

# Self-Assessed Time Span of Focused Attention During a Breath Focus Test Task as a Measure of Mindfulness: A Preliminary Evaluation

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## ABSTRACT:

**Introduction:** An easy task-based measure of mindfulness that can be self-administered in a daily life setting is still not available. We aimed to perform a preliminary evaluation of the Breath Focus Test Task to measure mindfulness. **Methods:** A quantitative observational study was performed among medical students. Each study participant was instructed to focus attention to the participant's own breath and count each breath with awareness until the participant noticed mind wandering. The last breath count attended before losing awareness of the task (breath count with awareness) was recalled and self-reported by each participant. Three such breath focus sessions were planned for each participant. Mean 'breath count with awareness' of each participant was then converted to time span of focused attention using the rate of breathing. This time span of focused attention was reported as the proposed measure of mindfulness. Each participant also completed the 'Mindful Attention Awareness Scale questionnaire'. **Results:** Out of 101 participants, 76 completed at least one breath focus session satisfactorily. Median time span of focused attention was three minutes (first quartile = 1.9 minutes and third quartile = 4.5 minutes). The Mindful Attention Awareness Score was 3.9 (SD = 0.6). The results did not show a significant correlation between the time span of focused attention and the Mindful Attention Awareness Score ( $r_s = 0.04$ ,  $p = 0.74$ ). **Conclusion:** This study shows the feasibility of the proposed test task. However, the measure obtained from the current form of the test did not correlate with Mindful Attention Awareness Score.

**Keywords:** Focused attention, Measurement, Meditation, Mindfulness.

## INTRODUCTION:

Mindfulness is most commonly defined as "the state of being attentive to and aware of what is taking place in the present".[1] Mindfulness practice and

interventions have been found to play an important role in prevention and management of mental health issues like stress, anxiety, depression, etc.[1,2] It also plays a supportive role in the management of chronic physical illnesses like cancer, diabetes and obesity as well as in the promotion of occupational health.[3,4,5] Besides this, a meta-analysis has suggested that mindfulness brings positive changes in the brain networks involved in attentional control

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which is beneficial for a wide range of cognitive functions.[6]

Self-reporting questionnaires are the most common tools currently in use to measure mindfulness whereas, some objective behavioral task-based measurements are also emerging.[7,8] Meditation breath attention scores task, Breath counting task and Mindful awareness task are some proposed behavioral task-based measures to assess mindfulness. However, further improvements are required to capture the complex construct of mindfulness.[8] Though the objective measures are generally more suitable than the self-reporting questionnaire-based scales for research purpose, such measures tend to be more complex and difficult-to-use for self-assessment and monitoring in daily life situations due to the need for sophisticated technology. Therefore, we proposed a technique that we have named breath focus test task (BFTT) as an easy to use, task-based, on-the-spot measure of mindfulness that could be self-administered without using advanced technology. We also expected that this proposed task-based measure of mindfulness could overcome some of the shortcomings of questionnaire-based measures like differences in the interpretations of the questions and the need to recall daily life experiences over time.

Breath focus meditation is a commonly practiced form of mindfulness meditation. Published literatures suggest that increase in mindfulness is associated with better control of attention and non-reactive awareness.[6,7,9] Based on this understanding, we expected that self-reported time span of focused attention (TSFA) defined as the duration of uninterrupted attention to breath during the BFTT would reflect the mindfulness of the person. Hence, this study aimed to perform the preliminary assessment of the BFTT and to assess the correlation of TSFA with the score obtained from self-reporting questionnaire-based Mindful Attention Awareness Scale (MAAS).

## **METHODS:**

The present study was a quantitative observational study conducted in the Department of Physiology, Lumbini Medical College and Teaching Hospital (LMCTH), Prabhass, Palpa, Nepal. The data was collected in a period of one month (26th August to 27th September, 2021) after the approval from the Institutional Review Committee of LMCTH (IRC LMC 03-D/021). Informed consent was obtained from each participant. Basic measures for prevention and control of transmission of infection were adopted as follows: Only the participants not having COVID-19 diagnosis or related symptoms were included in the study. Use of face masks, physical distancing of at least six feet, hand sanitization, non-sharing of pens or papers, daily disinfection of the frequently touched surfaces and proper natural ventilation of the room were also ensured. Our inclusion criteria was the age range from 18-28 years and the exclusion criteria were presence of acute illness at the time of study, major psychiatric or sleep disorder and use of psychotropic drugs at the time of data collection.

**Sample size and sampling technique:** Medical students volunteered for the study. The sample size was calculated as 95 expecting correlation coefficient of at least 0.3 (at least moderate monotonic correlation) between TSFA and MAAS setting the level of significance at 5%, power at 80% and accounting for an attrition rate of 10%.[10] A convenience sampling technique was used to obtain the required sample.

**Pretesting:** The Breath Focus Test Task (BFTT) protocol and BFTT-related pro-forma were conceptualized and developed by the authors themselves after a necessary literature review. BFTT-related pro-forma and MAAS questionnaire were pretested before data collection among nine individuals divided into two groups: one consisting of four females and the other of five males. These individuals were not included in the main study. Pretesting was carried out to make sure that the test task and the questions were comprehensible to the participants.

**Breath Focus Test Task (BFTT) Procedure:** The breath focus test task was performed by the participants on an empty stomach having refrained from coffee or tea in the morning; refrained from alcohol in the last 24 hours and having a good night sleep. The test was conducted between 7:00 – 8:30 AM in a normally lit well ventilated quiet room. The number of participants performing the breath focus test task per day varied from a single person to a small group of six (five on average). The participants were introduced to the BFTT and the pro-forma by the principal researcher beforehand.

For the test, each of the participants was instructed to sit with his/her eyes gently closed, comfortably on a cushion on the floor or a chair as per the participant's preference. After a brief period of relaxation, the participant focused his/her attention to breathing sensation at the nostrils.[11] The participant attended to quiet breathing focusing on the nostrils for each inspiration and expiration followed by (i.e. not overlapping) respective count for the breath silently (within the mind). In other words, the sequence to be attended was breathing in, breathing out, count 'one', breathing in, breathing out, count 'two' and so on. Hence, there were three elements to be attended to during each breath cycle namely breathing in, breathing out (both at the nostrils) and its mental count while still maintaining the focus at the nostrils. The participant terminated the BFTT session when he/she noticed that he/she had missed any one of the three elements from his/her continuous awareness. The participant then recalled and immediately recorded, in the pro-forma, the last attended breath count up to which he/she had been continuously aware of all of the three elements (will be called just 'breath count with awareness' or BCA henceforth). However, peripheral awareness of other sensations with the main focus still maintained on breath would not lead to termination of the breath focus session.

The participants were instructed to note the mode of termination of a breath focus session i.e. whether the participant (a) forgot to continue counting or (b) did it automatically without awareness or (c) had

low confidence in the continuity of awareness of the task or (d) experienced unforeseen major distractions or discomfort. If the case was (b) or (c), the participants also noted the breath count at the time of termination of the session called 'breath count on termination'.

Whenever permitted by the time constraints (total duration of one hour and 30 minutes for a participant for all activities, namely signing the consent form, instructions, practice, breath focus sessions, rest sessions and completing the pro-forma), each of the participants performed a total of three such breath focus sessions in a row in the same sitting and the participant was given a rest period between two test sessions as desired by the participant. The rationale of obtaining data from multiple sessions was to average out the possible variation across the sessions. If a participant was not able to complete all three sessions, reports from the completed sessions were included in the analysis. Each of the participants' rates of breathing was recorded over one minute by the researcher during the test task by inspecting chest/shoulder movement with each breath.

**Time Span of Focused Attention (TSFA): The Proposed Measure of Mindfulness:** TSFA was defined as the duration of uninterrupted attention to breath during the BFTT. TSFA (in minutes) of a participant was calculated by dividing breath count with awareness (BCA) by rate of breathing (BR per minute) i.e.  $TSFA = BCA/BR$ . For the participants' meeting criteria for satisfactory completion of two or three breath focus sessions, mean of the BCAs was used in the above calculation. If only a single session met the criteria, BCA from that session alone was used. TSFA had no predefined maximum possible score.

**Pro-forma:** The BFTT-related structured pro-forma included questions in English language about: (1) The breath count with awareness, (2) the level of confidence (on a scale from 1-5) in that the participant reached that breath count (neither an earlier one nor a later one) during a breath focus session, (3) The level of confidence in the

continuity of the awareness of the task before that count, (4) the level of relaxation during the session and (5) the mode of termination of the test i.e. whether the participant forgot to continue counting or did it automatically without awareness or had low confidence in the continuity of awareness of the task or experienced unforeseen major distractions and (6) the breath count the participant reached when he/she terminated the task i.e. 'breath count on termination' (if applicable according to the mode of termination). The pro-forma contained three separate equivalent sections and a section was to be filled after each of the three breath focus sessions. The pro-forma also included information about the age, sex, prior experience with meditation and breathing rate during the task. The pro-forma was filled up by the participants themselves except for the space for breathing rate which was filled up by the researcher.

**Criteria for satisfactory completion of a breath focus session:** A breath focus session meeting all of the following criteria was considered to have been satisfactorily completed for the purpose of calculation of TSFA.

1. Not terminated by unforeseen major distractions
2. Having an acceptable level of relaxation (at least 3/5)
3. Having an acceptable confidence level (at least 3/5) in the BCA
4. Having an acceptable confidence level (at least 3/5) in the continuity of awareness before the reported BCA
5. Not having incompatible reports of termination mode and breath count on termination. For example, if a participant reported that he counted up to 20 breaths with awareness, was for certain counting automatically at the time of termination of the session but reported that the breath count on termination was also 20. Such incompatible reports might occur due to lack of understanding of the task.

**Mindful Attention Awareness Scale (MAAS):** Mindful Attention Awareness Scale (MAAS) is an already validated probably most commonly used self-report measure of mindfulness.[1,12] English version of MAAS questionnaire was used for data collection after pretesting. Maximum possible score for a participant is 6. Reliability of the scale in our study as measured with Cronbach's alpha was found to be good (0.75; 95% CI, 0.67 - 0.82).

**Data Analysis:** Data analysis was carried out with Microsoft Excel and R (version R-4.1.1) using R packages 'readr' (version 2.0.2), 'dplyr' (version 1.0.7), 'magrittr' (version 2.0.1), 'ggplot2' (version 3.3.5) and 'psych' (version 2.1.9). The measures of central tendency were expressed as mean  $\pm$  SD or median (first quartile - third quartile). Spearman correlation was used to assess the relationship between TSFA and MAAS.

## RESULTS:

A total of 101 participants (53 females) participated in the present study. The age of the participants ranged from 19-28 years ( $21.5 \pm 1.7$  years). Regarding their prior experience of meditation, the majority (65.3%) of the participants had not practiced it regularly though they had some experience of meditation while 23.8% had no prior experience of meditation (Table 1). In total, 76 (75.2%) of all participants (N = 101) had at least one breath focus session meeting criteria for satisfactory completion (Table 1).

Thirteen participants did not perform the third session of the BFTT due to time constraints. Out of the 290 sessions performed by all participants in total, unforeseen distraction or discomfort was reported as the mode of termination of the task in 101 (34.8%) breath focus sessions (Table 2).

Table 3 summarizes breath focus test task-related findings. The average breath count with awareness (BCA) of the study participants was 42.5 (27.3 -67.2). Intersession breath count difference was defined as the difference between the maximum and the minimum BCAs of a participant who had two or

three satisfactorily completed sessions. Corrected intersession difference was computed by dividing intersession breath count difference by his/her mean BCA. The average intersession breath count difference was 20 (13 – 35) and average corrected intersession difference was 0.46 (0.28 - 0.73).

Table 1: Baseline characteristics of the participants (N=101)

Variable	n (%)
<b>Prior meditation experience</b>	
Every day	4 (4.0)
Three or more days per week	3 (3.0)
Less than three days per week	4 (4.0)
Not regular but has some experience	66 (65.3)
Never practiced	24 (23.8)
<b>Participants meeting criteria for satisfactory completion of the following number of breath focus sessions:</b>	
Nil	25 (24.8)
One	31 (30.7)
Two	25 (24.8)
Three	20 (19.8)

Visual inspection of the histogram revealed that the time span of the focused attention (TSFA) did not follow the normal distribution (Fig 1).

Table 2: Frequency distribution of breath focus sessions with certain features (N = 290)

Breath focus session features	n (%)*
Meeting the criteria for satisfactory completion	141 (48.6)
Terminated due to unforeseen distraction or discomfort	101 (34.8)
Without reports of reason for termination	4 (1.4)
With relaxation level less than 3/5 or not reported	13 (4.5)
With confidence in BCA** less than 3/5 or not reported	5 (1.7)
With confidence 'in continuity of awareness of breath focus task before reaching the reported BCA' less than 3/5 or not reported	8 (2.8)
With incompatibility among the reports of BCA, mode of termination and breath count on termination	38 (13.1)
<b>Total</b>	<b>290 (100)</b>

\* The sum of the percentage values is greater than 100 as some of the breath focus sessions had multiple features in common. \*\*BCA: Breath count with awareness

The average TSFA (N = 76) was 3 (1.9 - 4.5) minutes. Mean breath count on termination and mean time on termination for a participant were also calculated from the available data and the sample averages were also determined (Table 3).

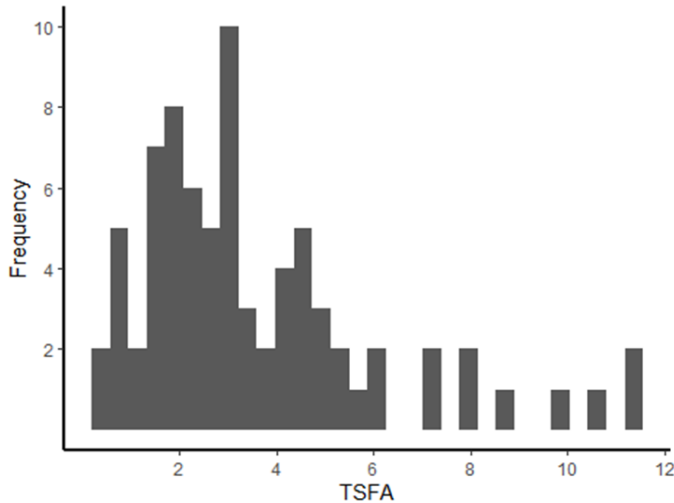


Fig. 1: Histogram showing the frequency distribution of TSFA (Time Span of Focused Attention in minutes)

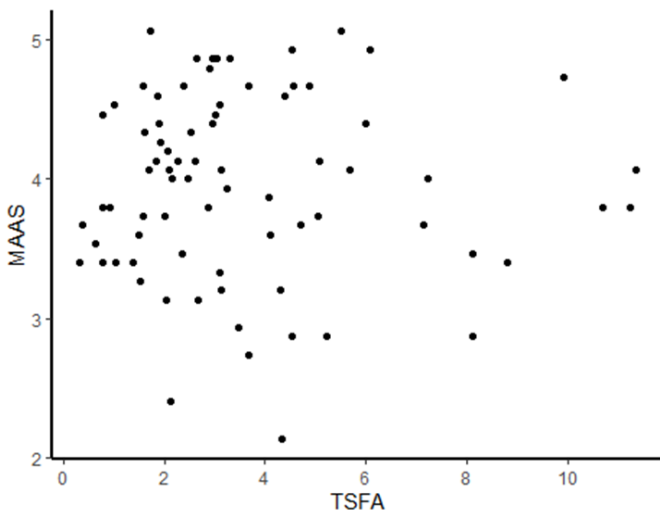


Fig.2 Scatterplot showing relationship between TSFA (Time Span of Focused Attention in minutes) and MAAS (Mindful Attention Awareness Score) ( $r_s = 0.04$ ; 95% CI, -0.19 to +0.26;  $p = 0.74$ )

The average MAAS score was  $3.9 \pm 0.6$ , (N = 101). There was negligible correlation between TSFA and MAAS ( $r_s = 0.04$ ; 95% CI, -0.19 to +0.26;  $p = 0.74$ ). Fig. 2 is the scatter plot showing the relationship between TSFA and MAAS score.

Table3: Major findings (N = 76 unless specified otherwise)

Variable	Observation
Rate of breathing (breath cycles per minute)	$14.6 \pm 3.6$
Breath count with awareness	42.5 (27.3 - 67.2)
Intersession breath count difference	20 (13 - 35)
Corrected intersession breath count difference	0.46 (0.28 - 0.73)
Time span of focused attention (minutes)	3.0 (1.9 - 4.5)
Breath count on termination* (N = 57)	51 (33 - 80)
Time on termination (N = 57)	3.9 (2.3 - 6.4)
MAAS**	$3.9 \pm 0.6$
Correlation between TSFA*** and MAAS	$r_s = 0.04$ ; 95% CI = [-0.19 to +0.26]; $p = 0.74$

\*Not applicable for the sessions in which a participant reported that he/she had forgotten to continue counting. \*\*Mindful Attention Awareness Score, \*\*\*Time Span of Focused Attention

## DISCUSSION:

The present study aimed to perform a preliminary evaluation of the Breath Focus Test Task (BFTT) as a task-based technique to measure mindfulness. We determined the time span of focused attention (TSFA) during BFTT and assessed its correlation with a self-reporting questionnaire-based measure of mindfulness namely the Mindful Attention Awareness Scale (MAAS).

MAAS score of the participants in the present study was  $3.9 \pm 0.6$ . Normative data based on previous 14 independent samples showed MAAS score of  $3.83 \pm 0.7$  in college students.[13]

In the present study, TSFA of the participants (N = 76) was three minutes (1.9 - 4.5 minutes). Ziegler DA et al., though using somewhat different paradigm, found that their participants had sustained attention to breath for about 20 seconds on the first day and for six minutes on average after 25 day-meditation-training.[9] Differences in test paradigms and the levels of experience of the participants may account for the observed results.

The preliminary evaluation showed that almost three fourth of the participants met the criteria for completion of at least one breath focus session. Unforeseen distraction or discomfort was the major reason for not meeting the criteria. This might be overcome by adopting more rigorous attempts to minimize noise (e.g. with sound-proof laboratory setting, testing individually instead of testing in a group at a time). The core test-related factors namely incompatible answers to different questions, low confidence in the breath count or low confidence in the continuity of awareness before the count, low level of relaxation during the task were relatively uncommon. This indicates the feasibility of the technique. Adopting more practice sessions or test sessions for each participant might further reduce the rate of incompatible answers or low confidence.

Contrary to our expectation, our results showed negligible correlation between TSFA and MAAS

( $r_s = 0.04$ ; 95% CI, -0.19 to +0.26;  $p = 0.74$ ) which was not statistically significant. However, expected results would show a monotonic positive non-linear relationship between TSFA and MAAS. Other behavioral measures of mindfulness have shown weak to moderate positive correlation with questionnaire-based trait mindfulness.[14,15,16] For example, mindfulness score as measured with Breath Counting Task was found to correlate with MAAS ( $r = 0.20$ ,  $p = 0.05$ ).[15]

There might be various explanations, mainly the limitations of the study setting, for not observing the significant correlation between MAAS and TSFA in our study.

A possible limitation of the study method was that the reports of TSFA from our participants might not have been very reliable as many of them were not familiar with meditation. The basic understanding of the course of events during a BFTT as described below is helpful in this regard. The format of a BFTT session considerably matches with the real-life mindfulness practice (breath focus meditation) and is in line with the theoretical construct of mindfulness. In a typical breath focus meditation; there is an alternating sequence of attentional focus on breath followed by automatic attentional lapse or mind wandering, detection of mind wandering and willful refocusing on breath. The cycle repeats itself over and over throughout the typical meditation.[17] A BFTT session differs only in that, to offer the report from a single cycle, the participant terminates the BFTT session at the end of the first cycle i.e. on detection of mind wandering instead of going to the next cycle. As many of the research participants (23.8%) were not familiar with meditation, they could not have understood the phenomenon of mindfulness or mind wandering properly and hence not reported breath count reliably. If this was the case, the proposed measure would not be suitable to measure mindfulness of the individuals who have no basic understanding or experience of mindfulness meditation. However, after having the basic understanding, its utility in self-monitoring of the

improvement in mindfulness is a potential advantage.

Further, there was considerable within-subject variation of TSFA across different sessions. If all subjects had performed three valid sessions of BFTT, their average TSFA might have reflected their mindfulness better. Besides this, social desirability bias might have obscured the real scores. Testing in groups (though small) and ambient noise (though minimal) might have influenced the results. Other factors like background mental or emotional state at the time of the test task might also have affected the results. The level of understanding of BFTT and MAAS by the participants of various levels of mindfulness might also have influenced their reports.[11]

A major limitation intrinsic to TSFA during BFTT as a measure of mindfulness is that as it relies on self-report of the person to measure mindfulness, the score is not available to any objective instrument. However, the task-based nature of the proposed test reduces subjectivity on the part of the subject. Also, as BFTT is substantially similar to a

common form of mindfulness meditation, the measurement process is less likely to interfere with the parameter being measured.

## CONCLUSION:

This preliminary study suggests the feasibility of the breath focus test task which we have proposed as an easy task-based potential measure of mindfulness that can be self-administered in a daily life setting. However, the measure obtained from the present technique did not correlate with a commonly used self-reporting questionnaire-based mindfulness scale. Further study is required to explore the various aspects of validity and reliability of the breath focus test task. Major shortcomings of this study protocol and potential solutions have been identified and may guide future studies.

**Conflict of interest:** The authors declare that the principal author was not involved in the editorial workflow of the article.

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