

# Can mindfulness focus attention meditation alter pain sensitivity?

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## Abstract

*Studies show that long-term mindfulness meditation provides the ability to enhance a broad spectrum of cognitive health outcomes on chronic pain patients. However, there are not many studies which show the effect of short-term mindfulness for chronic neck pain. The purpose of this study was to determine if short-term mindfulness focus attention meditation can alter pain sensitivity, and to decide if it can be considered as an effective treatment method for patients with chronic pain. Pressure pain was applied with an algometer three times on the upper trapezius in healthy subjects with 5 days in between. Whereby pressure pain threshold and pressure pain tolerance were evaluated. The treatment group practiced 20 minutes of mindfulness meditation on 5 consecutive days between the two measurements, whilst the control group continued their normal routine. No significant improvement of the pressure pain threshold and pressure pain tolerance between the groups was found. Moreover, no significant difference between the difference as a percentage in threshold and tolerance was found. Nevertheless this study still contributes to the field of pain relief using mindfulness meditation. Since this study shows the tendency that mindfulness FA meditation increases both, threshold and tolerance, a longer period of practicing mindfulness FA meditation should be investigated.*

## I. INTRODUCTION

Approximately 20 % of the population suffer from chronic pain [1]. The characteristic of chronic pain is a duration of pain more than three months [2]. Due to the persistence of pain the patients get restricted physically as well as psychically. The patients' ability to participate in diverse activities decreases. Those activities are not only physically but also socially, maintaining an independent lifestyle and relationships to friends and family can be affected. A survey by Breivik et al. [3] showed that pain has an impact on the work life, whereby 25% of the patients indicated that they changed their job, responsibilities at job or lost their job due to chronic pain. Furthermore, depression was diagnosed in 21 % of those patients. [3] One of the most common types of chronic pain is neck pain, as 25 % suffer from this in

the UK [1]. Those patients are restricted by negatively affected fatigue and concentration [? ]. Furthermore, they suffer like the majority of chronic pain patients from anxiety and depressed mood, cognitive distress and the resulting physical limitations. [4] At the moment there is no cure for chronic pain. The current treatment methods only provide possibilities to relieve the pain. [5? ] Nevertheless, the majority of the patients feels pain daily and this pain increases throughout the day due to the daily activities. [3]

Chronic pain is mainly treated by medication. However, medications have side effects like abuse or organ damage. To avoid those risks, alternative methods can be used. One of those methods is mindfulness meditation. Whereby meditation is used as mental training to achieve diminished judgment of emotions,

cognitive control and existential insight. [?] ] One of the most common types of meditation techniques is focused attention, which trains the concentration by focusing at an object or specific thing [?] ].

Previous studies show that mindfulness meditation provides the ability to enhance a broad spectrum of cognitive health outcomes. Furthermore, stress, depression and anxiety can be relieved. These improvements are due to practicing mindfulness meditation, especially because of the mental training in emotion regulation, cognitive control, acceptance and positive mood. [?] 6] Nevertheless, there are not many studies which show the effect of mindfulness meditation on chronic neck pain. [1] Additionally, the pain relieve properties are mostly investigated after practicing mindfulness meditation over a time period of two months or more. The effect of a shorter time period of mindfulness meditation on chronic neck pain is not investigated yet.

The present study addressed if mindfulness meditation can alter pain sensation in the neck by measuring pressure pain threshold and pressure pain tolerance before and after short-term mindfulness meditation. Therefore the hypothesis "Short-term mindfulness meditation increases the pressure pain threshold and the pressure pain tolerance in the upper trapezius" was tested.

## II. METHOD

### i. Subjects

42 healthy subjects, 21 men and 21 women were recruited (age:  $23.93 \pm 2.74$  years, BMI:  $23.66 \pm 3.28$ ). Subjects with ongoing meditation practice, acute or chronic pain, neurological, musculoskeletal or mental illness, pregnancy or taking medications that might influence their response to pain were excluded.

### ii. Study design

A controlled trial was designed, whereby the subjects were assigned into a control and treat-

ment group with an equal gender distribution, as illustrated in Figure I.

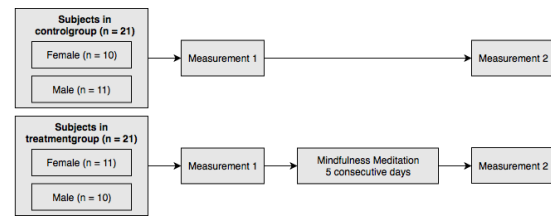


Figure I: Study design

The subjects of the treatment group practiced 20 minutes mindfulness meditation on 5 consecutive days between the two measurements, while the subjects of the control group continued their normal routine. The same time interval between the measurements was used for the two groups.

### iii. Measurements

The testing point, as shown in Figure II, was marked at the right upper trapezius to ensure reliable and rapid location during the experimental procedure. The location of the testing points on the upper trapezius was determined between the acromion and 7th cervical vertebra.

Pressure Pain Threshold and Pressure Pain Tolerance were measured with an algometer (Wagner Force Ten™ Digital force Gage) three times with a 5 minutes rest period in between. The examiner was blinded during the three measurements to avoid bias. The mean of the three measurements, was computed.

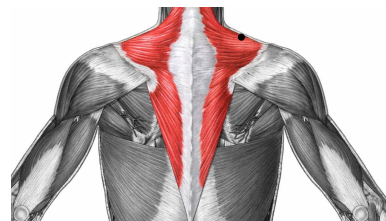


Figure II: Testing point on the upper trapezius.

#### iv. Meditation Technique

Short-term mindfulness meditation with 20 minutes of meditation on 5 consecutive days. To ensure same meditation conditions, a guided meditation in form of an audio file was used.

A short introduction to mindfulness meditation was provided before the first meditation session. The meditation was focused attention focusing on breath flow.

#### v. Data Analysis

At first the normality of the data sample was evaluated with a Shapiro-Wilk test. According to the outcome of the Shapiro-Wilk test, for comparison of treatment and control group with regards to threshold and tolerance of first and second measurement a two-way mixed ANOVA was applied. For comparison of the groups with regards to the difference in threshold and tolerance as a percentage of first and second measurement a t-test was applied.

### III. RESULTS

The tolerance for some of the subjects is not representative, as the examiner was not able to apply enough force with the algometer to reach the subjects' tolerance, thus those subjects were excluded.

The Shapiro-Wilk test showed a normal distribution ( $\alpha > 0.05$ ) for the threshold and tolerance pre and post for both, treatment and control group. Therefore the two-way mixed ANOVA was applied. The test showed an equality of covariance ( $p = 0.955$ ) and a equality of error variances ( $p > 0.05$ ) for threshold and tolerance pre and post. Whereby the pre and post measurements of threshold and tolerance were compared to see the within-subjects effect. These results are illustrated in Table I. The groups, treatment and control, were compared to see the between-subjects effect. These results are illustrated in Table II.

The test indicates that there is a significant main effect between the pre and post measurements (within-subject effect, Measurement).

**Table I:** Results from the two-way mixed ANOVA, showing the within-subject effect. The asterisk indicates significant difference.

Within-Subjects Effect	F	Sig
Measurement	13.052	0.001*
Measurement x Group	0.154	0.507

**Table II:** Results from the two-way mixed ANOVA, showing the between-subject effect.

Between-Subjects Effect	F	Sig
Group	1.492	0.231

However, no significant main effect is seen between the treatment and control group (between-subjects effect, Group), nor a significant main interaction between the measurements and the groups (within-subjects effect, Measurement<sup>x</sup>Group).

The Shapiro-Wilk test showed a normal distribution ( $\alpha > 0.05$ ) for the difference in threshold and tolerance as percentage of the pre and post for both, treatment and control group. Therefore the T-test was applied. There is an equality of error variances for the tolerance ( $p = 0.159$ ) and no equality of error variance for threshold ( $p = 0.013$ ). The results from the T-test are illustrated in Table III.

**Table III:** Results from the T-test.

Threshold	Tolerance
0.149	0.330

The test indicates that there is no significant difference in the threshold and tolerance.

### IV. DISCUSSION

#### i. Summary and interpretation of the findings

There was seen an overall increase in the threshold and tolerance within the two measurements for both, the treatment and control group. However, no significant improvement of the pressure pain threshold and pressure

pain tolerance between the groups was found. Furthermore, no significant difference between the difference as a percentage in threshold and tolerance was found. But a tendency can be seen that the treatment group has a higher percentage increase in both threshold and tolerance compared with the control group.

## ii. Experimental Setup

One of the drawbacks of the manual algometer is the difficulty in assessing objectively the rate in pressure applied. Different studies insist in the importance of training and practice with the algometer in order to achieve reliable values. However, due to the thigh time to execute the project, an appropriate training period was not possible, which would be convenient.

Different subjects expressed difficulties rating their own threshold, why it is challenging to find true values of pain. Hence, this research rely on the ability of the subjects to rate their pain.

It appears more convenient to focus on the pressure pain threshold instead of the pressure pain tolerance, because of the big variability in tolerance measures and validity of the measures obtained from the subjects, because pain tolerance is harder to reach with the algometer.

A study by Tesarz et al. [?] concludes that pain perception can be altered by physical activity. Subjects with good physical condition participating in the study, showed higher threshold and tolerance values compared with other subjects. Nevertheless, this fact does not affect the outcomes of the study because we compared the subjects with themselves, not with the others. Along a study by Koltyn et al. [?] concludes that high-intensity exercise is followed by hypoalgesia, which leads to an increased pain threshold as well as pain tolerance values during and after exercise. Based on this, the exclusion criteria should take into account that subjects cannot train before the measurement.

## iii. Meditation technique

Other studies have shown that mindfulness meditation has an effect on pain. Those studies investigated the effect of a meditation practice over two months or more using MBSR. [? ? ] The effect on pain intensity and pain unpleasantness of short-term mindfulness meditation practice was shown by Zeidan et al. [6]. However, Zeidan et al. [6] used a meditation technique which was a combination of FA and OM, particularly focusing on pain-related brain processing. Whereas this study was investigating the effect of regular short-term mindfulness FA meditation. Hence one could speculate that different meditation types affect pain after various time periods of practice and that 5 consecutive days are not sufficient to elicit mindfulness FA meditation's modulation of pain.

Nevertheless, there were some limitations within the used meditation technique. Potentially the used audio-guide did not ensure that the subjects understood the principles of mindfulness FA meditation, even though an introduction to mindfulness meditation was given orally on the first day. However, this introduction was provided by a non-specialist, who possibly did not know the key focus of explaining mindfulness meditation to laymen. This uncertainty was based on board spectrum of mindfulness meditation techniques and their unclear delineations. Furthermore, the subjects were told to meditate in the most comfortable position, which varied from subject to subject. These inconsistent sitting positions may have influenced the meditation outcome of single subjects. In addition, there was no control, if the subjects were meditating in the right way.

## V. CONCLUSION

Short-term mindfulness FA meditation on 5 consecutive days did not show an effect on pressure pain relief in this study. Nevertheless this study still contributes to the field of pain relief using mindfulness meditation as an alternative method. Since this study shows the tendency that mindfulness FA meditation in-

creases both, threshold and tolerance, a longer period of practicing mindfulness FA meditation should be investigated. Furthermore, this study indicates that the effects of mindfulness meditation varies depending on the meditation technique. Hence the effects of the different meditation techniques should be further investigated in order to evaluate if different meditation techniques have various effects on pain relief.

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