

Innovations in Dental Hygiene Education

A 15-Minute Yoga Intervention to Reduce Entry-Level Dental Hygiene Student Stress

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Abstract

Purpose: Health science students have an increased source of stress due to the rigorous curriculum, high clinical expectations, and academic demands. The purpose of this study was to determine the effectiveness of a 15-minute yoga intervention to reduce stress in entry-level dental hygiene students.

Methods: First year dental hygiene students were invited to participate in the experimental study (n=32) and were randomly assigned to either the experimental or control group. The stress reduction intervention (gentle yoga movements, breathing, and meditation) was performed prior to each final exam for a total of six times. The control group proceeded with their usual pre-exam routines. Baseline and post-trial blood pressure, pulse and 10-item Perceived Stress Scale (PSS) data were recorded for both groups. Repeated measures of blood pressure and pulse were recorded before and after yoga for the experimental group and the control group prior to each exam. Data analyses included *Paired-samples t-test*, *Independent-samples t-test* and ANOVA, ($p=0.05$).

Results: The main effect for yoga from pre- to post-session was statistically significant for blood pressure ($p=0.02$ systolic; $p=0.02$ diastolic) but not for pulse ($p=0.23$). Significant effects on blood pressure measures showed yoga movement sessions reduced stress however the effects sizes were small. The *paired t-tests* indicated the 10-item PSS values were significantly lower ($p<0.00$). Statistical significance of differential, beneficial effects of yoga versus control were not demonstrated.

Conclusions: Fifteen-minutes of yoga movements had feasibility, compliance, and appeared to have positive effects related to stress reduction. No evidence of statistical significance was demonstrated compared to the control. Research on a larger sample of entry-level dental hygiene students using yoga movements over the course of a semester is recommended.

Keywords: stress reduction, stress management, dental hygiene students, yoga, physiological measures

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Introduction

Stress is a physical, psychological, or emotional response to an internal or external demand.¹ Stress can be beneficial by enhancing productivity and motivation, or stress can be crippling, reducing performance. The bidirectional relationship between individuals and their environments is complex and influential because stressors from daily situations can physiologically and psychologically be considered a threat to the body.² Extended periods of stress can disrupt normal biological functions; this prolonged strain on the body may contribute to health problems.¹

College students are particularly vulnerable to stress due to the fluctuating nature of college life in general.² Evidence of college stress was found in the American College Health Association (ACHA) survey data which concluded 44% of the respondents felt enormous stress that negatively impacted their academic and personal lives.³ Health science students, including entry-level dental hygiene students, have increased sources of stress due to the rigorous curriculum, high clinical expectations, and academic demands.^{2,4,5} Challenging course work, the number and complexity of assignments, exams, lack of control, fear of failing, and uncertainty about the

future, are examples of additional stressors in academic dental hygiene programs.⁵ Clinical stressors include manual dexterity skills, transition to patient care, completing clinical requirements, clinical decision making, rotating faculty, time management, and grade concerns.⁵ These issues are cause for immediate concern for college students' psychological and physiological health. Safe and feasible stress reduction interventions for college students, including dental hygiene students, are needed.^{2,4,5}

Yoga has been accepted as a natural, popular practice to achieve and maintain physical and emotional health and is considered an alternative therapy to address mind-body needs.^{6,7} Yoga is a Sanskrit word that comes from the Sanskrit root "yuj" which means to connect, join or balance and represents the suppression of the modifications of the mind to enhance one's inherent force in a balanced manner to obtain self-realization.⁸ Various styles of yoga are practiced including Vinyasa (athletic yoga), Hatha (beginner poses), Iyengar (alignment poses), Kundalini (invigorating poses), Ashtanga (physically demanding poses), Bikram (poses performed in sauna like temperatures, "hot yoga"), and Restorative (props used for deep, extended relaxation). Many yoga sessions include both Asanas and Pranayamas for various lengths of time to target and enhance the mind-body connection.⁸ Asanas are physical poses and movements; Pranayama is referred to as breathing regulation.

Yoga appeals to a wide range of individuals seeking natural control over their health, including stress management, and can also serve as a preventive lifestyle enhancement. National surveys and reports in the literature from 2012 – 2016, affirm the exponential growth in the practice of yoga from 21 million to 36.7 million users.⁹ Health promotion and disease prevention have been identified as the leading reasons for the practice of yoga.⁹⁻¹¹

A review of the literature was conducted to establish the existing body of knowledge on the benefits of yoga. Heart rate variability (HRV) is one of the physiological indicators for stress. In a study conducted to observe the impact of an eight-week yoga program on heart rate variability (HRV) and mood in generally healthy women, indicators for stress, anxiety, and depression were also observed.¹² The intervention participants (n=26) were instructed to attend a 60-minute yoga session twice a week; the control group (n=26) was advised to do nothing physical outside their normal activities.¹² Participants in the yoga intervention group demonstrated a statistically significant reduction in anxiety ($p=0.01$), evidence of yoga's anxiolytic effect in healthy women; however, yoga was not found to be significantly effective in managing depression or stress in this study.¹²

A systematic review and meta-analysis was performed to examine the effectiveness of yoga on Positive Mental Health (PMH) in healthy adults to determine whether a correlation exists.¹³ Four indicators were identified that correlated to PMH: psychological well-being, life satisfaction, social relationships, and mindfulness.¹³ Yoga was found to be significantly correlated to an increase in psychological well-being.¹³ The review authors recommended future researchers to measure positive outcomes from yoga use, since the vast majority (95%) of the current research measures negative outcomes.¹³

The emotional and physical stress that healthcare professionals face working in the healthcare fields can cause burnout, reduced quality of life, and other negative health effects. For these reasons, yoga and work-related stress in mental health professionals was studied in a 12-week, randomized controlled trial with a one-hour weekly session of yoga intervention.¹⁴ The researchers collected data by self-administered questionnaires and measuring heart rate variability, and the results indicated that the yoga intervention had a statistically significant effect on work-related stress.¹⁴

Studies in educational settings offer a unique perspective on various levels of maturity and cognitive development of the practitioner in relation to yoga's impact on stress, mood, performance, emotion, behaviour, and strength. To better understand the psychological effects of yoga on college students, a study was performed to initiate evidence of Vinyasa yoga's acute effects on college age students' stress levels.¹⁵ Participants were encouraged to attend yoga classes twice a week with each Vinyasa style session lasting approximately 90 minutes.¹⁵ Data analyses resulted in a statistically significant increase in positive effect scores on mood.¹⁵

Due to the increasing levels of stress students experience throughout their dental education,^{4,5} research has been conducted related to yoga and dental students. To examine yoga's efficacy in lowering student anxiety levels prior to performing their first periodontal surgery a randomized control trial was conducted with a convenience sample of 100 undergraduate dental students.¹⁶ The intervention group was instructed to practice the recommended yoga strategies at least once a day or as needed.¹⁶ The control group was provided with a 60-minute lecture on stress, anxiety, and health and were given a cassette tape with the sound of ocean waves.¹⁶ Yoga was shown to be effective at lowering pre-procedural stress and anxiety levels and improved the dental students' ability to relax when compared to the control group.¹⁶

While numerous stress reduction treatments and pharmacological interventions are available, little is known about the effect yoga has on entry-level dental hygiene

students' stress. The purpose of this study was to determine the effectiveness of a 15-minute yoga intervention to reduce stress in entry-level dental hygiene students.

Methods

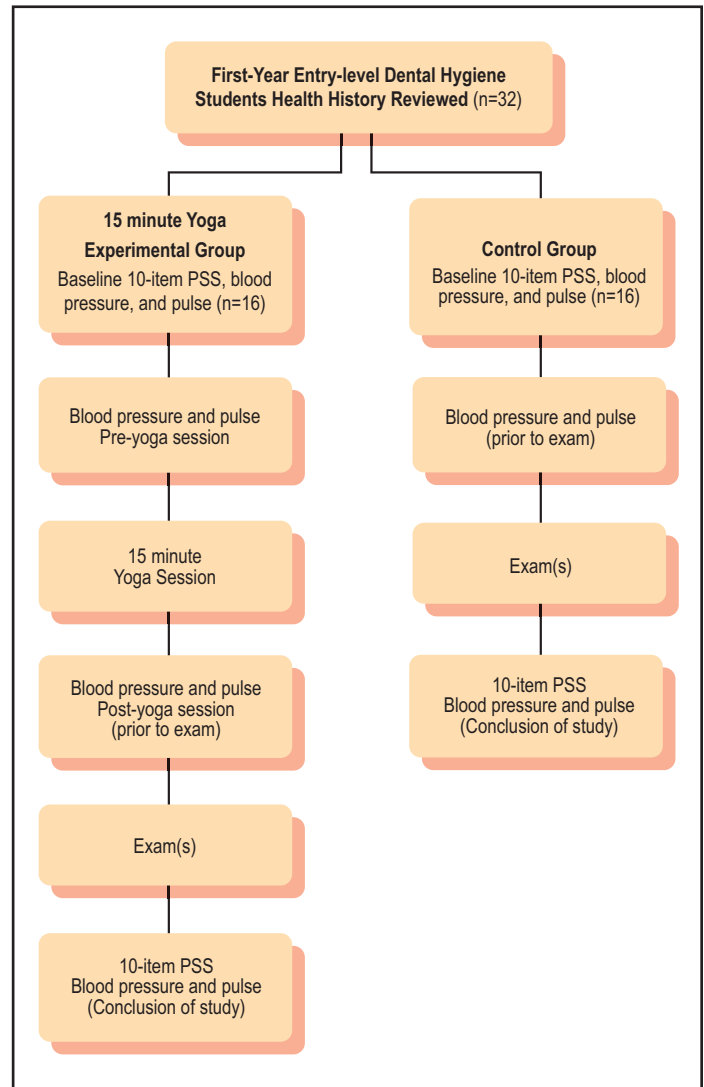
The Human Subjects Committee of Idaho State University granted this study exempt status based on the educational intervention (IRB-FY2019-215). This study was a non-blinded randomized control trial conducted on healthy first year entry-level dental hygiene students during finals week, which was intentionally selected as a potentially stressful time in their curriculum. Members of the first-year dental hygiene class were invited to participate in the study (n=32). Inclusion criteria were first-year entry-level dental hygiene students over the age of 18 and an in good health, as defined by no significant health conditions based on a health history evaluation. Written informed consent was obtained from all participants prior to the study.

Subjects were randomly assigned to two groups: a 15-minute yoga experimental (n=16) or a control group (n=16) using a random number generator. The participants' previously completed and updated health histories were reviewed, and blood pressure and pulse were assessed for outliers. Outliers and <10% baseline variation were evaluated and accounted for to ensure equal distribution between groups. Participants were screened for previous yoga and/or mindfulness activities prior to the trial to ensure internal validity. During finals week (April 29-May 2019), the experimental yoga group participated in a 15-minute yoga intervention session prior to each examination (two per day, six total). The control group was instructed to avoid physical activities including yoga during this time period and to continue their normal routines prior to testing during finals week. The control group confirmed they would not typically be performing any particular physical activity prior to any final examination. Figure 1 provides a flow diagram of the study profile.

The 15-minute yoga intervention was conducted by video session immediately prior to each final examination. The video was selected because the Hatha and Iyengar style of movements and breathing are known to specifically reduce stress and are appropriate and safe for beginners. The session was presented by a certified yoga instructor from YogaTX's free website.¹⁷ Relaxing music accompanied the verbal and visual instructions; deep breathing, inhalations and exhalations, were verbalized by the instructor to accompany movements.

The physical movements involved four steps. Step one, in

Figure 1 Methodology flow chart



a supine position on a yoga mat, slow purposeful arm and hip movements were added to each breath. Step two, gentle spine-twisting was performed during a side-supine position. Step three, in a supine position, gentle knee movements with each breath commenced. The final sequence included a two-and-a-half-minute guided meditation and breathing posture, Savasana, in a supine and static position. This intervention was performed by the experimental group prior to each final examination for a total of six times. The principal investigator (PI) monitored each session to ensure that each step was performed as specified and all six sessions were completed.

The physiological variables (blood pressure and pulse) were measured using a new, calibrated automated electronic blood pressure and pulse wrist cuff. Permission was provided to use the 10-item Perceived Stress Scale (PSS), a self-reported stress survey designed to measure perceptions of stress.¹⁸ The PSS, composed of 5-positive and 5-negative items rated on a

5-point Likert scale, was administered to both groups prior to the first exam and following the last exam.¹⁸ The PSS has structural validity ranging from 0.78 to 0.87 and test-retest reliability was >0.70.¹⁹ The PSS form is shown in Figure 2.

The groups were normally distributed. *Paired-samples t-test*, *Independent-samples t-tests*, and two-factor repeated ANOVAs were used to analyze data. The level of significance was set at $p=0.05$.

Figure 2. Perceived Stress Scale (PSS)¹⁸

Perceived Stress Scale*					
The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.					
	Never	Almost Never	Sometimes	Fairly Often	Very Often
1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and “stressed”?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last month, how often have you felt angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

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Results

A total of 32 first year dental hygiene students consented to participate in the study. All participants identified as females; the majority were Caucasian (n=29) and Hispanic (n=3), ranging in age from 20 to 37 years. Between group differences were not significant in relation to their age, education, yoga/mindfulness experience, or health status. Two students from the control group did not arrive prior to the second exam in time to have their blood pressure and pulse recorded and one participant did not take the baseline 10-item PSS. Otherwise, no other data were missing for the measures collected in this study.

Effect of yoga sessions on physiological stress

The effect of yoga was measured in blood pressure and pulse taken before and after each session prior to each of the six exams in the experimental group (Table I). This was a 2 by 6 repeated measures design. Preliminary analyses indicated the assumption of sphericity was met for all the repeated measures factors except for the interaction effect for diastolic blood pressure where the reported p value is for Greenhouse-Geisser adjusted test.

The separate two-factor repeated-measures of ANOVA revealed a statistically significant main effect for pre-exam physiological stress for systolic blood pressure ($p=0.02$), diastolic blood pressure ($p<0.00$), and pulse ($p<0.00$). As shown in Table I, the mean systolic blood pressure, diastolic blood pressure, and

Table I Means for blood pressure and pulse taken before and after each yoga session (n=16).

	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6	Total
	M(SD)*	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M
Systolic	111.4	111.5	111.7	110.7	116.3	109.7	111.9
Before	110.1 (10.1)	113.4 (11.0)	116.3 (12.2)	110.1 (6.9)	119.0 (11.5)	111.5 (8.8)	113.4
After	112.7 (14.8)	109.6 (13.2)	107.1 (10.4)	111.2 (10.9)	113.6 (14.3)	107.8 (7.5)	110.3
Diastolic	75.2	75.2	75.5	72.3	80.7	77.0	76.0
Before	74.2 (8.9)	76.5 (7.5)	79.4 (10.9)	72.4 (7.1)	81.1 (11.6)	79.6 (11.2)	77.2
After	76.3 (8.9)	73.8 (9.2)	71.6 (9.6)	72.3 (9.3)	80.3 (12.8)	74.4 (8.3)	74.8
Pulse	82.5	78.6	79.8	89.8	83.4	82.6	82.8
Before	84.1 (14.2)	78.6 (13.6)	82.1 (14.6)	90.1 (13.0)	85.5 (15.8)	81.1 (12.5)	83.6
After	80.9 (15.7)	78.6 (9.3)	77.3 (10.8)	89.4 (17.8)	81.3 (15.9)	84.2 (13.0)	81.9

*M=means; SD=Standard deviations

**Two-factor repeated-measures of ANOVA

pulse varied across exams. The main effect for yoga from pre-session to post-session was statistically significant and *Cohen's d* effect sizes were small for systolic blood pressure ($p=0.02$, $d=-0.36$) and diastolic blood pressure ($p=0.02$, $d=-0.35$), but not statistically significant for pulse ($p=0.23$, $d=0.18$). The *Cohen's d* effect sizes were small, but the significant effects on the blood pressure measures showed the yoga sessions impacted stress levels.

The interaction effect for yoga from pre-session to post-session by yoga session was also statistically significant for systolic blood pressure ($p=0.01$) and diastolic blood pressure ($p<0.00$), but not for pulse ($p=0.37$). For systolic blood pressure, the means were higher before the yoga session than after the yoga session with the exception of Exam 1 and Exam 4. For diastolic blood pressure the means were higher before the yoga session than after the yoga session with the exception of Exam 1, Exam 4, and Exam 5. Together, the results indicated the yoga sessions had small effects on systolic and diastolic blood pressure across the pre-exam yoga sessions, but the effects varied by exam. The yoga sessions did not affect pulse rates.

Effect of yoga on pre-exam stress compared to control

The effect of yoga versus the control (no yoga) on the three measures of pre-exam stress (pulse, systolic blood pressure, and diastolic blood pressure) was evaluated across five of the exams. Exam 2 was excluded from these analyses due to the loss of data from two participants in the control group. The design was a 2 by 5 mixed design with each pre-exam occasion serving as a fixed repeated measures factor. The means are presented in Table II.

Preliminary analyses indicated the assumption of sphericity was met for the repeated measure factor for pulse but not for systolic or diastolic blood pressure. Consequently, reported p values are for Greenhouse-Geisser adjusted tests for the repeated measures effects for blood pressure. The between groups effect of yoga was not statistically significant for any of the stress measures ($p=0.35$ for systolic, $p=0.46$ for diastolic, and $p=0.68$ for pulse). *Cohen's d* effect sizes reveal the difference between the mean of the yoga group and the control group were $d=-0.15$ for systolic blood pressure, $d=-0.12$ for diastolic blood pressure, and $d=0.06$ for pulse. The effect sizes were all negligible.

The effect of exam was not statistically significant for systolic blood pressure ($p=0.19$), but it was statistically significant for diastolic blood pressure ($p<0.00$), and pulse ($p<0.00$). For diastolic blood pressure, the mean was highest for Exam 5 and lowest for Exam 4. For pulse, the mean was highest for Exam 4 and lowest for Exam 3. The interaction effect was statistically significant for systolic blood pressure ($p=0.01$), but not for diastolic blood pressure ($p=0.06$) nor pulse ($p=0.46$). Multiple comparisons of the yoga conditions across the five exams applying a Bonferroni adjusted significance criterion of $p \leq 0.01$ for the five tests indicated the locus of the interaction effect on systolic blood pressure occurred at Exam 6 ($p<0.00$). No other differences were statistically significant. Yoga ($M=107.8$) lowered systolic blood pressure before the last exam (Exam 6) compared to no yoga ($M=116.9$, $d=0.77$) showing a medium effect size.

Table II Means for pre-exam stress measures for experimental group compared to control group

		Exam 1	Exam 3	Exam 4	Exam 5	Exam 6	Total
	N or n	M(SD)*	M(SD)	M(SD)	M(SD)	M(SD)	M
Systolic	32	112.1 (13.3)	111.3 (11.1)	109.2 (10.0)	114.5 (13.5)	112.3 (9.4)	111.9
Yoga	16	112.7 (14.8)	107.1 (10.4)	111.2 (10.9)	113.6 (14.3)	107.8 (7.5)	110.5
Control	16	111.5 (12.1)	115.6 (10.3)	107.3 (9.1)	115.4 (13.2)	116.9 (9.0)	113.4
Diastolic	32	74.8 (8.8)	74.7 (9.5)	72.6 (8.7)	80.2 (12.6)	77.2 (8.4)	75.9
Yoga	16	76.2 (8.9)	71.6 (9.6)	72.2 (9.3)	80.2 (12.8)	74.4 (8.3)	74.9
Control	16	73.3 (8.8)	77.9 (8.5)	73.0 (8.2)	80.2 (12.9)	80.1 (7.9)	76.9
Pulse	32	79.9 (12.7)	76.4 (12.0)	88.5 (17.1)	83.5 (13.2)	81.2 (12.6)	81.9
Yoga	16	80.9 (15.7)	77.3 (10.8)	89.4 (17.8)	81.2 (15.9)	84.2 (13.0)	82.6
Control	16	79.0 (9.4)	75.4 (13.3)	87.6 (16.8)	85.8 (9.8)	78.3 (11.9)	81.2

*M=means; SD=Standard deviations

Effect of yoga on perceived stress compared to control

The score for one entry-level dental hygiene student in the control group was not available for the baseline measure of the 10-item PSS. Scores were available for all participants for the 10-item PSS measure collected at the conclusion of the study. Based on independent *t*-tests, the yoga group (n=16, *M*=23.0, *SD*=5.5) and the control group (n=15, *M*=21.7, *SD*=6.6) did not differ statistically (*p*=0.54) with respect to their mean baseline 10-item PSS scores at the beginning of the study but the mean perceived stress was lower in the control group. The yoga group (n=16, *M*=21.3, *SD*=5.9) and the control group (n=16, *M*=22.2, *SD*=7.6) also did not differ significantly (*p*=0.68) at the conclusion of the study. However, the results of *paired t*-tests indicated the 10-item PSS scores were significantly lower (*p*<0.00) at the conclusion of the study for the participants in the yoga group (*Mean Difference*=-1.8, *SD*=1.8, *d*=-1.0), but were not significantly lower (*p*=0.82) for the participants in the control group (*Mean Difference*=0.2, *SD*=3.4, *d*=0.06). The effect size of the difference for the yoga group was large.

Discussion

This study sought to understand whether yoga provided a non-pharmaceutical stress management solution for entry-level dental hygiene students. Existing literature has demonstrated yoga's use as a natural stress management option for various populations including persons clinically diagnosed with stress and anxiety, work burnout, decreased mental health, non-clinical, and dental student populations.¹²⁻¹⁶ During an eight-week yoga intervention study, heart rate variability was

not affected yet anxiety scores were significantly reduced in the yoga versus the control group.¹² It was recommended to study yoga's effect on participants with higher stress levels.¹² Therefore, this study enrolled entry-level dental hygiene students in a highly stressful time during their curriculum to evaluate yoga's effect. Results from this study indicate that yoga reduced the perceived stress of the experimental group as compared to the control group. In another study examined the effects of a one-hour yoga intervention on perceived stress and mindfulness in dental hygiene and dental students were examined.²⁰ Findings suggested that even a brief yoga intervention could be especially effective at increasing a state of mindfulness for students with high levels of stress.²⁰

Compliance was a barrier for the college student participants during an eight-week randomized control trial.¹⁵ The experimental group attended two Vinyasa 90-minute yoga classes a week, resulting in a significant increase in mood for the yoga group, however, no statistical change occurred in other domains.¹⁵ The authors' attributed insignificant statistical findings across all domains to a lack of compliance in the experimental group and a moderately-physical active control group.¹⁵ In comparison, this study used a no-treatment control, a short yoga intervention, and a convenient location. As a result, compliance was more successful and demonstrated that 15-minutes of yoga can be easily integrated into academic routines in educational settings.

Another study analysed the impact of an extended duration and more intense Bikram 90-minute yoga sessions three to five times a week over a period of 16 weeks.²¹ Yoga class attendance was a powerful indicator of success, as the

improvements were directly proportionate to the number of classes taken by the experimental group.²¹ Similar to previously discussed research, compliance was the primary limitation to the study's success. Conversely, in this study the compliance barrier was overcome by reducing the duration and intensity of the yoga sessions for the experimental group.

Yoga and meditation have been explored to improve the psychological and physical well-being of healthcare workers to manage and prevent stress and burnout.²² A systematic review of clinical trials analyzing yoga interventions and stress levels, sleep quality, and quality of life among healthcare workers demonstrated that yoga appears to be effective in the management of stress in these individuals.²² This study of entry-level dental hygiene students sought to address student stress management prior to entering the healthcare workforce. Because the literature on dental hygiene students' stress management is in its early stages, it is important to conduct more research with varying styles and duration of yoga among dental hygiene students to broaden the body of knowledge. Yoga is new to dental hygiene as a stress management strategy and developing a range of interventions is worth investigating.

Compliance was found to be a primary limitation in yoga's effectiveness across the literature. A strength of this study was the high-level of compliance which offers solid evidence that yoga may be implemented into the entry-level dental hygiene curriculum to potentially help manage student stress. Furthermore, exposure to stress management options like yoga during their education may help future professionals cope with workforce stress and enhance their career satisfaction and longevity. Additional strengths of this study include the randomized control trial design, with a no-treatment control, and the inclusion of valid and reliable physiological and psychological measures. The yoga intervention, which was delivered via a video, provided consistency and feasibility and increased participant compliance.

There were also several limitations to this study. Small sample size limited the power of the statistical analysis and generalizability of the findings. Finals week may not have been the ideal time to introduce yoga because the condensed exam schedule may have been too intense of a time period to conduct a research study. Bias was minimized by having a trained statistician manage all data which was de-identified. A larger sample and more robust population are suggested to add power to detect and increase greater effect size and generalizability. Future researchers are encouraged to increase frequency and possible duration of yoga interventions over the course of a semester or academic year. Various styles of

yoga should also be explored for stress reduction including Restorative yoga. Additional research is warranted related to dental hygiene students because this population has been identified as being at risk for higher levels of academic stress.

Conclusion

A 15-minute yoga intervention was studied among entry-level dental hygiene students during the final examination period in their second semester. Measures included the 10-item PSS, blood pressure, and pulse. Results demonstrated statistically significant positive effects on stress measures, particularly blood pressure, within the yoga group. However, statistical significance of the differential, beneficial effects of yoga versus control were not demonstrated. This study provides evidence of yoga's positive effects in both physiological and psychological domains within entry-level dental hygiene students. High levels of compliance were achieved and demonstrated yoga's feasibility even during a highly stressful time for entry-level dental hygiene students.

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