone screening Groups: I: yoga (N=5) C: TAU (N=6)	Dropout-out: N=1 in I Analysis: intention-to-treat	Iyengar	12	3	Per week: 90 Total: 1080	SF-36	I: baseline aver. 50.5 (SD 22.1) I: end aver. 65.0 (SD 22.1) C: baseline aver. 50.9 (SD 22.2) C: end aver. 59.2 (SD 22.0) P<0.005	Mental Health +
5. Bower et al., 2012	N= 31 Cancerpatients Inclusion: (1) diagnosed with stage 0-II breastcancer, (2) has received therapy, (3) 40-65 years old, (4) has had menopause	Recruitment:: paperarticles and flyers. Groups: I: Yoga group (N=16) C: Health	Dropout-out: N=2 in I Analysis: intention-to-treat	Iyengar	12	3	Per week: 90 Total: 1080	BDI-II	I: baseline aver. 15.5 (SD 7.5) I: end aver. 7.7 (SD 5.8) C: baseline aver. 14.3 (SD 7.5) C: end aver. 11.6 (7.1) P<0.0001	Depression +

		seminars(N=15)								
6.Carson et al. 2010	N=53 Fibromyalgia Inclusion: (1) women, 21- years old, (2) diagnosed with fibro. For longer than a year, (3) stable treatment situation	Recruitment: fibromyalgia database of local primary care doctor Groups: I: yoga (N=25) C: Treatment as Usual (N=28)	Dropout-out: N=3 in I Analysis: Intention-to-treat	Dyyana, Pranayama, Swadhyaya, Satsang	8	8	Per week: 120 Total: 960	FIQ	I: baseline aver. 4,2 (SD 3,03) I: end aver. 2,68 (SD 2,59) C: baseline aver. 4,53 (SD 3,13) C: end aver. 4,14 (SD 2,19) Effect size: 1,28 p=0,0407	Fear +
7. Cohen et al. 2008	N=24 Metabolic syndrome Inclusion: (1) People with metablic problems (bloodpressure, bloodsugar), (2) 30-65 yrs. Of age, (3) insufficient exercise	Recruitment: Unmentioned Groups: I: yoga (N= 12) C: No intervention (N= 12)	Dropout-out: N=2 in I Analysis: Intention-to-treat	Restorative Yoga	10	10	Per week: 135 Total: 1350	CES-D	No difference Yoga-Control: p=0.69 No difference in yoga group: p=0.1	Depression 0
8. Culos-Reed et al. 2006	N=36 Breastcancer patients Inclusion: (1) No other health problems, (2) at least three months after last surgery	Recruitment: Unmentioned Groups: I: yoga (N= 18) C: waiting list (N= 18)	Dropout-out: N=2 in I Analysis: Intention-to-treat	Asanas, Shevasana	7	7	Per week: 75 Total: 525	POMS	Y: baseline aver. 4,7 (SD 7.86) Y: end aver. 2.22 (SD 2.65) C: baseline aver. 5.44 (SD 5.10) C: end aver. 5.5 (SD 6.03) p<0.1	Depression 0
9. Danhauer et al., 2008	N= 28 Breastcancerpatients Inclusion: (1) 18 years and older, (2) diagnosis breastcancer, (3) 3-24 months before treatment	Recruitment: Physicians of WFU CCC in Florida Groepen: I: yoga (N= 14) C: TAU (N= 14)	Drop-out: None Analysis: Completers	Asanas, Pranayama, Savasana	10	4.5	Per week: 75 Total: 750	CES-D	I: baseline aver. 12.3 (SD 1.2) I: end aver. 10.5 (SD 1.4) C: baseline aver. 12.5 (SD 1.0) C: end aver. 11.9 (SD 1.1) P<0.01	Depression +
10. Dannhauer et al. 2009	N=27 Breastcancer patients Inclusion: 2 to 24 months after last surgery and no contra-indications	Recruitment: Unmentioned Groups: I: yoga (N= 13) C: waiting list (N= 14)	Dropout-out: N=9 in I, N= 8 in C Analysis: Completers	Asanas, Savasana, Pranayana	10	10	Per week: 75 Totaal: 750	CES-D	Y: baseline aver. 16.3 (SD 9.7) Y: end aver. 8.1 (SD 8.9) C: baseline aver. 16.6 (SD 14.7) C: end aver. 17.8 (SD 1.69) P=0.026	Depression +
11.Dhruva et al. 2012	N=23 Cancerpatients Inclusion: (1) intravenous chemotherapy for cancer, (2) score: 4 or higher on the visual	Recruitment: via medical treatment team in the local hospital Groups: I: yoga (N=9)	Drop-out: (N= 1 in I and N= 1 in C Analysis: Intention-to-	Pranayama	4	6	Per week:120 Total: 480	HADS	I: baseline aver. 8,4 (SD 2,7) I: end aver. 5,6 (SD 3,8) C: baseline aver. 5,6 (SD4,2) C: end aver. 5,5 (SD 3,4) p=0,04	Fear +

	analogue scale for fatigue, (3) Karnofsky Performance Status of 60 or higher	C: TAU (N=9)	treat							
12. Donesky et al., 2009	N= 41 COPD patients Inclusion: (1) <40 years, (2) are capable of doing daily chores	Recruitment: advertisements and messages in the paper of the American Lung Association Groups I: yoga (N= 20) C: care as usual (N= 21)	Drop-out: N=6 in I, N=6 in C Analysis: Completers	Iyengar, Pranayama	12	4	Per week: 120 Total: 1440	SF-36	I: baseline aver. 54.2 (SD 6.1) I: end aver. 54.8 (SD 8) C: baseline aver. 51.5(SD 9.3) C: end aver. 52.3 (SD 9.6) P=0.93	Mental Health 0
13. Fulambarker et al., 2012	N=22 COPD patients Inclusion: (1) diagnosis COPD	Recruitment: referals at the COPD clinic in North Chicago Groups I: yoga group (N= 11) C: waiting list (N= 11)	Drop-out: None Analysis: Completers	Pranayama, Asanas, Kapalabhati	6	2	Per week: 180 Total: 1080	SGRC	I: baseline aver. 50.8 (SD 17.3) I: end aver. 41.09 (SD 18.67) C: baseline aver. 51.1 (SD 17.88) C: end aver. 48.6 (SD 18.23) P<0.0001	Quality of Life +
14. Innes et al., 2012	N=20 Restless Legs Syndrome Inclusion: (1) non-smoking, (2) at least 45 yrs. Of age, (3) after menopause, (4) physically inactive	Recruitment: brochures local hospital and flyers Groups: I: ‘gentle’ yoga cursus (N= 38) C: Health seminar (N=37)	Dropout-out: N= 2 in I Analysis: intention-to-treat	Iyengar	8	3	Per week: 180 Total: 1440	POMS	I: baseline aver. 24 (SD 4.11) I: end aver. -12.05 (SD 7.06) C: baseline aver. 18.6 (SD 2.71) C: end aver. 24.11 (SD 8.96) Effect size: 2.35 P<0.02	Mental health +
15.John et al. 2007	N=65 Migrain Inclusion: (1) diagnosis chronic migrain, (2) no comorbid conditions, (3) age 20-25 years	Recruitment: via a medical institute which focuses on headaches and a newspaper ad Groups: I: yoga (N=32) C: TAU (N=33)	Uitval: N=4 uit I en N=3 uit C Analysis: Completers	Pranayama, Kriya	12	12	Per week: 300 Total: 3600	HADS	I: baseline aver. 9.84 (SD 2.16) I: end aver. 4.34 (SD 1.33) C: baseline aver. 11.88 (SD 2.20) C: end aver. 13.21 (SD 1.92) P=0,01	Fear +
16. Kovačič et al., 2011	N=32 Breastcancer patients Inclusion: (1) Receiving treatment for breastcancer stage 0-II, (2) soon to have scheduled surgery	Recruitment: Oncology specialist asks patients for enrollment study in oncology clinic Groups: I: yoga (N=16) C: standard fysiotherapy	Drop-out: None Analysis: Intention-to-treat	Asanas, pranayama, yoga nidra	4	4	Per week: 78 Total: 315	GHQ-12	I: baseline aver. 21 (SD 6.22) I: end aver. 3.65 (SD 2.42) C: baseline aver. 20.37 (SD 4.4) C: end aver. 21.13 (SD 4.62) P= .0005	Psychological Distress +

		group (N= 16)								
17. Kroner - Herwig et al. 1995	N=43 Chronic tinnitus Inclusion: (1) Eardistortions >6 months, (2) Can communciate in a group, (3) no other medical/psychic conditions	Groups: I: yoga (N= 9) TCT: Tinnitus coping (N= 15) C: Waiting list (N= 19)	Drop-out: None Analysis: Completers	Hatha, Asanas	10	10, 12	Per week: 120 Total: 1200	DS	Yoga - Control (F=4,53, df=1.32, P <0.5)	Depression+
18.Kutt-ner et al. 2006	N=28 Adolescents with irritable bowel syndroom Inclusion: (1) age 11-18, (2) met the IBS criteria (Rome I criteria)	Recruitment: via local hospital and flyers Groups: I: yoga (N=14) C: Waiting list (N=14)	Drop-out: N=3 in C Analysis: Intention-to-treat	Hatha, Iyengar	4	4	Unmentioned	RCMAS	I: baseline aver. 10,9 (5,32) I: end aver.10,64 (5,20) C: baseline aver.14,62 (7,19) C: end aver. 14,75 (6,42) F(1,23)=3,134 p=0,09	Fear 0
19. Littman et al., 2012	N= 63 Breastcancerpatients with obesitas Inclusion: (1) Received therapy for breastcancer fase 0-3	Recruitment: Referrals by oncologists Groups: I: yoga (N= 32) C: TAU (N= 31)	Drop-out: N=5 in I, N=4 in C Analysis: Intention-to-treat	Viniyoga	26	6	Per week: 75 Total: 1950	FACT-G	I: baseline aver. 89 (SD 9.4) I: end aver.. 90.3 (SD 11) C: baseline aver. 87.7 (SD 14.2) C: end aver. 87.7 (SD 15) P= 0.30	Quality of Life 0
20. Oken et al., 2004	N= 69 Multiple Sclerosis patients Inclusion: (1) Had to meet the criteria for the condition of MS, checked by a neurologist, (2) had to be able to easily walk 100 metres	Recruitment: Via local newspapers and internet newspapers Groups: I: yoga (N=21) C1: exercise (N= 26) C2: waiting-list (N= 22)	Drop-out: N=6 in I, N=4 in C1, N=2 in C2 Analysis: Intention-to-treat	Iyengar	30	6	Per week: 90 Total: 2700	SF-36	I: baseline aver. 73.7 (SD 12.9) I: end aver. 73.5 (SD 14.3) C: baseline aver. 75.6 (SD 18.8) C: end aver. 75.6 (SD 14.3) P	Mental Health 0
21.Ragh a-vendra et al. 2009	N=88 Breastcancer Inclusion: (1) Women with a recent breastcancer diagnosis (operable), (2) 30-70 years	Recruitment: Unmentioned Groups: I: yoga (N=44) C: supportive therapy (N=44)	Drop-out: N=2 in I, N=11 in C Analysis: Intention-to-treat	Asanas, Pranayama	6	6	Per week: 270 Total: 1620	HADS	I: baseline aver. 8,05 (SD 3,87) I: end aver. 4,88 (SD 3,34) C: baseline aver. 9,35 (SD 3,98) C: end aver. 8,12 (SD 3,80) Effect size: 0,31 P<0,001	Fear +
22. Ülger et al., 2010	N= 20 Cancerpatients Inclusion: (1) cancer diagnosis, (2) had chemotherapy at least 6 months ago	Recruitment: referals at the Haceteppe University Groups: I: yoga (N= 10) C: Wachtlijst (N= 10)	Drop-out: None Analysis: Intention-to-treat	Asanas, Pranayama	4	1	Per week: 120 Total:480	STA-I STA-II	I: baseline aver. 103.23 (SD 23) I: end aver. 85.91 (SD 19.21) C: baseline aver. 102 (SD 5.89) C: end aver. 98 (SD 3.17)	Stress +

									P<0.001	
23. Vempati et al., 2009	N= 60 Bronchial asthma Inclusion: (1) 18 years or older, (2) diagnosed with BA, (3) taking medication	Recruitment: diagnosees who are refered to the Integral Health Clinic in India Groups: I: yoga (N= 30) C: Waiting list (N= 30)	Drop-out: N=1 in I, N=2 in C Analysis: Completers	Asanas, Pranayama, Kriyas, meditationen Shavasana	2	1.5	Per week: 1200 Total: 2400	AQOL	I: baseline aver. 3.94 (SD 1.5) I: end aver.. 5.71 (SD 1.3) C: baseline aver. 3.6 (SD 1.4) C: end aver. 4.15 (SD 1.8) P= 0.006	Emotional Functioning +
24. Rao et al., 2009	N= 98 Breastcancerpatients, recently been diagnosed Inclusion: (1) recently diagnosed, (2) between 3-70 years, (3) diploma of high school	Recruitment: Hospital referals Groups: I: Yoga (N= 45) C: supportive therapy (N= 53)	Drop-out: N=12 in I, N=17 in C Analysis: Completers	Asanas, Pranayama, meditation, yogic relaxation techniques	24	6	Per week: 90 Total: 2160	STAI-Anxiety	I: baseline aver. 47.7 (SD 11.1) I: end aver. 37.8 (SD 11.6) C: baseline aver. 51.1 (SD 10.9) C: end aver. 45.9 (SD 14.2) P<0.05	Anxiety +
25. Saper et al., 2009	N= 30 Chronic low back pain Inclusion: (1) diagnosis CLBP, (2) 18-64 years old	Recruitment: two community health centres in Boston recruited Groups: I: Hatha yoga (N= 15) C: care as usual (N= 15)	Drop-out: None Analysis: Completers	Hatha Yoga, Svasana	12	6½	Per week: 75 Total: 900	SF-36	I: baseline aver. 47 (SD 11) I: end aver. 44.3 (SD 3.5) C: baseline aver. 45 (SD 11) C: end aver. 44.8 (SD 4.1) P=0.08	Mental Health 0
26. Sareen et al., 2007	N= 60 Chronic pancreatitis Inclusion: (1) chronics pancreatitis diagnoses, (2) currently on pain medication	Recruitment: Family doctors in and around Ontario, Canada Groups: I: yoga (N= 28) C: care as usual (N= 24)	Drop-out: N=2 in I, N=6 in C Analysis: Completers	Pranayama, Savasana	12	3	Per week: 120 Total: 1440	POMS	I: baseline aver. 9.7 (SD 6.6) I: end aver. 5.4 (SD 5.8) C: baseline aver. 9.6 (SD 4.7) C: end aver. 9.4 (SD 6.3) P<0.001	Depression +
27. Satyapriya et al., 2009	N= 90 Pregnant women with high pregnancy risks Inclusion: (1) pregnant between 18 and 20 weeks, (2) primigravidity	Recruitment: Prenatal care obsetric units in Bangalore Groups : I: yoga (N= 45) C: standard prenatal exercises (N=45)	Drop-out: N=16 in I, N=18 in C Analysis: Intention-to-treat	Asanas, Breathing Exercises, Pranayama	36	9	First four weeks: 300 per week Consequently 150 mins per week Total: 4800	PSS	I: baseline aver. 15.9 (SD 5) I: end aver. 10.88 (SD 4.97) C: baseline aver. 15.43 (SD 5.7) C: end aver. 17.33 (SD 5.43) P= 0.001	Stress +
28. Tekur et al., 2012	N= 80 Chronic Low Back Pain	Recruitment: Two rheumatologists decided the inclusion based on X-	Drop-out: None	Asanas	1	1	Per day: 300 min	BDI	I: baseline aver. 12.13 (SD 8.82) I: end aver. 6.43 (SD 7.73)	Depression +

	Inclusion: (1) Has had condition for over more than 3 months, (2) 18-60 years	rays Groups: I: yoga (N= 40) C: waiting list (N= 40)	Analysis: Intention-to-treat				Total: 2100		C: baseline aver. 13.05 (SD 6.53) C: end aver. 10.45 (SD 5.55) P<0.001 Effect Size: 0.96	
29. Vadiraja et al., 2009	N= 88 Breastcancerpatients in an early stage who undergo radiotherapy Inclusion: (1) recently diagnosed, (2) between 30-70 jaar	Recruitment: at centres for cancer Groups: I: yoga (N= 42) C: lectures (N= 33)	Drop-out: N=2 in I N=11 in C Analysis: Intention-to-treat	Asanas, Pranayama	6	2	Per week: 180 Total: 1080	PANAS	I: baseline aver. 24 (SD 7.28) I: end aver. 27.85 (SD 7.11) C: baseline aver. 21.81 (SD 7.37) C: end aver. 23.33 (SD 8.3) P<0.01 Effect Size: 0.59 Cohen's F	Positive Affect +
30. Velikonja et al., 2010	N= 20 MS patients Inclusieon (1) Relapsing MS, (2) 26-50 years	Recruitment: Unmentioned Groups: I: yoga (N= 10) C: TAU (N= 10)	Drop-out: None Analysis: Intention-to-treat analyse	Hatha	10	3	Per week: 120 Total: 1200	CES-D	I: baseline aver. 9.5 (SD 20.3) I: end aver. 3 (SD 13.0) C: baseline aver. 10 (SD 6.5) C: end aver. 5 (SD 3) P= 0.212	Depression 0

Abbrevations: **BDI-II**: Beck's Depression Inventory II, **POMS**: Profile of Mood States, **GHQ-12**: General Health Questionnaire (12 items), **AQOL:** Asthma Quality of Life, **HADS:** Hospital Anxiety and Depression Scale, **SGRQ**: St George Respiratory Questionnaire, **SF-36**: Short Form (36 items) Health Survey, **STA-I+II:** State-Trait Anxiety Inventory, **CES-D:** Center for Epidemiologic Studies-Depression scale, **MSQOL-45:** Multiple Sclerosis Quality of Life, **PSS:** Perceived Stress Scale, **PANAS:** Positive and Negative Affect Schedule, **FACT-G:** Functional Assessment of Cancer Therapy-General, **RCMAS:** Revised Children's Manifest Anxiety Scale, **DS:** Depressivitäts Skala, **FIQ:** Fibromyalgia Impact Questionnaire

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(* in the study name is included in the analysis)

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