

S2-I. Fatigue Assessment Scale (FAS) Results

FAS, a questionnaire used to assess subjective fatigue over an extended period, comprises ten questions graded progressively from 1 to 5, indicating disagreement to agreement. Total scores range from 10 to 50, with higher scores indicating greater fatigue severity. De Vries *et al.* introduced the FAS scale [1], categorizing fatigue degrees as follows: scores below 22 indicate a healthy or normal fatigue degree; scores between 22~34 indicate mild to moderate fatigue; and scores over 35 indicate severe fatigue. In the experiment, the ten subjects completed the FAS questionnaires before and after participating. Their scores were observed to evaluate subjective fatigue levels. A comparison of the FAS questionnaires revealed that four of ten subjects were deemed healthy before the experiment, while five exhibited mild fatigue states. Subject 9 had already experienced severe fatigue before the experiment. Post-experiment questionnaire results indicated that eight subjects experienced a shift to severe fatigue, while the remaining two approached moderate and severe fatigue levels. The average pre-experiment score was 23.4, increasing to 37.5 post-experiment—an average rise of 14.1 points. This significant increase suggests that the experiment notably induced subjective fatigue among the participants. This finding will be compared with subsequent objective fatigue assessments to verify its accuracy.

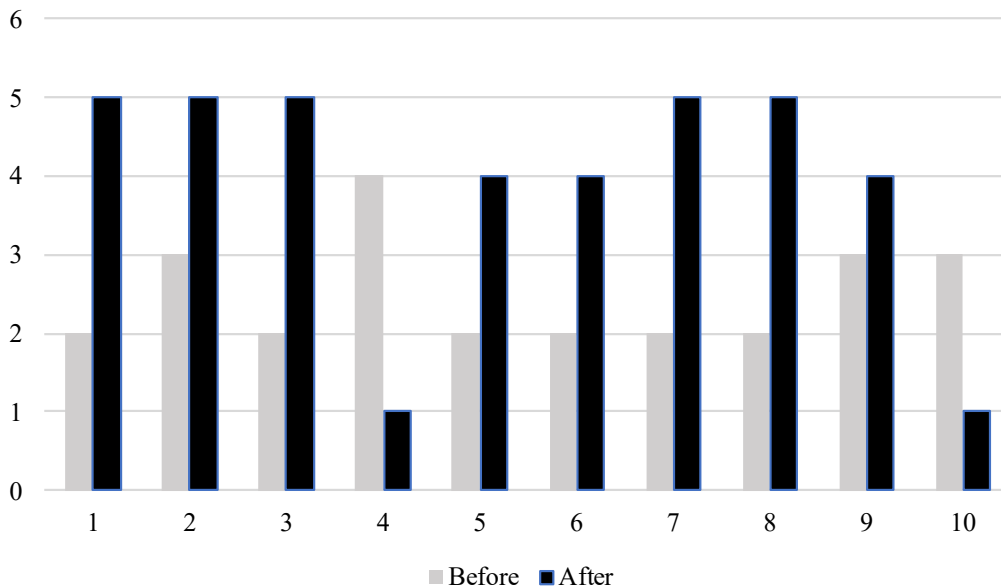


Figure 1 FAS questionnaire results for subject No. 1

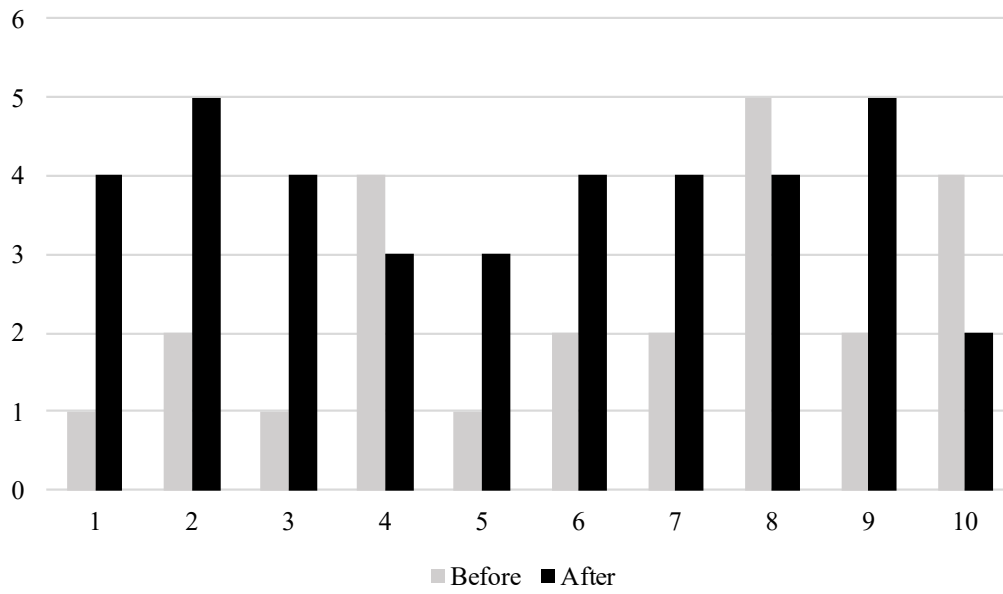


Figure 2 FAS questionnaire results for subject No. 2

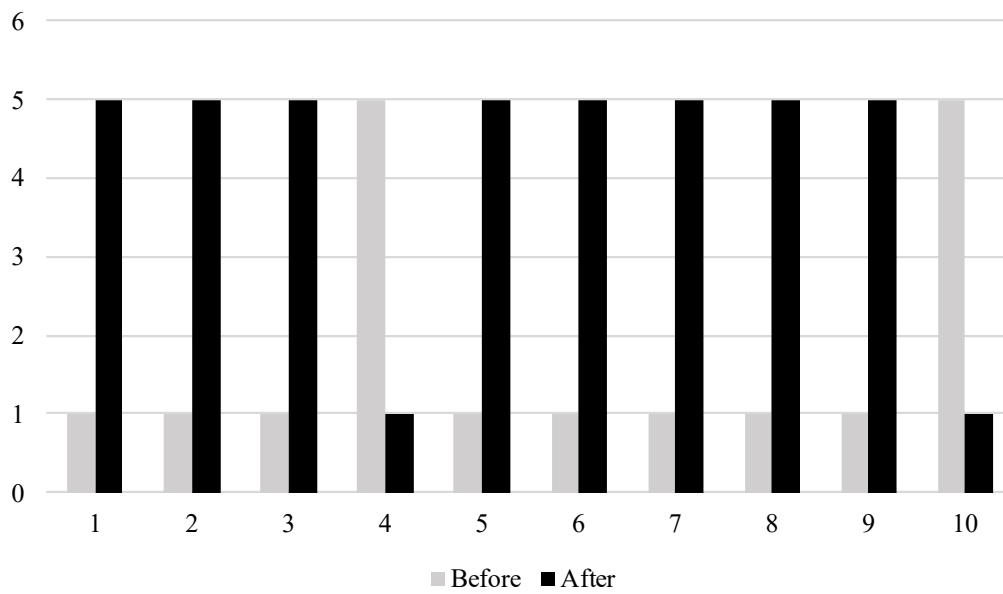


Figure 3 FAS questionnaire results for subject No. 3

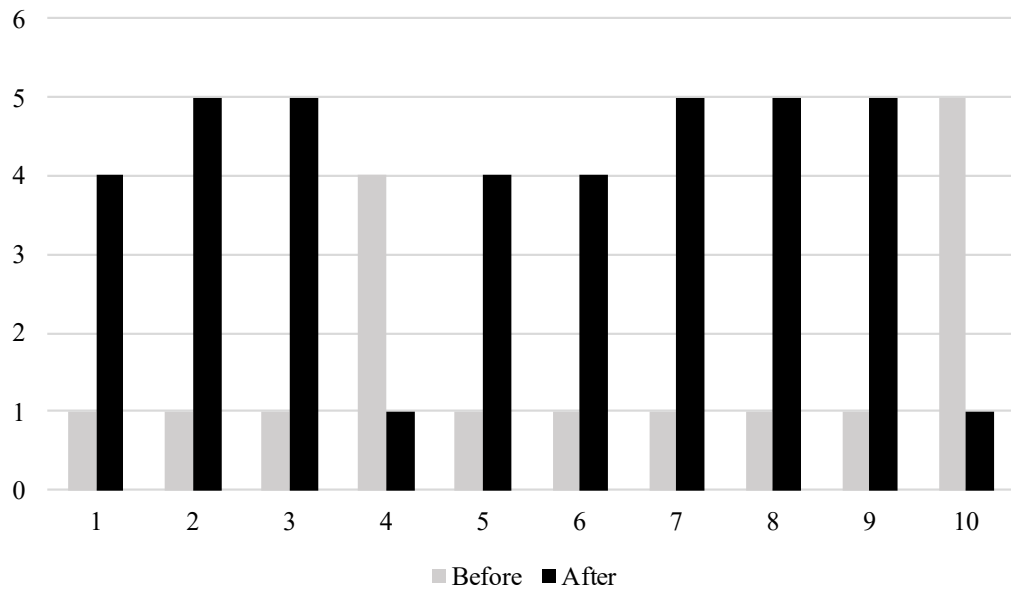


Figure 4 FAS questionnaire results for subject No. 4

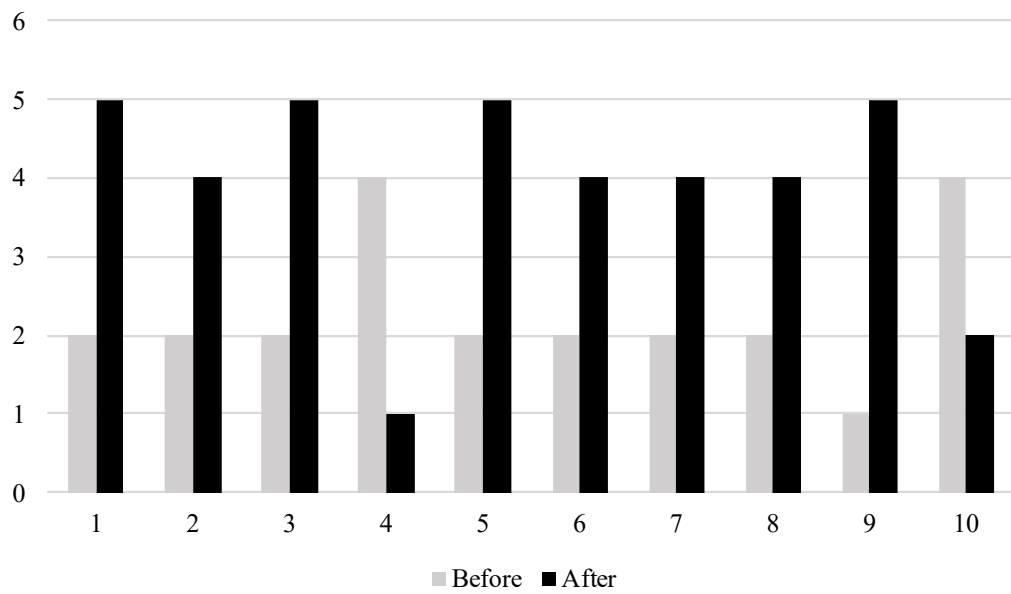


Figure 5 FAS questionnaire results for subject No. 5

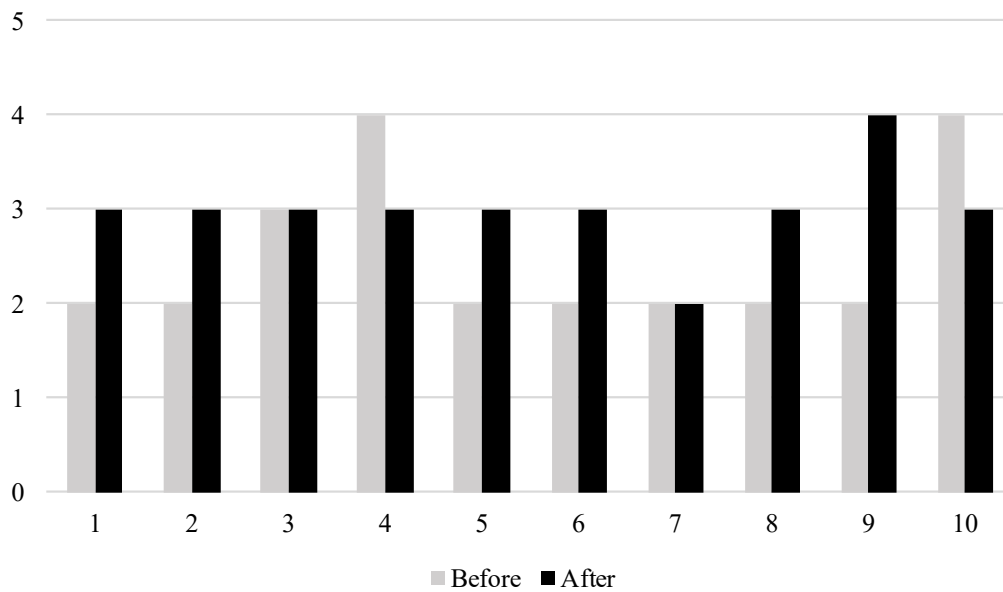


Figure 6 FAS questionnaire results for subject No. 6

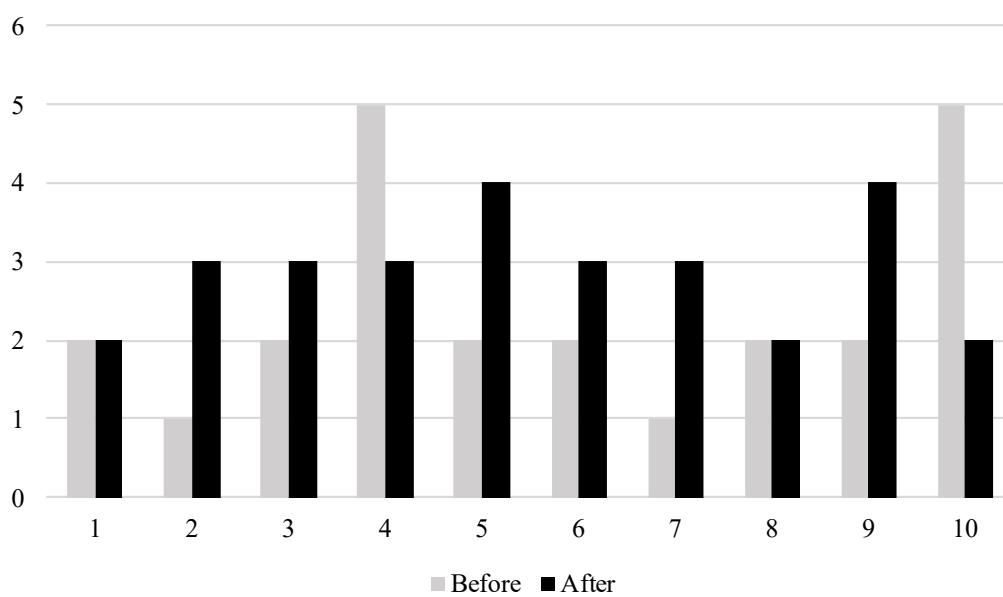


Figure 7 FAS questionnaire results for subject No. 7

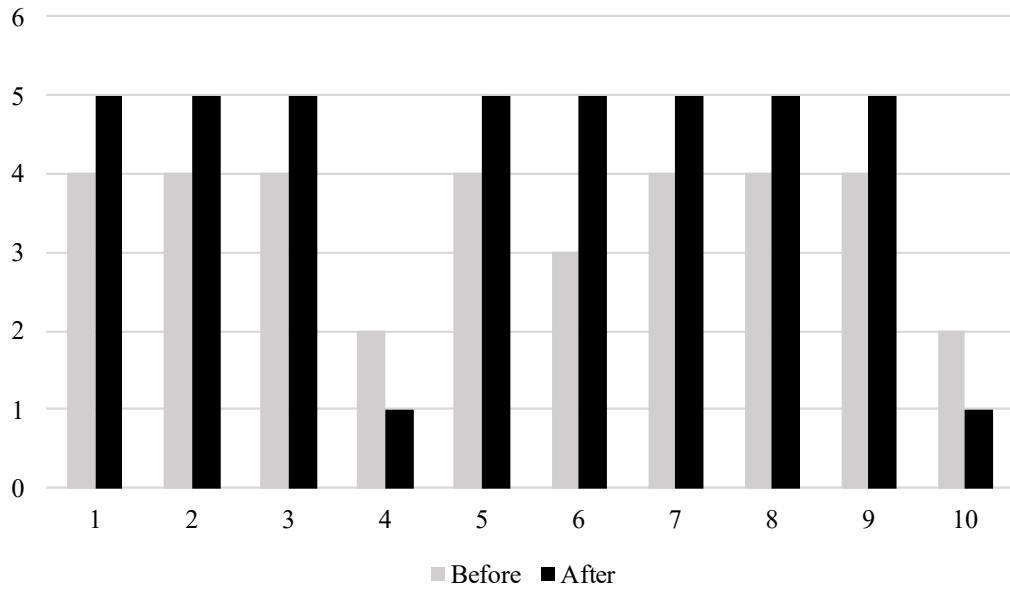


Figure 8 FAS questionnaire results for subject No. 8

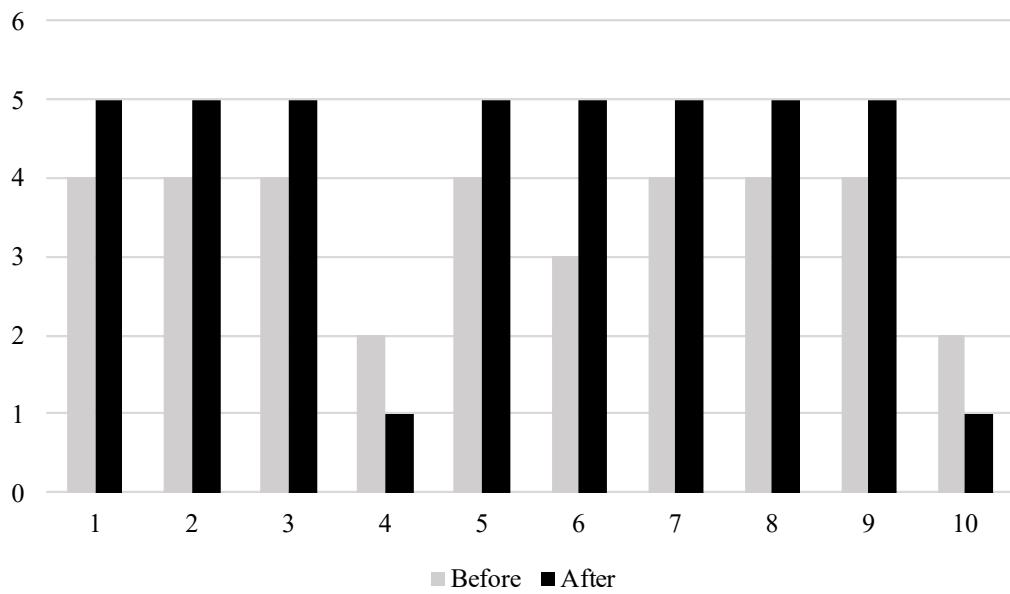


Figure 9 FAS questionnaire results for subject No. 9

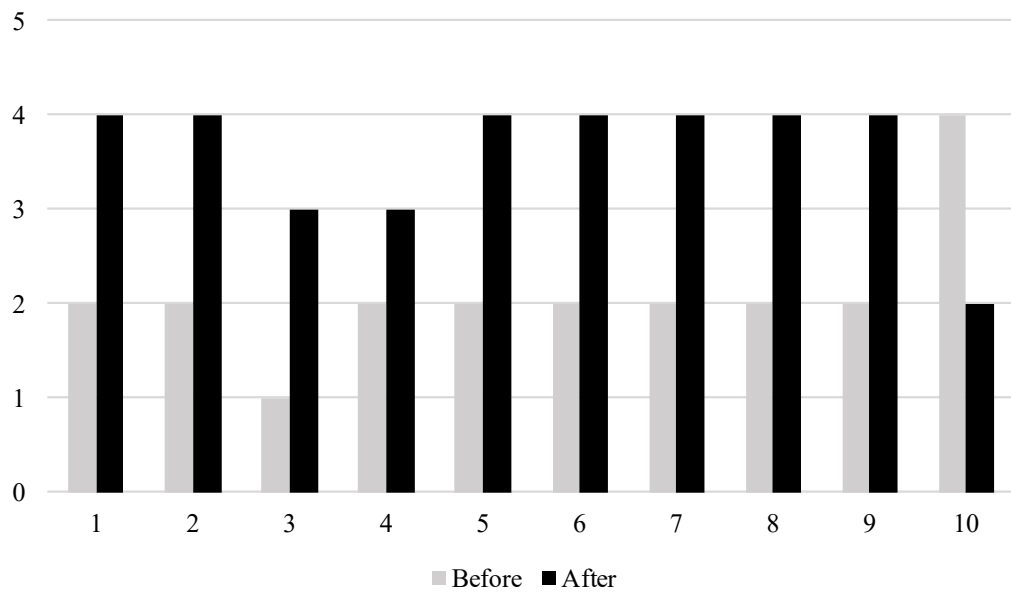


Figure 10 FAS questionnaire results for subject No. 10

S2-II. wPLI-based connectivity analysis

Figure 5 in the manuscript is based on the top 10 individual wPLI connectivity strengths. In the results, wPLI values lower than an individual's strength median indicate low synchronization in the corresponding brain regions. Therefore, our analysis focuses on the top five individual wPLI connections—those with values above the median for each participant. See Table S1 for the non-fatigue state and Table S2 for the fatigue state.

Table S1 Individual's top five wPLI connectivity for non-fatigue state

		Category	Brain Region Category
S1	F4-FT8	right-right	Right Frontal Lobe - Right Temporal Lobe
	FP1-P3	left-left	Left Frontal Lobe - Left Parietal Lobe
	F4-CPz	cross	Right Frontal Lobe - Central Posterior Parietal Lobe
	P3-Pz	cross	Left Parietal Lobe - Central Parietal Lobe
	FP1-F4	cross	Left Frontal Lobe - Right Frontal Lobe
S2	CP4-P4	right-right	Right Posterior Parietal Lobe - Right Parietal Lobe
	C4-P4	right-right	Right Parietal Lobe - Right Parietal Lobe
	FP1-Oz	cross	Left Frontal Lobe - Central Occipital Lobe
	AF3-T8	cross	Left Frontal Lobe - Right Temporal Lobe
	FP1-P7	left-left	Left Frontal Lobe - Left Parietal Lobe
S3	C4-CP4	right-right	Right Parietal Lobe - Right Posterior Parietal Lobe
	C3-C4	cross	Left Parietal Lobe - Right Parietal Lobe
	T8-TP8	right-right	Right Temporal Lobe - Right Posterior Parietal Lobe
	C4-Pz	cross	Right Parietal Lobe - Central Parietal Lobe
	TP7-P3	left-left	Left Posterior Parietal Lobe - Left Parietal Lobe
S4	FT7-C3	left-left	Left Temporal Lobe - Left Parietal Lobe
	F8-FT7	cross	Right Frontal Lobe - Left Temporal Lobe
	FT7-FT8	cross	Left Temporal Lobe - Right Temporal Lobe
	CP4-P4	right-right	Right Posterior Parietal Lobe - Right Parietal Lobe
	FC4-CP4	right-right	Right Posterior Parietal Lobe - Right Posterior Parietal Lobe
S5	FP1-F3	left-left	Left Frontal Lobe - Left Frontal Lobe
	FP1-Fz	cross	Left Frontal Lobe - Central Frontal Lobe
	FP2-F8	right-right	Right Frontal Lobe - Right Frontal Lobe
	FP1-FP2	cross	Left Frontal Lobe - Right Frontal Lobe
	FC4-Pz	cross	Right Posterior Parietal Lobe - Central Parietal Lobe
S6	FP1-FP2	cross	Left Frontal Lobe - Right Frontal Lobe

	FP2-Oz	cross	Right Frontal Lobe - Central Occipital Lobe
	FP1-O1	left-left	Left Frontal Lobe - Left Occipital Lobe
	AF4-O1	cross	Right Frontal Lobe - Left Occipital Lobe
	FP2-O1	cross	Right Frontal Lobe - Left Occipital Lobe
S7	F7-FC3	left-left	Left Frontal Lobe - Left Posterior Parietal Lobe
	F7-F3	left-left	Left Frontal Lobe - Left Frontal Lobe
	FT7-FC3	left-left	Left Temporal Lobe - Left Posterior Parietal Lobe
	Fz-FC3	cross	Central Frontal Lobe - Left Posterior Parietal Lobe
	FC3-FC4	cross	Left Posterior Parietal Lobe - Right Posterior Parietal Lobe
S8	FP2-Oz	cross	Right Frontal Lobe - Central Occipital Lobe
	FCz-C4	cross	Central Frontal Parietal Lobe - Right Parietal Lobe
	AF4-Oz	cross	Right Frontal Lobe - Central Occipital Lobe
	AF4-FCz	cross	Right Frontal Lobe - Central Frontal Parietal Lobe
	FP2-P7	cross	Right Frontal Lobe - Left Parietal Lobe
S9	FT7-Cz	cross	Left Temporal Lobe - Central Parietal Lobe
	F8-FT8	right-right	Right Frontal Lobe - Right Temporal Lobe
	F4-FT7	cross	Right Frontal Lobe - Left Temporal Lobe
	FT7-CPz	cross	Left Temporal Lobe - Central Posterior Parietal Lobe
	FP2-FT7	cross	Right Frontal Lobe - Left Temporal Lobe
S10	C3-T8	cross	Left Parietal Lobe - Right Temporal Lobe
	F3-T8	cross	Left Frontal Lobe - Right Temporal Lobe
	FP2-O1	cross	Right Frontal Lobe - Left Occipital Lobe
	AF4-P7	cross	Right Frontal Lobe - Left Parietal Lobe
	FP2-P7	cross	Right Frontal Lobe - Left Parietal Lobe

Table S2 Individual's top five wPLI connectivity for fatigue state

	Category	Brain Region Category
S1	F4-F8	right-right Right Frontal Lobe - Right Frontal Lobe
	F4-FT8	right-right Right Frontal Lobe - Right Temporal Lobe
	FP1-F4	cross Left Frontal Lobe - Right Frontal Lobe
	F4-C4	right-right Right Frontal Lobe - Right Parietal Lobe
	C3-Oz	cross Left Parietal Lobe - Central Occipital Lobe
S2	O1-Oz	cross Left Occipital Lobe - Central Occipital Lobe
	FP2-Cz	cross Right Frontal Lobe - Central Parietal Lobe
	C4-P4	right-right Right Parietal Lobe - Right Parietal Lobe
	FP1-C4	cross Left Frontal Lobe - Right Parietal Lobe

	FP2-C4	right-right	Right Frontal Lobe - Right Parietal Lobe
	F4-TP8	right-right	Right Frontal Lobe - Right Posterior Parietal Lobe
	F4-T8	right-right	Right Frontal Lobe - Right Temporal Lobe
S3	FC4-T8	right-right	Right Posterior Parietal Lobe - Right Temporal Lobe
	FC4-TP8	right-right	Right Posterior Parietal Lobe - Right Posterior Parietal Lobe
	FP1-AF3	left-left	Left Frontal Lobe - Left Frontal Lobe
	AF4-F4	right-right	Right Frontal Lobe - Right Frontal Lobe
	F7-FT8	cross	Left Frontal Lobe - Right Temporal Lobe
S4	F7-T8	cross	Left Frontal Lobe - Right Temporal Lobe
	AF3-F7	left-left	Left Frontal Lobe - Left Frontal Lobe
	F8-T8	right-right	Right Frontal Lobe - Right Temporal Lobe
	FP1-F3	left-left	Left Frontal Lobe - Left Frontal Lobe
	FP1-Fz	cross	Left Frontal Lobe - Central Frontal Lobe
S5	FP2-F8	right-right	Right Frontal Lobe - Right Frontal Lobe
	FP1-FP2	cross	Left Frontal Lobe - Right Frontal Lobe
	FP1-FCz	cross	Left Frontal Lobe - Central Central Frontal Parietal Lobe
	F7-FT7	left-left	Left Frontal Lobe - Left Temporal Lobe
	AF4-TP8	right-right	Right Frontal Lobe - Right Posterior Parietal Lobe
S6	T8-TP8	right-right	Right Temporal Lobe - Right Posterior Parietal Lobe
	FP1-FP2	cross	Left Frontal Lobe - Right Frontal Lobe
	F7-O2	cross	Left Frontal Lobe - Right Occipital Lobe
	AF4-F3	cross	Right Frontal Lobe - Left Frontal Lobe
	AF3-F3	left-left	Left Frontal Lobe - Left Frontal Lobe
S7	FP2-F3	cross	Right Frontal Lobe - Left Frontal Lobe
	FP1-F3	left-left	Left Frontal Lobe - Left Frontal Lobe
	AF4-Pz	cross	Right Frontal Lobe - Central Parietal Lobe
	O1-O2	cross	Left Occipital Lobe - Right Occipital Lobe
	O1-Oz	cross	Left Occipital Lobe - Central Occipital Lobe
S8	P4-O1	cross	Right Parietal Lobe - Left Occipital Lobe
	FP1-AF3	left-left	Left Frontal Lobe - Left Frontal Lobe
	FP1-FP2	cross	Left Frontal Lobe - Right Frontal Lobe
	FT7-T8	cross	Left Temporal Lobe - Right Temporal Lobe
	AF3-FT7	left-left	Left Frontal Lobe - Left Temporal Lobe
S9	FP1-FT7	left-left	Left Frontal Lobe - Left Temporal Lobe
	FT7-T7	left-left	Left Temporal Lobe - Left Temporal Lobe
	FP1-T8	cross	Left Frontal Lobe - Right Temporal Lobe

	AF3-O1	left-left	Left Frontal Lobe - Left Occipital Lobe
	FP1-O1	left-left	Left Frontal Lobe - Left Occipital Lobe
S10	AF3-Oz	cross	Left Frontal Lobe - Central Occipital Lobe
	FT8-T7	cross	Right Temporal Lobe - Left Temporal Lobe
	FT7-FT8	cross	Left Temporal Lobe - Right Temporal Lobe

References

- [1] J. De Vries, H. Michielsen, G. L. Van Heck, M. Drent, Measuring fatigue in sarcoidosis: the Fatigue Assessment Scale (FAS). *British journal of health psychology*, 9(3) (2004), 279-291. <https://doi.org/10.1348/1359107041557048>.