

Changes in cognitive performance during open-sea 200MSW saturation diving

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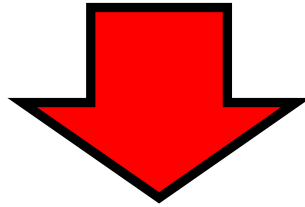
Key words : Deep saturation diving, Stroop interference, Selective attention

1. Background

- ◆ Cognitive impairment within an artificial hyperbaric environment was *influenced by the elevation of environmental pressure rather than psychological stress* (Kageyama et al., 2010).
- ◆ The accumulation of sleep debt, *fatigue, and loss of psychological vigor occurred during an open-sea saturation diving* (Townsend and Hall, 1974)

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- ◆ Cognitive impairment within an artificial hyperbaric environment was influenced by the elevation of environmental pressure rather than psychological stress (Kageyama et al., 2010).
- ◆ The accumulation of sleep debt, fatigue, and loss of psychological vigor occurred during an open-sea saturation diving (Townsend and Hall, 1974).



The goal of this study

To investigate whether psychological stress causes cognitive impairment during open-sea saturation diving or not.

2. Methods: Procedures

Participants Subjects were six male professional divers (age: 34.00 ± 2.45).

Cognitive test **Stroop and Reverse-Stroop Color-Word interference test** (Hakoda and Watanabe, 2005)

Psychological states Japanese version of POMS (Profile of mood states; Yokoyama, 1994), and GVA (Global and Vigor; Monk, 1989).

Procedure The three tests were carried out at eight points throughout a open-sea 200MSW(21ATA) saturation dive: Pre-diving(P1), 0-150m compression(P2), 200m-1(P3), 200m-2(P4), 200m-3(P5), 200m-150m decompression(P6), 100m-0m(P7), and Post-diving(P8). These test were conducted at Deck Decompression Chamber.

2. Methods: Materials

Stroop interference is a robust measure of selective attention in cognitive psychology (MacLeod, 1992).

① Control task(task1)

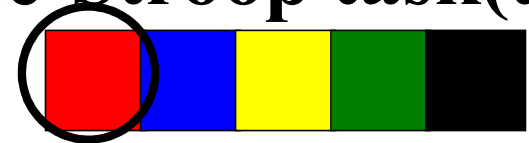
Red



To select a color from five color patches

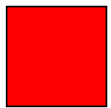
② Reverse-Stroop task(task2)

Red



To select a color which is expressed by the word from five color patches

③ Control task(task3)



Red Blue Yellow Green Black

To select a color word from five color words

④ Stroop task (task4)

Red

Red Blue Yellow Green Black

To select a color word with which the word is printed from five color words

⇒ Each task has a 10-second practice session following by a 60-second main session.

Stroop Interference Effect

Stroop interference: $(③ - ④) / ③$, Reverse-Stroop interference: $(① - ②) / ①$

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2. Methods: Measuring points

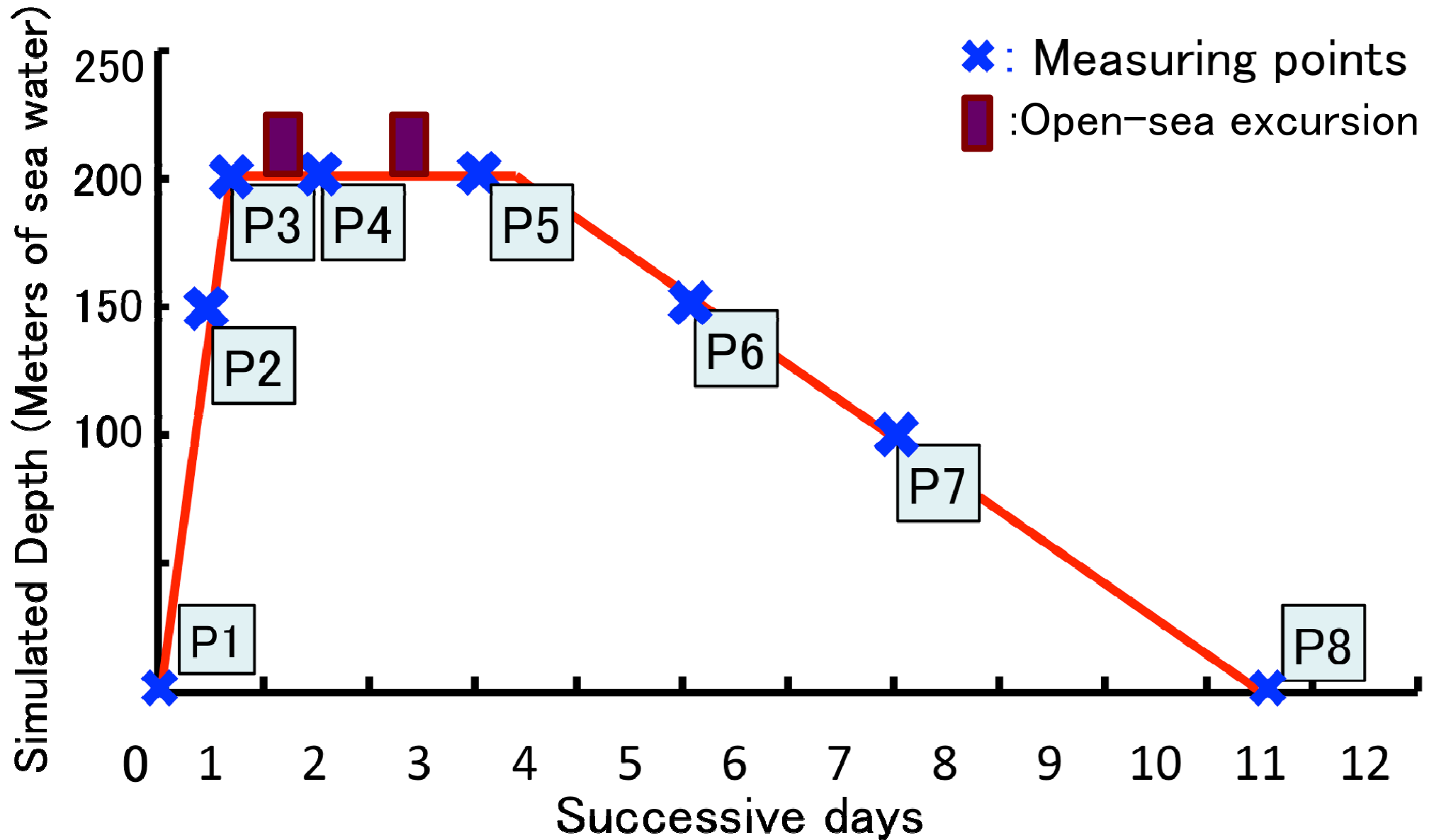


Figure 1. The dive profile and timing of measurement.

3. Results: Cognitive performance

Cognitive tasks

- ◆ The amount of interference **did not change** during eight test session.
- ◆ Correct responses of both the Stroop and reverse-Stroop tasks **at 200MSW** were significantly lesser than those at other assessment points were.

3. Results: Cognitive performance

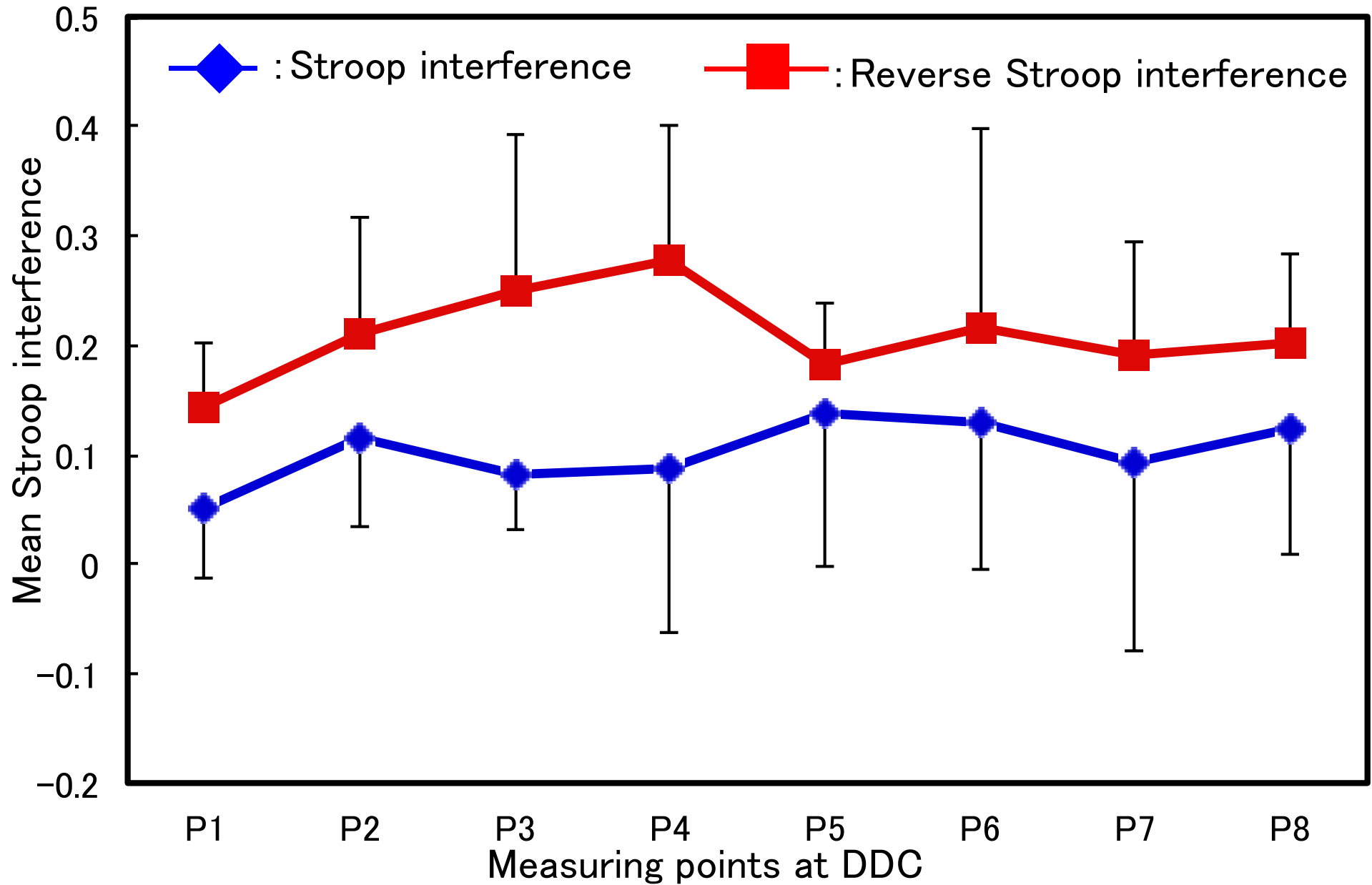


Figure 2. Comparison between the amount of Stroop interference interference during the 200MSW saturation dive(N=6). Error bar: SD. * : $p < .05$.

3. Results: Cognitive performance

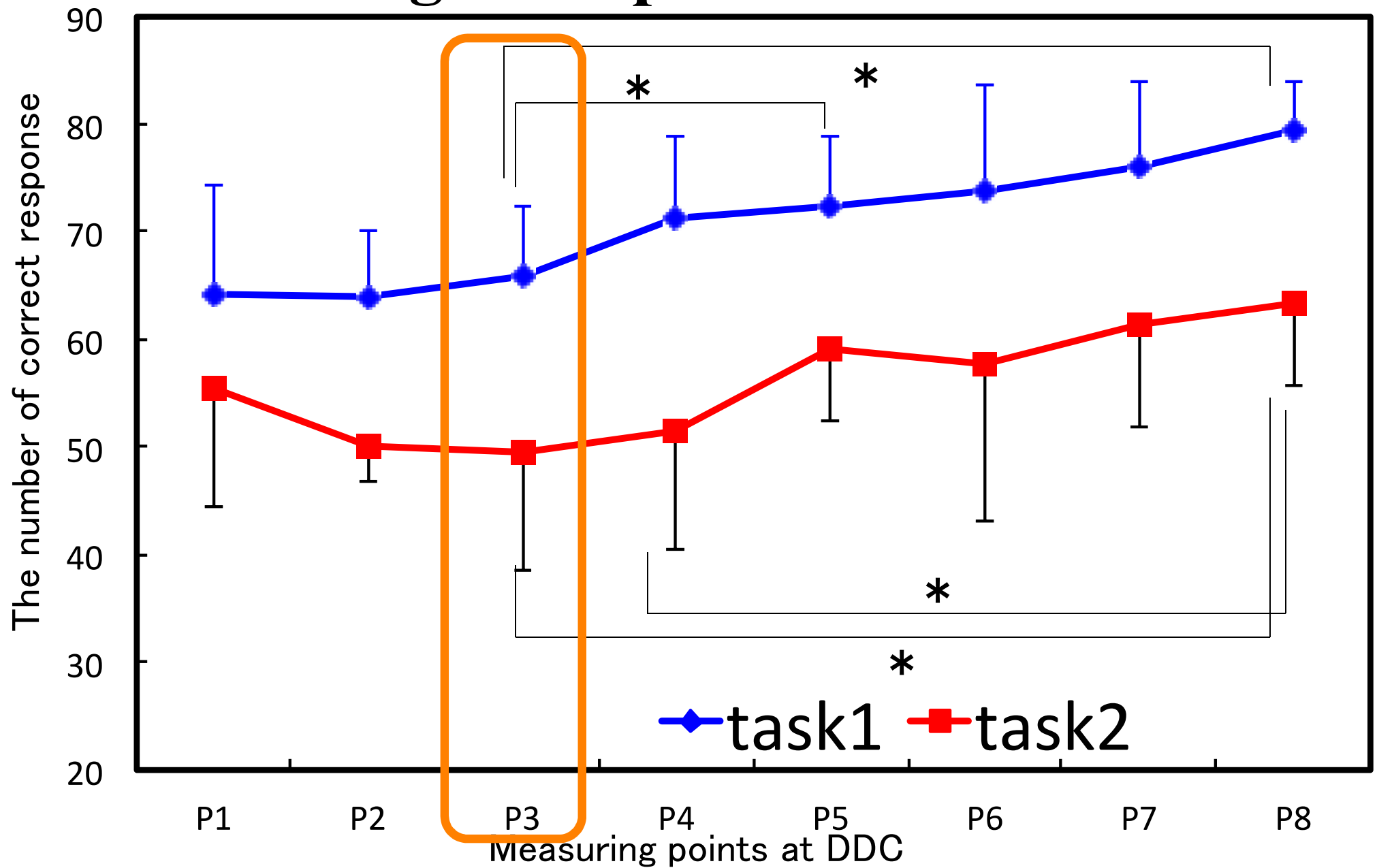


Figure 3. Comparison between the number of correct response of task 1 and task 2 during the 200MSW saturation diving (N=6). Error bar: SD.*: $p < .05$

3. Results: Psychological states

Cognitive task

- ◆ The amount of interference **did not change** during eight test session.
- ◆ Correct responses of both the Stroop and reverse-Stroop tasks at **200MSW** were significantly lesser than those at other assessment points were.

Psychological states

- ◆ **Psychological stress was not detected throughout the dive.**

3. Results: Psychological states

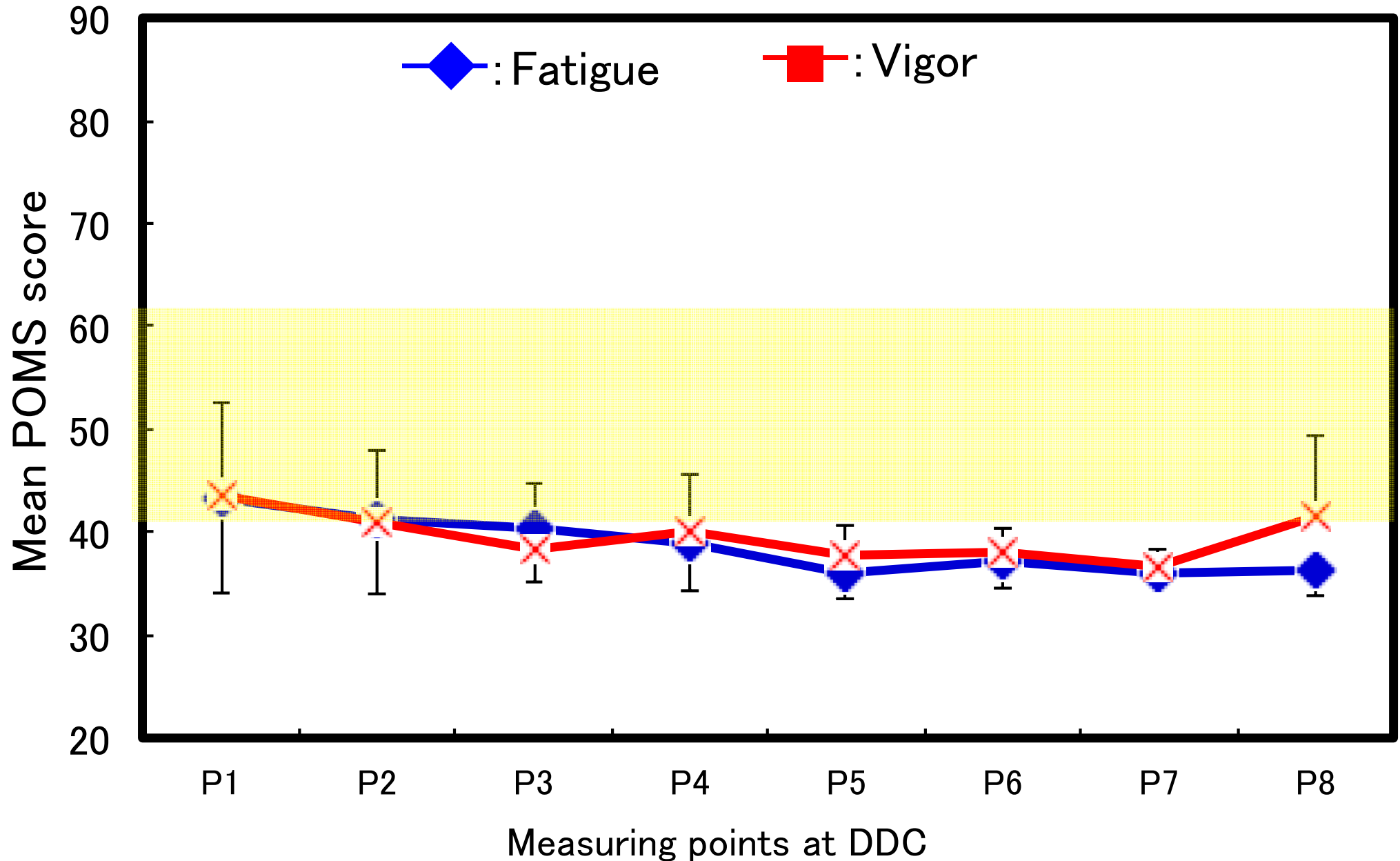


Figure 6. Comparison between mean POMS scores during the 200MSW saturation dive(N=6). Error bar: SD, : The range of normal fluctuation.

4. Conclusions

This study

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Psychological states Psychological stress was not detected throughout the dive.

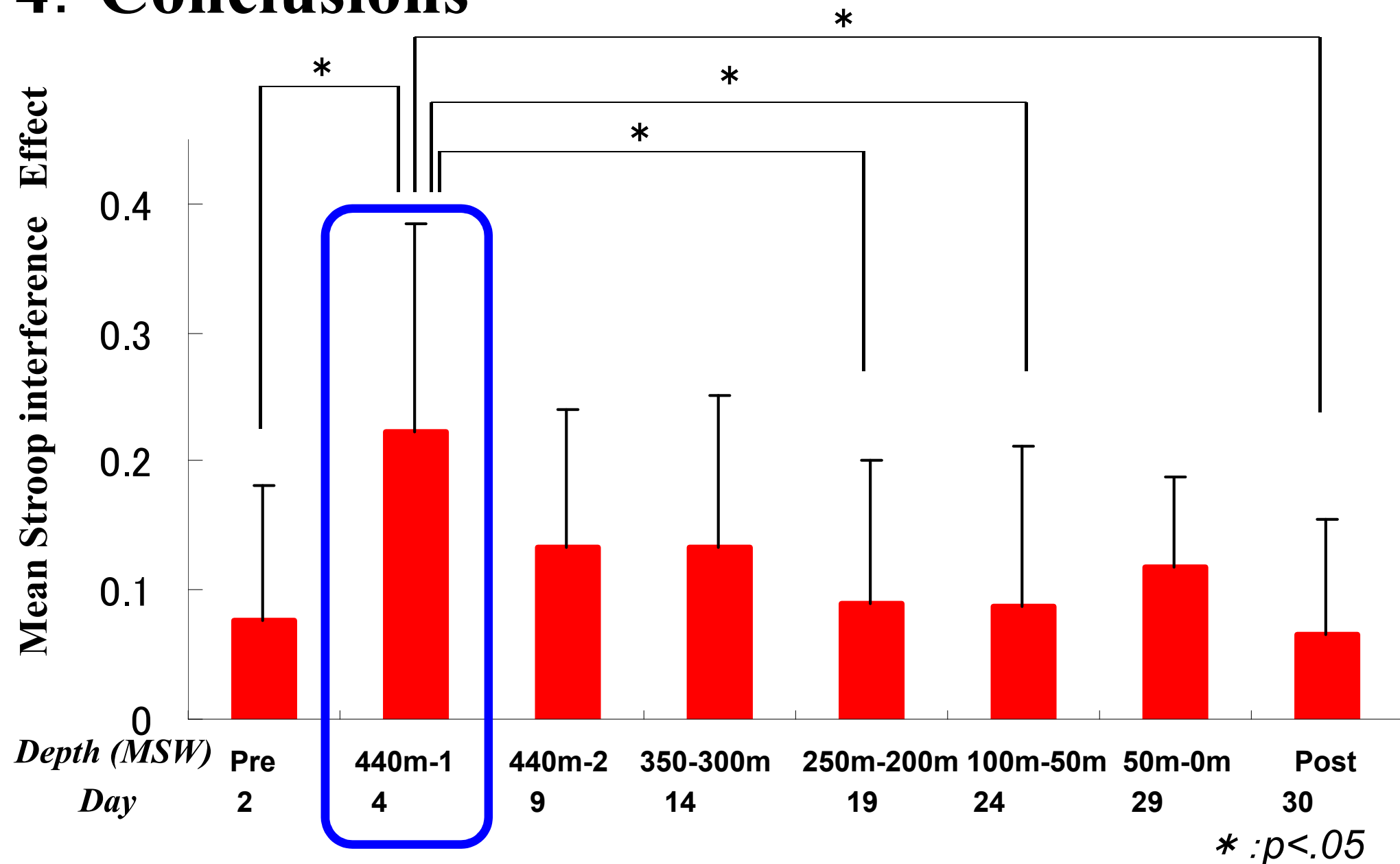
Previous study

Cognitive tasks The amount of interference **was the highest at 440MSW.**

Correct responses of both the Stroop and reverse-Stroop tasks **at 440MSW** were significantly lesser than those at other assessment points were (Appendix 1).

Psychological states Psychological stress was not detected throughout the dive.

4. Conclusions



Appendix 1. Changes in the amount of Stroop interference effect during the 440MSW saturation dive (Kageyama et al., 2010).

4. Conclusions

This study

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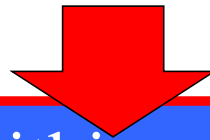
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Correct responses of both the Stroop and reverse-Stroop tasks **at 440MSW** were significantly lesser than those at other assessment points were (Appendix 1).

Psychological states Psychological stress was not detected throughout the dive.



Cognitive impairment within a hyperbaric chamber is influenced by the magnitude of environmental pressure rather than psychological stress, even in offshore diving was conducted on the open sea.