



## King's Research Portal

DOI:

[10.1089/acm.2016.0363](https://doi.org/10.1089/acm.2016.0363)

*Document Version*

Peer reviewed version

[Link to publication record in King's Research Portal](#)

*Citation for published version (APA):*

Oates, J. (2017). The effect of yoga on menstrual disorders: a systematic review. *JOURNAL OF ALTERNATIVE AND COMPLEMENTARY MEDICINE*, 23(6), 4017-417. <https://doi.org/10.1089/acm.2016.0363>

### **Citing this paper**

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

### **General rights**

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

### **Take down policy**

If you believe that this document breaches copyright please contact [librarypure@kcl.ac.uk](mailto:librarypure@kcl.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.

**Title page**

Title: The effect of yoga on menstrual disorders: a systematic review

For journal: Journal of Complimentary & Alternative Medicine

Key words: yoga; women's health; symptoms management; systematic review; menstruation

Running head: Yoga for menstrual disorders

Author: Jennifer Oates, PhD, MA, PGCert, BA, Dip He, RMN

Contact details for corresponding author:

Jennifer Oates, Florence Nightingale Faculty of Nursing and Midwifery, King's College London,

James Clerk Maxwell Building, 57 Waterloo Road, SE1 8WA, email: [jennifer.oates@kcl.ac.uk](mailto:jennifer.oates@kcl.ac.uk)

Affiliations: Florence Nightingale Faculty of Nursing & Midwifery, King's College London

## **Abstract**

**Objective:** To summarise and evaluate evidence for the effect of yoga on menstrual disorders.

**Methods:** PubMed, Cinahl/ Medline, Web of Science, AMED and Scopus were searched for english language literature relevant to the review question. All primary research studies were included. **Results:** 15 studies, described in 18 papers were included in the review. A range of yoga interventions were used. Some studies used a combination of asana, pranayama and other yogic relaxation or meditation techniques. The included studies all reported some change in their outcome measures suggesting reduced symptoms of menstrual distress following a yoga intervention, however the heterogeneity and intensity of the interventions and outcome measures meant that findings have limited generaliseability and applicability in practice settings.

**Conclusions:** further research on the relationship between yoga practice and menstrual disorders is warranted, but there must be both a consistency in the methodology, measures and quality of studies as well as a shift towards research on yoga practices that are replicable outside of the clinical **trial** setting.

## Introduction

This paper reviews the evidence for the effect of yoga practice on common menstrual disorders in premenopausal women. Common primary menstrual disorders include: amenorrhea (lack of menstruation), oligomenorrhea (irregular menstruation), dysmenorrhea (painful menstruation), premenstrual syndrome (PMS), which incorporates cyclical psychological and physical symptoms) and premenstrual dysphoric disorder (a severe form of premenstrual syndrome)<sup>1</sup>. Menstrual disorders are common. Prevalence of PMS and premenstrual dysphoric disorder has been reported as being between 5 and 8%<sup>2</sup>. Prevalence rates for dysmenorrhea range from 16% to 91%.<sup>3</sup> Surveys of women in developing countries, America, Europe and Australia have found that 5-20% of women report dysmenorrhea to the extent that it stops them from participating in usual activities.<sup>4</sup> Menstrual disorder is also a component of the Female Athletic Triad (along with osteoporosis and disordered eating), the prevalence of which among female athletes is between 0 to 15.9%.<sup>5</sup> Where medical assessment and treatment of menstrual disorders should in the first instance establish whether they are secondary to other conditions, such as polycystic ovarian syndrome, thyroid problems, menopause or pregnancy<sup>6</sup>, many women choose to manage their menstrual problems through the use of complementary and alternative therapies, including the practice of yoga<sup>7,8,9</sup>

## Background

Yoga is a term used to describe a variety of practices, although its literal translation in Sanskrit means 'yoke' or 'union'.<sup>10</sup> Yogic practices may include physical exercises (asanas), breathing exercises (pranayama), relaxation techniques and meditation or concentration practices, including Yoga Nidra (a form of guided relaxation practice). **There are many different types of yoga,**

according to different schools or traditions, for example the asana-heavy styles of yoga practiced often in the West according to the teachings of three pupils of Krishnamacharya (1889-1989): the school of BKS Iyengar<sup>11</sup>, Ashtanga Vinyasa Yoga of Patthabi Jois<sup>12</sup> and the Viniyoga of Desikachar.<sup>13</sup> Yoga practice in the modern context is primarily focused on asana as a physical exercise regime, whereas traditionally, and certainly prior to the mid-20th century, yoga is a term more widely associated with spirituality and contemplation, with asana practice being a less prominent aspect.<sup>14</sup> Research on yoga as a therapeutic intervention grows apace<sup>15,16,17</sup> although the variability in study quality, interventions and outcome measures means that the extent to which yoga practice may positively affect health cannot yet be definitively stated.<sup>15,16</sup> The mechanism by which yoga may improve health is commonly considered to be its effect on the autonomic stress response.<sup>18</sup> Yoga-based practices have been shown to affect a complex series of physiological and cognitive mechanisms, which in turn may impact on aspects of self-regulation of stress.<sup>19,20,21</sup> A recent attempt to define a comprehensive theoretical framework from which hypotheses regarding how bottom-up neurophysiological and top-down cognitive mechanisms may explain the impact of yoga on wellbeing has differentiated between the effects of the movement, breath and attention aspects of practice.<sup>19</sup> It has also differentiated between a number of neuro and physiological processes that may be involved in self-reported changes in wellbeing of yoga practitioners. These include: the impact of yoga movement on the basal ganglia and cerebella circuits; the influence of yoga breathing practices on concentrations of oxygen and carbon dioxide in the blood and; the effect of the attention element of practice, akin to other meditative activities, on structural changes in parts of the brain responsible for bodily awareness.

Alongside the exponential increase in yoga research, there has been 'a parallel surge' in yoga practice.<sup>16</sup> Demographic surveys of yoga practitioners in the US have found yoga practitioners to be more likely to be white, female, highly educated and middle aged.<sup>22,23</sup> As well as the trial

based evidence that yoga may positively affect health, in particular the psychology and physiology of stress, there are practical benefits to suggesting yoga as an intervention for menstrual disorders, in that it is not costly, requires no equipment and is readily available (there are classes in most cities, and yoga tutorials are available online). A recent meta analysis of clinical trials found yoga to be as safe as usual care or exercise.<sup>24</sup> A relationship between yoga asana practice and menstrual disorder symptoms has been established in both the non academic popular literature and in yoga manuals. In the grey non-academic literature (namely the plethora of yoga websites and magazines, and mentions of yoga on health and wellbeing sites) there is evidently an association between frequent yoga practice and oligomenorrhea, and the possible effects of yoga on menstrual disorders (a Google search of 'yoga AND menstrual disorders' yielded 'About 340,000 results' on 6 Nov 2016 and 'yoga AND oligomenorrhea' yielded 'About 36,000 results on 6 Nov 2016). Commonly in yoga manuals and instructional articles, women are advised to refrain from certain asanas, such as the inversion postures Sirsasana (headstand) or Sarvangasana (shoulder stand) during menstruation<sup>25</sup>, whereas in the Ashtanga Vinyasa tradition of Patthabi Jois<sup>12</sup> women are advised to refrain from asana practice in the first three days of menstruation off from practice.<sup>26</sup> Popular yoga manuals offer women specific sequences to be undertaken during menstruation, for example, Geeta Iyengar's Yoga: A Gem for Women<sup>27</sup> recommends a sequence including Upavistha Konasana and Baddha Konasana to ease dysmenorrhoea and Judith Hanson Lasater offers a sequence for menstruating women in her 'The Moon club: Honouring the Monthly Cycle'<sup>28</sup>, which aims to: assist the body in releasing menstrual flow, reducing fatigue and moderating hormonal shifts. Like Iyengar, her sequence is based around versions of Baddha Konasana and Upavistha Konasana. The sequence of postures recommended online Yoga Journal for menstruation<sup>29</sup> include: Baddha Konasana, Dhanurasana (the bow), Setu Bandha Sarvangasana (bridge pose), Ustrasana (the camel), dolphin and Adho Mukha Svanasana (downward dog). The PopSugar lifestyle site article: 'Skip the ibuprofen and do these yoga poses to ease period pain'<sup>30</sup> suggests a 'half bound squat'

(Malasana), arching pigeon (Kapotasana), one-armed camel (Ustrasana) and a wide child's pose (Balasana) and a reclining twist (it is probably worth noting that the first three of these poses are rather advanced and would probably not be taught in a beginner's class).

The aim of this review was to assess the evidence for correlations between yoga practice and various forms of menstrual disorder and to identify which forms of yoga have been evaluated as interventions for menstrual disorders. The review also aimed to evaluate the published primary research evidence for the efficacy of yoga as an intervention for treating menstrual disorders. Does published research evidence accord with yoga wisdom, as reflected in journals, webpages and instructions manual?

## **Methods**

This study was a systematic literature review of primary research on the impact of yoga on menstrual disorders.

A search was conducted of the English language literature between 1996 and 2016. The following databases were searched: PubMed, Cinahl/ Medline, Web of Science, AMED and Scopus, using the following terms: Yoga AND menstruation OR menstrual period OR menarche; Yoga AND amenorrhea; Yoga AND dysmenorrhea. Studies were included if the following criteria were met: primary research; on premenopausal women; undertaking yoga practice. Studies were excluded: if their participants were menopausal women; if yoga was not the intervention being undertaken; if not primary research. This study aimed to comprehensively review all research literature on the impact of yoga on menstruation, not just RCT evidence, so all types of primary research study were included.

One reviewer reviewed each paper using a standardized data extraction form. Extracted data included authors, year of publication, sample size, interventions, main outcomes, and adverse events. The data extraction process is detailed in Figure 1.

The methodological quality and risk of bias of the included studies were measured using the Critical Appraisal Skills Programme (CASP) criteria<sup>31</sup> and the Cochrane Handbook for Systematic Reviews of Interventions (Version 5.0.2).<sup>32</sup> The domains of bias that were reviewed were: random sequence generation, allocation concealment, blinding of participants and personnel, incomplete outcome data, selective reporting, and other sources of bias.

## **Results**

15 studies, described in 18 papers were included in the review. The year of publication, authors, study design, sample size, age of participants, intervention modality, intervention dosage, outcome measure and salient findings for each study are reported in Table 1. Three were case controlled trials comparing women with menstrual disorders and healthy women. Nine studies were randomised controlled trials (RCTs). Three were intervention studies. Eight studies were conducted in India. Three studies were conducted in Taiwan. There was one study each from Iran, Japan and Korea. The included studies measured the effect of yoga on premenstrual symptoms and menstrual distress. No studies were found that measured the effect of yoga on amenorrhea or oligomenorrhea. No studies measured the effect of yoga on menstruation in women who were regular yoga practitioners.

## **Participant characteristics and recruitment**



The age range of women included in the studies varied between 13 and 45. In two studies participants were adolescent girls who attended residential colleges<sup>33,34</sup>. Other studies recruited participants through referral from and attendance at gynaecology clinics,<sup>35,36,37,38,39,40</sup> on students at a metropolitan college,<sup>41</sup> students on a physiotherapy course,<sup>42</sup> female volunteers with no stated specific origin,<sup>43</sup> unmarried medical students,<sup>44</sup> students,<sup>45</sup> nursery and kindergarten teachers<sup>46</sup>, staff and students at a university,<sup>47</sup> female workers at an electronics factory,<sup>48</sup> college students,<sup>49</sup> nursing college students.<sup>50</sup>

## **Interventions**

A range of yoga interventions were used. Some studies used a combination of asana, pranayama and other yogic relaxation or meditation techniques. Two studies<sup>35,36,38,39</sup> measured the sole impact of Yoga Nidra practice. In one study<sup>46</sup> the **effect of three specific yoga asanas (cobra, cat and fish)** was measured. In other studies a range of asana were practiced. The length of the yoga practice sessions differed between studies, from 10 minutes<sup>42</sup> to 90 minutes.<sup>40</sup> Frequency of practice ranged from daily for 16 weeks<sup>40</sup> to 20 minutes for 14 days.<sup>45</sup> In one study<sup>46</sup> participants were taught the asana routine then given a DVD to use for home practice. In the other studies instruction was provided in a class setting. One study<sup>42</sup> compared the efficacy of two pranayama techniques. In one study<sup>34</sup> the control group undertook non yogic exercise, breathing and rest at the same time as the yoga intervention group. The control groups in the other RCTs and case control studies did not take part in a control intervention.

## **Outcome measures**

There was little consistency between studies in the outcome measured used. In some studies versions of the Moos Menstrual Distress Questionnaire (MDQ)<sup>51</sup> was used, in others pain

scales, primarily the Visual Analogue Scale for Pain (VASP)<sup>52</sup> and general quality of life and stress scales were used (see Table 1). Mood scales and mental health scales were also used. In some studies physiological assessments were used as objective measures of impact, and to identify underlying mechanisms for the potential impact of yoga on menstrual distress. These included the use of resting EEGs; BMI, hand grip and reach tests autonomic function tests and serum levels of hormones at certain points in the menstrual cycle.

## **Findings**

All studies reported a beneficial effect of yoga as an intervention for menstrual disorders. Yoga practice was associated with lower MDQ scores;<sup>41,50</sup> lower serum homocysteine<sup>41</sup>; lower negative affect<sup>40</sup>; reduced pain scores;<sup>42,43,44,48</sup> increased wellbeing scores;<sup>38,43</sup> autonomic system changes;<sup>33,35,36,37</sup> a heightened relaxation response;<sup>47</sup> decreased menstrual disorder symptoms<sup>48</sup>. No study concluded that yoga had no effect on menstrual disorder symptoms.

Only one study<sup>38</sup> reported an adverse effect of the yoga intervention, namely one participant dropped out due to 'non-restorative sleep' following the Yoga Nidra practice. Only three studies confirmed no adverse effects of the practice (because of reporting the included studies.<sup>40,45,49</sup> In all other studies there was no mention of adverse effects or affirmation of their being no adverse effects.

## **Quality of studies**

The quality of studies was assessed using CASP criteria.<sup>31</sup> All studies gave clear statements of their methodology and aims. Recruitment strategies, data collection and analysis methods were stated. Two studies<sup>39,40</sup> did not state that it had been approved by an ethics committee or institutional review board. All studies described the use of appropriate statistical analysis techniques.

Whilst the research methodology and aims were replicable, description of the yoga intervention used was variable, limiting the replicability of the intervention in future research. Most studies described the specific asana used in their intervention, with the exception of Nidhi et al<sup>34</sup> and Sakuma et al.<sup>46</sup> The studies focused on Yoga Nidra as an intervention<sup>35,36,37,39</sup> did not give detail of how Yoga Nidra was instructed or performed. There was limited discussion of the rationales for the specific asana and pranayama chosen for the interventions.

High risk of bias was identified in three studies<sup>33,40,48</sup> (see Table 2) due to high attrition rates, lack of description of randomisation methods and sole use of subjective self report methods to measure outcomes. Given the nature of the interventions it was not possible to blind participants to their allocation or the intervention. Where several studies used self report measures , such as pain analogue scales, there was a risk of bias in outcome assessment.

Whilst all studied reported some positive impact of yoga on menstrual distress, as reported by participants and as found by assessing physiological correlates of menstrual distress, the external validity of the studies is limited by the frequency of the interventions used, with daily practice under instruction being an unrealistic expectation of most working age women. This concern has also been raised in a review of yoga for menopausal symptoms.<sup>53</sup> No studies included long term follow up, meaning that the continued effect of the intervention was not measured.

## **Discussion**

Yoga is a term used to describe a range of practices, following a number of traditions of schools.<sup>10</sup> The findings of this review mirror those of systematic reviews of yoga for other health conditions, in that the positive outcomes of individual studies must be countered by concerns

about their lack of replicability and their heterogeneity.<sup>12,48,49</sup> Yoga practice is growing exponentially<sup>24</sup>, particularly in the population most likely to suffer menstrual distress: women of childbearing age. The complex mechanisms by which yoga practice may affect the person cognitively and physiologically, with an assumed impact on the 'stress response' have been noted earlier.<sup>19,20,21</sup> The effect of yoga specifically on the underlying mechanisms of menstrual disorder is therefore hard to determine here. The reduction of menstrual disorder symptoms (as reflected in pain or wellbeing scores) may be due to a generic effect of yoga on pain tolerance and stress reduction, rather than an impact on underlying causes of menstrual disorder, such as hormone imbalance, for example.

Whilst the studies did discuss the possible and previously trialled benefits of yoga there was no rationale for the specific regimes that were followed, neither the sets of postures used in the interventions nor the duration and frequency of the intervention. In the studies where a limited and specific practice has been followed, for example, Yoga Nidra<sup>35,36,37,38,39</sup> or the comparison of two types of Pranayama<sup>42</sup>, there was not a justification for these practices over others in the yoga pantheon. The exception is Rakhshae et al's study<sup>45</sup>, using three specific poses. Their use is justified because of the action of the cobra pose on spinal flexibility and muscular strength, the cat pose on movement and breath coordination, and the fish pose on relief of stiffness and improvement of flexibility. The mechanism by which these proposed effects addresses menstrual disorder requires further inquiry though.

The included studies all reported some change in their outcome measures suggesting reduced symptoms of menstrual distress following a yoga intervention, however there was considerable variation in the interventions and outcome measures used. Several studies documented the effect of intensive programs of daily yoga that may be difficult to sustain outside of the college or industrial settings of the studies, whereby the same groups of women could be present in the

same place for several days in a week. Between the 18 studies there was limited parity of intervention or outcome measure. Most studies measured the effect of yoga on an intervention group with no prior experience of yoga practice, meaning that the influence of yoga on menstruation over the long term or in regular practitioners was not gauged. Frequency of practice is a predictor of good health and high subjective wellbeing in established practitioners<sup>22</sup>, however, the regimens described for yoga novices in some studies in this cohort were particularly intensive<sup>33,34,40,43,44</sup>. There is scope for future research that both controls for the effect of frequency and duration of practice on menstrual disorders, and explores the specific influence of frequency and duration.

Another main methodological drawback is lack of comprehensive reporting of trial methodology and heterogeneity of interventions, as has been identified in reviews of yoga for depression,<sup>54,55</sup> weight management,<sup>56</sup> and menopausal symptoms.<sup>53</sup> A recent comprehensive review of research on yoga 2010 to 2016 concluded that RCT studies should compare yoga to other forms of exercise and that physiological tests to identify underlying mechanisms should be used rather than self reported measures.<sup>15</sup> Recent systematic review and meta analyses of yoga intervention studies for physical and mental health conditions have also called for a more sophisticated approach, whereby aspects of the practice and characteristics of different practitioners are explored.

### **Strengths and Weaknesses.**

This was the first systematic review of studies of yoga and menstrual disorders in women of childbearing age, including randomized controlled trials. A limitation of this review was the lack of eligible studies and lack of similarity between studies. Another limitation was the restriction to

english language studies. There was no research available on amenorrhea and yoga or oligomenorrhea and yoga. Evidence from yoga manuals, internet searches and the non academic literature suggests that the effect of yoga practice on menstrual disorders may well extend beyond it being a possible treatment, and that frequent practice may be implicated in the genesis of menstrual disorders as well as potentially relieving them. Such a relationship has not been explored in primary research.

### **Implications for Further Research.**

The results of the studies included here suggest that further research is warranted. There is a need for consistency of measurement and intervention in studies of the efficacy of yoga for menstrual disorders. Long term follow up should be included in research designs. The effect of different aspects of yoga practice (asana, pranayama, Yoga Nidra, relaxation and meditation) as well as the different styles of yoga should be compared, rather than treated as one intervention. Yoga interventions should be designed to be realistically followed by working age women, in order that they may be generalised to the wider population. There have been no studies in this field on Western women. There have been no baseline studies measuring the presence of menstrual disorders in regular yoga practitioners. Of particular interest is the extent of amenorrhea or oligomenorrhea in frequent practitioners of the more strenuous forms of yoga, such as Ashtanga.

Future studies should follow rigorous reporting and methodological standards, meaning that their design should address risks of bias, particularly in randomisation, outcome measures used and reporting bias. The challenge of allocation concealment and blinding of participants should be acknowledged.

## **Conclusion**

This systematic review found a number of studies presenting evidence for the effectiveness of yoga as an intervention for symptoms of menstrual disorder. There was a lack of consistency in the interventions and outcome measures used precluding meaningful meta synthesis. There have been no studies looking at the long term effects of yoga practice on menstrual disorders or of prevalence of menstrual disorders in long term yoga practitioners. The results of this review suggest that further research on yoga for menstrual disorders is warranted, so long as both methodological standards are met and the study design enables generalisability to the target population.

## **Acknowledgements**

None

## **References**

- 1 Grady-Weliky, TA. Premenstrual dysphoric disorder. *New England Journal of Medicine*, 2003 348(5), 433–438.
- 2 Yonkers, KA, O'Brien, PS, & Eriksson, E. Premenstrual syndrome. *The Lancet*, 2008; 371(9619), 1200-1210.
- 3 Osayande, AS & Mehulic, S. Diagnosis and initial management of dysmenorrhea. *Am Fam Physician*, 2014; 89(5), 341-6.
- 4 Harlow, SD & Campbell, OM. Epidemiology of menstrual disorders in developing countries: a systematic review. *BJOG: An International Journal of Obstetrics & Gynaecology*, 2004; 111(1), 6-16.
- 5 Gibbs, JC, Williams, NI & De Souza, MJ. Prevalence of individual and combined components of the female athlete triad. *Medicine and Science in Sports and Exercise*, 2013; 45(5), 985–996.

- 6 National Institute for Health and Care Excellence (NICE) (July 2014). Clinical Knowledge Summary: Amenorrhoea. Retrieved from <http://cks.nice.org.uk/amenorrhoea> on 11 October 2016.
- 7 Factor-Litvak P, Cushman LF, Kronenberg F et al. Use of Complementary and Alternative Medicine Among Women in New York City: A Pilot Study. *PAM. Journal of Alternative & Complementary Medicine*, 2001;7(6), 659–666.
- 8 Fugh-Berman A & Kronenberg F. Complementary and alternative medicine (CAM) in reproductive-age women: a review of randomized controlled trials. *Reproductive Toxicology (Elmsford, N.Y.)*, 2003; 17(2), 137–52.
- 9 Fisher C, Adams J, Hickman L et al. The use of complementary and alternative medicine by 7427 Australian women with cyclic perimenstrual pain and discomfort: a cross-sectional study. *BMC Complementary and Alternative Medicine*, 2016; 16(1), 129.
- 10 Singleton M & Goldberg E. (Eds.). *Gurus of modern yoga*. Oxford: Oxford University Press, 2013.
- 11 Iyengar, BKS. *Light on yoga: yoga dīpikā*. New York, Schocken Books. 1970
- 12 Jois, SKP. *Yoga Mala: The seminal treatise and guide from the living master of Ashtanga Yoga*. London, Macmillan. 2010.
- 13 Desikachar, TKV. (1999). *The heart of yoga: Developing a personal practice*. Vermont, Inner Traditions/Bear & Co. 1999
- 14 Ivtzan I & Jegatheeswaran S. The Yoga Boom in Western Society: Practitioners' Spiritual vs. Physical Intentions and Their Impact on Psychological Wellbeing. *Journal of Yoga & Physical Therapy*, 2015; 5(3), 1–7.
- 15 Field T. Yoga research review. *Complementary Therapies in Clinical Practice*, 2016; 24, 145–161.
- 16 Jeter PE, Slutsky J, Singh N et al. Yoga as a Therapeutic Intervention: A Bibliometric Analysis of Published Research Studies from 1967 to 2013. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*, 2015; 21(10), 586–592.



- 17 Khalsa SB, Cohen L, McCall T, Telles S eds. Principles and Practice of Yoga in Health Care. Glasgow, Handspring. 2016.
- 18 Pascoe MC & Bauer IE. A systematic review of randomised control trials on the effects of yoga on stress measures and mood. *Journal of Psychiatric Research*, 2015; 68, 270–82.
- 19 Schmalzl, L, Powers, C, & Blom, EH (2015). Neurophysiological and neurocognitive mechanisms underlying the effects of yoga-based practices: towards a comprehensive theoretical framework. *Frontiers in human neuroscience*, 9: 235. Published online 2015 May 8. doi: 10.3389/fnhum.2015.00235
- 20 Schmalzl L, Streeter, CC & Khalsa SB. The psychophysiology of yoga in Khalsa SB, Cohen L, McCall T, Telles S eds. Principles and Practice of Yoga in Health Care. Glasgow, Handspring. 2016.
- 21 Gard T, Noggle JJ, Park CL, Vago DR, Wilson A. Potential self-regulatory mechanisms of yoga for psychological health. *Frontiers in human neuroscience*. 2014 Sep 30;8:770.
- 22 Ross A, Friedmann E, Bevens M et al. National survey of yoga practitioners: Mental and physical health benefits. *Complementary Therapies in Medicine*, 2013; 21(4), 313–323.
- 23 Park CL, Braun T & Siegel T. Who practices yoga? A systematic review of demographic, health-related, and psychosocial factors associated with yoga practice. *Journal of Behavioral Medicine*, 2015; 38(3), 460–471.
- 24 Cramer H, Ward L., Saper R et al. The Safety of Yoga: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *American Journal of Epidemiology*, 2015; 182(4), 281–293.
- 25 Yoga Journal (2016) Poses Contraindicated for Menstruation Retrieved from <http://www.yogajournal.com/category/poses/contraindications-modifications/menstruation-contraindications-modifications/> on 7 Nov 2016
- 26 Sweeney M. Astanga Yoga As It Is. Primary, Intermediate, Advanced A & B Asana and Vinyasa. 2005; Yoga Temple.

- 27 Iyengar GS. Yoga: A gem for women (Vol. 1). Mumbai, Allied Publishers, 1998.
- 28 Lasater J. Relax and renew: Restful yoga for stressful times. Berkeley, Ca, Rodmell Press; 2011
- 29 Yoga Journal, Yoga for Menstruation, <http://www.yogajournal.com/category/poses/yoga-by-benefit/menstruation/> [accessed 20 Dec 2016]
- 30 Jenny Sugar, Skip the Ibuprofen and Do These Yoga Poses To Ease Period Pain, Pop Sugar, <https://www.popsugar.co.uk/fitness/Skip-Ibuprofen-Do-Yoga-Poses-Ease-Period-Pain-37990826> [accessed 20 Dec 2016]
- 31 Public Health Resource Unit, Critical Appraisal Skills Program. 2009. Retrieved from <http://www.casp-uk.net/> on 11 October 2016.
- 32 Higgins JPT & Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.0.2 [updated September 2009]. 2009; The Cochrane Collaboration. Retrieved from <http://handbook.cochrane.org/v5.0.2/> on 11 October 2016.
- 33 Parkhad, S. Effect of yoga on premenstrual and menstrual cycle disorders in adolescent girls Biomedicine, 2013, 33(2), 170-175.
- 34 Nidhi R, Padmalatha V, Nagarathna R et al. Effects of a holistic yoga program on endocrine parameters in adolescents with polycystic ovarian syndrome: a randomized controlled trial. Journal of Alternative and Complementary Medicine, 2013; 19(2), 153–60.
- 35 Rani K, Tiwari SC, Singh U et al. Impact of Yoga Nidra on psychological general wellbeing in patients with menstrual irregularities: A randomized controlled trial. International Journal of Yoga, 2011; 4(1), 20.
- 36 Rani K, Tiwari SC, Singh U et al. Six-month trial of yoga nidra in menstrual disorder patients: effects on somatoform symptoms. Industrial psychiatry journal, 2011; 20(2), 97.
- 37 Monika, R, Singh U et al. Impact of Yoga Nidra on menstrual abnormalities in females of reproductive age. Journal of Alternative and Complementary Medicine, 2013; 19(12), 925–9.

- 38 Rani K, Tiwari SC, Kumar S et al. Psycho-Biological Changes with Add on Yoga Nidra in Patients with Menstrual Disorders: a Randomized Clinical Trial. *Journal of Caring Sciences*, 2016; 5(1), 1–9.
- 39 Singh U, Ghildiyal A, Kala S et al. Effect of Yoga Nidra on physiological variables in patients of menstrual disturbances of reproductive age group. *Indian journal of physiology and pharmacology*, 2012; 56(2), 161.
- 40 Choudhary A & Mishra J. Effect of 16 weeks yogic intervention in premenstrual syndrome. *International Journal of Pharma and Bio Sciences*, 2013; 4(1), B207-b212.
- 41 Chien L.-W, Chang H-C & Liu, C-F. Effect of yoga on serum homocysteine and nitric oxide levels in adolescent women with and without dysmenorrhea. *Journal of Alternative and Complementary Medicine*, 2013; 19(1), 20–3.
- 42 Ganesh BR, Donde, MP & Hegde, AR. Comparative Study on Effect of Slow and Fast Phased Pranayama on Quality of Life and Pain in Physiotherapy Girls With Primary Dysmenorrhoea: Randomized Clinical Trial. *International Journal of Physiotherapy and Research*, 2015; 3(2), 960–965.
- 43 Kanojia S, Sharma VK, Gandhi A et al. Effect of Yoga on Autonomic Functions and Psychological Status During Both Phases of Menstrual Cycle in Young Healthy Females. *Journal of Clinical & Diagnostic Research*, 2013; 7(10), 2133–2139.
- 44 Nag U & Kodali M. Effect of Yoga on Primary Dysmenorrhea and Stress in Medical Students. *IOSR Journal of Dental and Medical Sciences*, 2013; 4(1), 69–73.
- 45 Rakhshae Z. Effect of Three Yoga Poses (Cobra, Cat and Fish Poses) in Women with Primary Dysmenorrhea: A Randomized Clinical Trial. *Journal of Pediatric and Adolescent Gynecology*, 2011; 24(4), 192–196.
- 46 Sakuma Y, Sasaki-Otomaru A, Ishida S et al. Effect of a Home-Based Simple Yoga Program in Child-Care Workers: A Randomized Controlled Trial *Journal Of Alternative And Complementary Medicine*, 2012; 18(8), 769–76.

- 47 Sharma B, Misra R, Singh K et al. Comparative study of effect of anuloma-viloma (pranayam) and yogic asanas in premenstrual syndrome. *Indian Journal of Physiology and Pharmacology*, 2013; 57(4), 384–389.
- 48 Tsai, S-Y. Effect of Yoga Exercise on Premenstrual Symptoms among Female Employees in Taiwan. *International Journal of Environmental Research and Public Health*, 2016; 13(7).
- 49 Wu, W.-L., Lin, T.-Y., Chu, I.-H., & Liang, J.-M. (2015). The Acute Effects of Yoga on Cognitive Measures for Women with Premenstrual Syndrome. *Journal of Alternative & Complementary Medicine*, 21(6), 364–369.
- 50 Yang N-Y & Kim, S-D. Effects of a Yoga Program on Menstrual Cramps and Menstrual Distress in Undergraduate Students with Primary Dysmenorrhea: A Single-Blind, Randomized Controlled Trial. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*, 2016; 0(0), 1–7.
- 51 Moos RH. The development of a menstrual distress questionnaire. *Psychosomatic Medicine* 1968; 30:853–867.
- 52 Andersch B, Milsom I. Epidemiologic study of young women with dysmenorrhea. *Am J Obstet Gynecol*, 1982; 144:655
- 53 Cramer H, Lauche R, Langhorst J et al. Effectiveness of yoga for menopausal symptoms: a systematic review and meta-analysis of randomized controlled trials. *Evidence-Based Complementary and Alternative Medicine: eCAM*, 2012; 2012, 863905.
- 54 Pilkington K, Kirkwood G, Rampes H et al. Yoga for depression: The research evidence. *Journal of Affective Disorders*, 2005; 89(1–3), 13–24.
- 55 Cramer H, Lauche R, Langhorst J et al. Yoga for depression: A systematic review and meta-analysis. *Depression and Anxiety*, 2013; 30(11), 1068–1083.
- 56 Lauche R, Langhorst J, Lee, MS et al. A systematic review and meta-analysis on the effects of yoga on weight-related outcomes. *Preventive Medicine*, 2016; 87, 213–232.

57 Nakagawa Y, Daibo I. Japanese Version of the General Health Questionnaire (Manual). Tokyo: Nihon Bunka Kagakusha, 1985.

58 Cohen, S., & Williamson, G.M. (1988) Perceived stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), *The social psychology of health*, 31-67. Newbury Park, CA: Sage.

59 Ware Jr, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Medical care*, 473-483.

