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Task-fMRI Group and Functional Connectivity Analysis of the Brain During Faradarmani Consciousness Field Connection

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Abstract

Task fMRI has played a critical role in recognizing the specific functions of the different regions of human brain during various cognitive activities. This study aimed to investigate group analysis and functional connectivity in the Faradarmangars brain during the Faradarmani CF (FCF) connection. Using task functional MRI (task-fMRI), we attempted the identification of different activated and deactivated brain regions during the Consciousness Filed connection. Clusters that showed significant differences in peak intensity between task and rest group were selected as seeds for seed-voxel analysis. Connectivity of group differences in functional connectivity analysis was determined following each activation and deactivation network. In this study, we report the fMRI-based representation of the FCF connection at the human brain level. The group analysis of FCF connection task revealed activation of frontal lobe (BA6/BA10/BA11). Moreover, seed based functional connectivity analysis showed decreased connectivity within activated clusters and posterior Cingulate Gyrus (BA31). Moreover, we observed an increased connectivity within deactivated clusters and frontal lobe (BA11/BA47) during the FCF connection. Activation clusters as well as the increased and decreased connectivity between different regions of the brain during the FCF connection, firstly, validates the significant effect of the FCF and secondly, indicates a distinctive pattern of connection with this non-material and non-energetic field, in the brain.

Keywords: Faradarmani Consciousness Field; functional connectivity; task fMRI

Introduction

Researchers have tried to discover how cognitive functions are organized in the brain for more than a century. Functional Magnetic Resonance Imaging (fMRI) is a powerful non-invasive technique that has allowed researchers to peek into a living brain while it carries out specific tasks and thereby see which parts of the brain are active as they are carried out (Delcomyn, 1998). Activation is defined as a brain region with changes in Blood-Oxygenation-Level-Dependent (BOLD) signal (Ogawa et al, 1990). In other words, activity in a specific brain area is associated with an increase in blood flow to this area, which provides the oxygen and glucose necessary for neural activity (Vincent et al, 2009). Increasingly, fMRI is being used for investigating the dysfunction that takes place in diseases like Alzheimer's (Greicius et al, 2004, Koenig et al, 2008), Parkinson's (Moody et al, 2004, Skidmore et al, 2011), Schizophrenia (Kim et al, 2010, Walter et al, 2009) and others. In addition, fMRI is particularly suited for screening the effects of pharmacological agents on pain processing within the human central nervous system (Schweinhardt et al, 2006).

Functional activity studies have also been used to clarify the level of functional communication between brain regions. Functional connectivity is defined as the temporal dependency between spatially remote neurophysiological events (Firston, 1998, Fox and Raichle 2007). For the first time Biswal and colleagues demonstrated that during rest-state, there were high degrees of temporal correlation both within and across the sensorimotor cortex (Biswal et al, 1997, Biswal et al, 1995). Various investigations have reported a connectivity between the left and right hemispheric motor cortex during rest (Van den Heuvel et al, 2010).

The default mode network (DMN) has been identified as the brain system that is preferentially active when individuals are not focused on the external environment (Buckner et al, 2008, Raichle et al, 2001). DMN has also been involved in self-referential mental activity (Gusnard et al, 2001). Goal-directed behaviors cause to lower activity in brain areas that include the medial frontal cortex, the medial and lateral parietal cortex, limbic and paralimbic brain regions, has been considered as the default network (Pallesen et al, 2009). Among these areas, medial prefrontal cortex (mPFC) most principally showing decreases during goal-directed behaviors in fMRI (Gusnard et al, 2001). It has been reported that activity and connectivity of DMN is involved in the integration of cognitive and emotional processing (Greicius et al, 2003) as well as mind-wandering (Mason et al, 2007). In addition, several studies have explored the alteration within this network in cognitive dysfunction diseases such as schizophrenia (Bluhm et al, 2007, Whitfield-Gabrieli et al, 2009, Calhoun et al, 2008) and depression (Grimm et al, 2008).

For a long time, the question of the relationship between mind-body, behavior, and specific regions of the brain has been examined by many researchers. The reductionist approach by some researchers show that every part of the brain has some specific functional role (Delcomyn 1998). Chen et al, 2019, provide evidence for directed information network architecture in the cerebral cortex using resting-state fMRI and suggest that features of the information flow configuration during rest underpins cognitive ability in humans.

Numerous research projects have been conducted to explore how the mind interact with the brain and the major neurological changes during this interaction. For example, the brain has been extensively studied under meditation or mindfulness states. There are several studies indicating that mindfulness is associated with brain activation and/ or connectivity of several regions in the brain (for a review see Marchand, 2014). According to a systematic review, mindfulness increased insular cortex activities across the seven regions. However, they didn’t find any robust evidence for increased activities in specific prefrontal cortex sub-regions studies (Young et al, 2017).

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Recently, a fMRI study during Transcendental Meditation practice showed that blood flow patterns were higher in anterior cingulate and dorsolateral prefrontal cortices but lower in the pons and cerebellum (Mahone et al, 2018). It has been reported that Meditation is associated with reduced activations in the DMN relative to performing active tasks in meditators compared to controls (Garrison et al, 2015). Similarly, it has been showed that in several different meditations including Concentration, Loving-Kindness, Choiceless Awareness, DMN (medial prefrontal and posterior cingulate cortices) are deactivated compared to control (Brewer et al, 2011).

In a novel approach presented by Mohammad Ali Taheri, consciousness is one of the three elements of the universe that is neither matter, nor energy, but that has direct effect on both matter and energy through specific and distinct non-material, non-energetic fields called the Consciousness Fields (CFs) which are the subcategories of a richly networked universal internet called the Cosmic Consciousness Network (CCN). The mentioned CFs are one of the achievements of using the CCN, in which people as a user receive troubleshooting and repair programs, by "Etesal" (virtual connecting) to the CCN followed by correction and treatment.

The CFs based on its position of influence and the special type of function, has several types, one of which is the Faradarmani that is applicable to all living (and non-living) creature including plants, animals, microorganisms, molecules etc. Faradarmani, establishes a consciousness bond between the whole consciousness and the parts where all constituents will be scanned and corrected.

The applied CFs according to Taheri, is mediated by Faradarmangar's mind (a person who makes a virtual connection). In this type of affection, mind-matter interaction occurred through connecting to the CCN by a Faradarmangar. In other words, according to the theory of the consciousness field, the human mind, has an intermediary role in this affection and the main

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achievement obtained as a result of the operation of the CFs. However, in cognitive science and neuroscience, mind is considered with an active role which has an interaction with the world of matter and energy.

By defining consciousness as neither matter nor energy we cannot associate a quantity to it. Since Consciousness isn't measurable its existing can only be known through experience. Although, the mechanism of this linkage is not yet definable by science, its consequences can be measured and studied scientifically (Taheri 2013).

Accordingly, Sciencefact has been defined by Mohammad Ali Taheri in 2020. Sciencefact discovers evidence of influence on the world of matter and energy through the consciousness fields (CFs) but conventional science studies matter and energy. The common point between science and Sciencefact is that both of them can be experienced at the level of matter and energy through reproducible laboratory experiments. On the other hand, investigation, usage and application of consciousness in Sciencefact distinguishes it from conventional science. In fact, the world of science is seen as a tool for the emergence of Sciencefact evidence. In previous researches, it is observed that MCF7 cancer cell line (Taheri et al, 2020a), wheat plants (Torabi et al 2020) and Alzheimer's disease rat models (Taheri et al 2021) are significantly affected under the influence of FCF. Further details about the theory of CF according to Taheri and the types of experimental studies are provided in this review (Taheri et al 2020b).

In a previous research (Taheri et al 2020c), the electrical activity of the brain during Faradarmani connection was screened in a Faradarmangar population and it was observed that the 34-40 Hz frequency band power in the frontal lobe was significantly increased. This increase was mainly in medial frontal gyrus (BA6) and after that, in paracentral lobule of the brain during performance of Faradarmani connection task compared to the no-task rest condition in the same Faradarmangar

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population. In the present study, in order to complete and further develop the previous mentioned accounts, the brain activity of a different Faradarmangar population was investigated, this time using fMRI technique. The aim of the present study is to examine the specific behavior of the human brain while communicating with the FCF using task groups and functional connectivity analyses.

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Methods

In the present study, we performed task-fMRI group analysis and functional connectivity analysis of a Faradarmangar population and compared their brain region activities during task performance and rest. Task is referred to the activity during which a Faradarmangar connects to the CCN. This study was approved by the ethics committee at Iran University of Medical Sciences (approval ID IR.IUMS.REC.1399.293).

Participants

The participants in this study comprise of 20 healthy persons (men and women in equal numbers) with a history of at least 2 years of practicing as Faratherapists. The age range of samples was between 20 and 50 years (MD=35.5±9.16).

Task design

In this study, three rest blocks (rest 1, 2 and 3) and two task blocks (task 1 and 2) were defined and the study began with the rest state (Figure 1). The purpose of this design, in addition to providing the conditions for observing more contrast between the task and rest modes, was to examine the changes in the brain activity in the shift from task to rest mode. The possibility of ending communication with the CF after the initial start has not been studied experimentally. Therefore, in this study, we examined the process of disconnection modes called resets 2 and 3 between the modes of connection with the FCF (task blocks 1 and 2).

The task in this study is defined as the establishment of connection with the FCF by the participants. In the begins of each task block a voice played and individuals were asked to close his/her eyes and begin this connection during their fMRI scan. The study began with a resting state (without connection to the FCF and with open eyes) and the total scan time in the task and rest states was 15 minutes per person. In the rest blocks present a fixation point (+) for 180s. All comparisons in this study were between the task and rest states of a participant group.

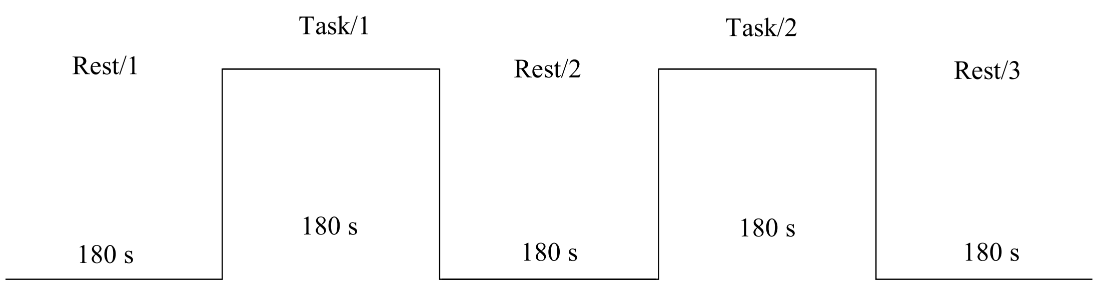

Figure 1. Block Task-Rest design and their duration in the present study.

fMRI Data Acquisition

Imaging was carried out at the national brain-mapping laboratory, Tehran, Iran. Volunteers laid down in the MRI system, and the head coil was used to decrease head motion and to increase the signal to noise (SNR) ratio. Data were acquired while applying a 3 Tesla magnetic field (Siemens, MAGNETOM Prisma) with a standard 20 channel head coil. T2x weighted, three dimensional functional images were acquired by applying a BOLD sensitive gradient echo and echo-planar imaging (EPI) sequence with echo time (TE) of 30 ms and repetition time (TR) of 3000 ms. Through each TR, 34 axial slices were obtained at 90° flip angle with 64x64 matrix size, 210 mm

FOV, and 3×3×3mm voxel size. The functional scans contained 248 volumes per participant. With high resolution, whole-brain images were obtained from each volunteer applying a T1 weighted MPRAGE sequence (TR 1800 ms, TE 3.47 ms, 7° flip angle, 176 slices, 256×256 mm FOV, 1×1×1mm voxel size).

Task fMRI analysis

Task fMRI analysis was performed with statistical parametric mapping software package (SPM12) (Wellcome Department of Cognitive Neurology, London, UK). The pre-processing step included field map correction, realignment, and co-registration of functional and anatomical scans, normalization, and smoothing. Moreover, Low frequency noise was removed by applying a high-pass filter (cutoff period = 100s) to the fMRI time series at each voxel. The amount of head motion was checked and the threshold was considered lower than Voxel Size (3mm). Significant hemodynamic changes for each condition were examined using the general linear model with boxcar functions convoluted with a hemodynamic response function. Statistical parametric maps for each contrast of the t statistic were calculated on a voxel-by-voxel basis.

fMRI connectivity and Group analysis

Data pre-processing for fMRI connectivity analysis was performed using a pre-defined pipeline of CONN toolbox (version 19.c) (Whitfield-Gabrieli and Nieto-Castanon 2012). The analysis involved the following steps: (1) estimation and correction of the participant's head movement (realignment and unwarp), (2) slice timing correction, (3) fragmentation of different brain regions (Gray/White/CSF) and normalization of data on standard MNI space. Subsequently, in the de-

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noising stage, fMRI signals were passed through a 100 s highpass filter to remove drift effects and respiratory and cardiac noise from the signal. In order to perform functional connectivity analysis, the peak coordinates of the activated clusters in fMRI data analysis were considered as seeds with a radius of 10 mm. Functional connectivity analysis was performed by generalized psychophysiological interaction (gPPI) (McLaren et al., 2012) in the 1st-level analysis step. The effects are reported according to the contrast for activation networks such that Task > Rest and for inactivation networks Rest>Task among all participants in the seed-to-voxel analysis mode.
In the 2nd-level analysis step, for each participant, the average gPPI model of BOLD time series of each seed was computed from their respective functional images as the representative of desired seed, and was further correlated with the time courses of whole-brain voxels using Pearson correlation analysis.,.

Statistical analysis

In task fMRI analysis paired T-test was used to form contrasts and p-value was set at 0.05. In functional connectivity analysis, statistical significance for all comparisons were set at $p < 0.05$, FDR corrected for cluster level (cluster threshold) and $p < 0.001$, uncorrected for voxel level (height threshold).

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Results

1. Group analyses of task fMRI

1.1 Activated and deactivated brain regions

Activation and deactivation brain regions were measured during the FCF connection as shown in Figure 2. As shown in this figure, the fronto-parietal lobes of two brain hemispheres show remarkably increased activity during the FCF connection; on the other hand, the temporal and the occipital lobes of the left and right hemisphere show deactivation during the CF connection.

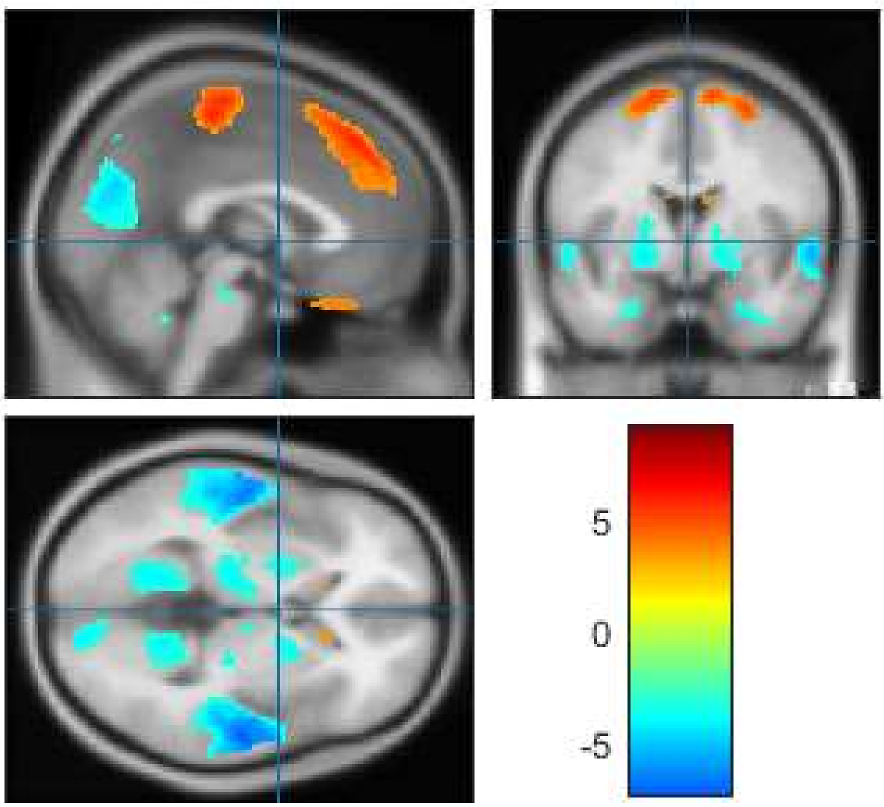

Figure 2. Activation and deactivation of brain regions during FCF connection in the Faratherapist population of the present study (red means higher and blue means lower activity).

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The 3D representation of the activated and deactivated areas of the brain during communication is shown in Figure 3.

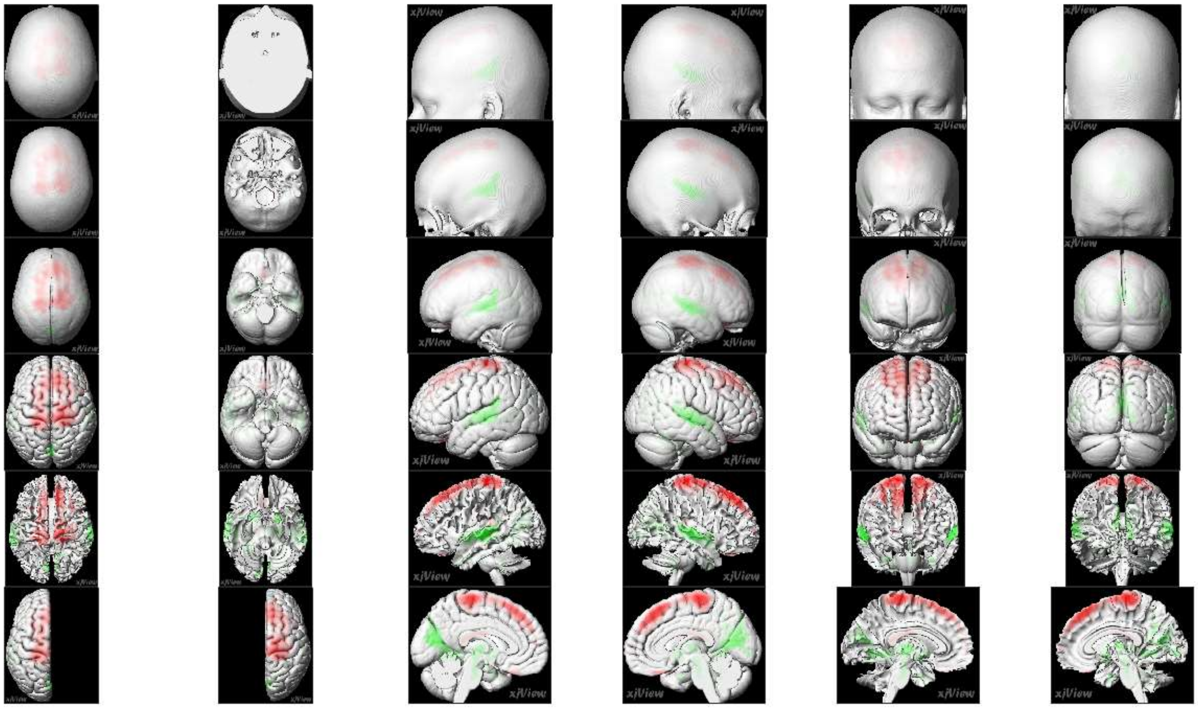

Figure 3. Render 3D view of brain of the Faradarmangar's population during task (FCF connection) fMRI in all directions (top, bottom, sagittal and dorsal views).

Interestingly, there is a symmetry in the activated and deactivated areas during the FCF connection which is also significantly different compared to rest as shown in Figure 3. The contrast comparison of the tasks from Reset 1 and all Reset blocks in activation and deactivation regions are shown in the Figure 4.

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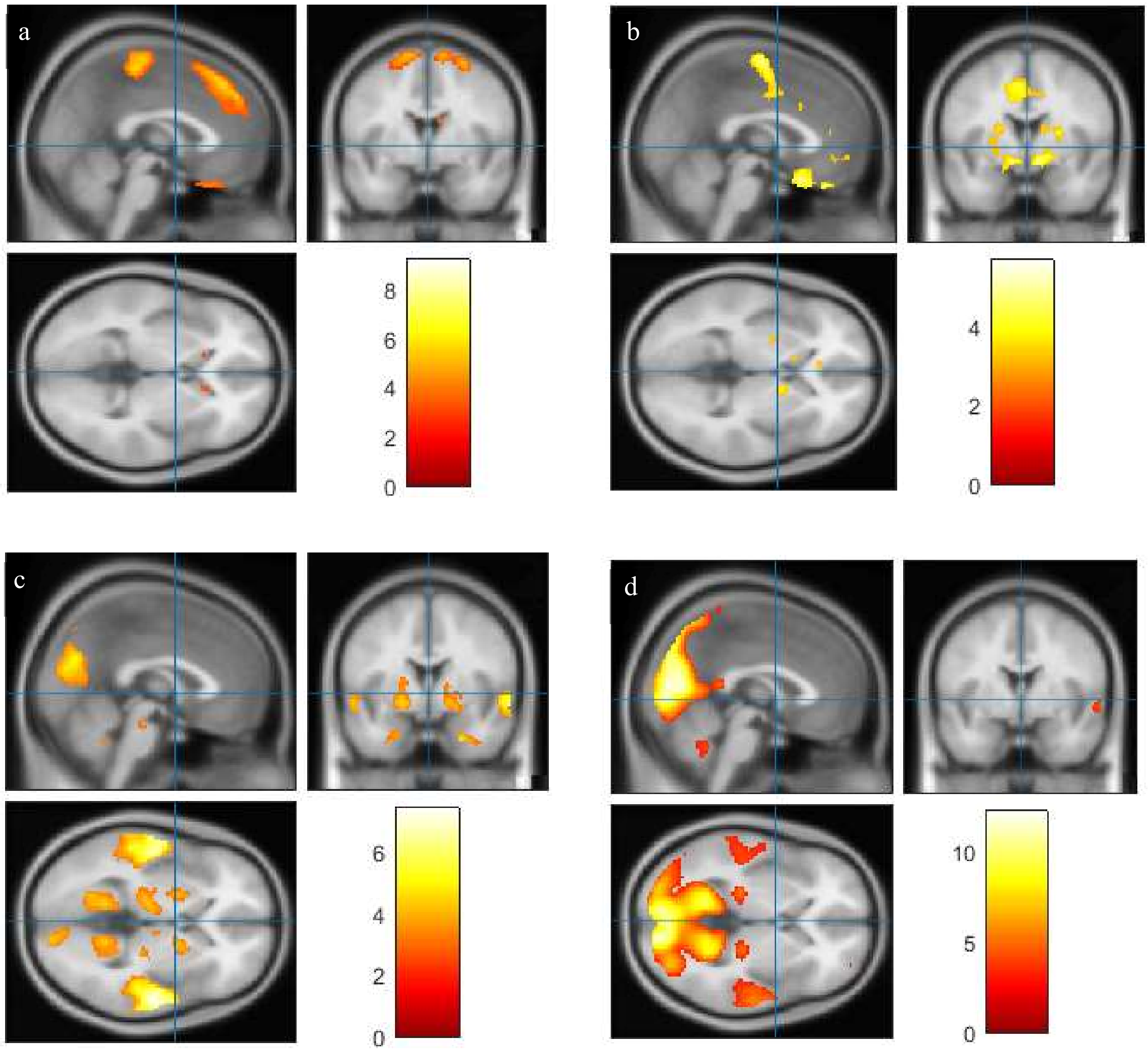

Figure 4. Activation and deactivation areas of Faradarmangars brain during FCF connection; activation in (a) Task>Rest 1 and (b) and Task >Rest; deactivation in (c) Rest1>Task (d) and Rest>Task.

As can be seen in the Figure 4, the different Rest considerations, resulted in remarkable changes in the intensity and areas of activation and deactivation in the Faradarmangars brain. For more clarification, the three sagittal views of (a) and (c) from Figure 4 are expanded and shown in Figure 5.

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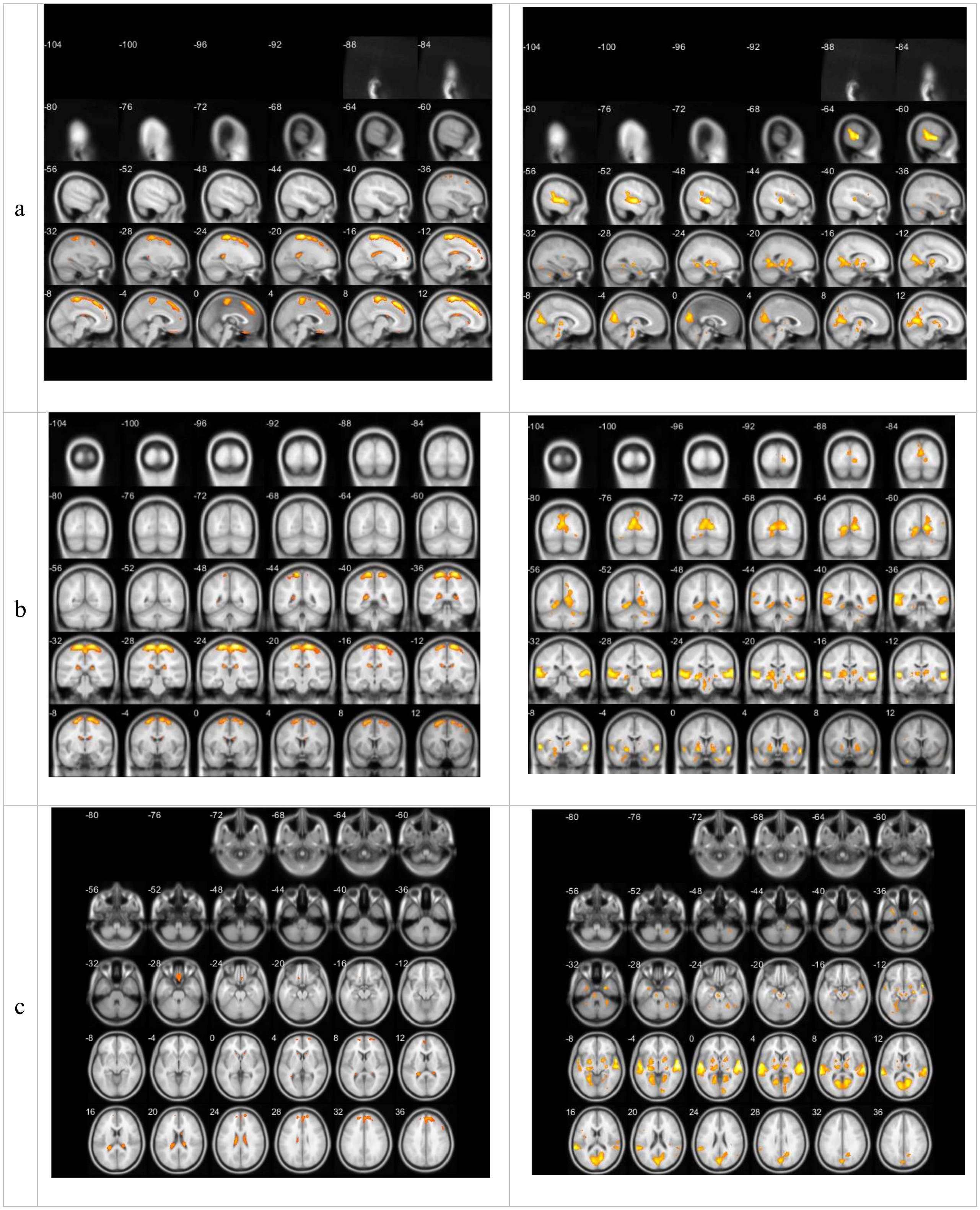

Figure 5. Activation (Left) and deactivation (Right) areas of Faradarmangars brain during the FCF connection in Task>Rest 1 and Rest1>Task, respectively, in (a) sagittal, (b) coronal, and (c) transverse views.

1.2 Activation and deactivation cluster analysis

Activation and deactivation clusters during FCF connection were measured during FCF connection and are shown in Tables 1 and 2, respectively. The threshold for this analysis was set at p-value= 0.001, intensity=3.0916 and cluster size=5.

Table 1. Number of voxels, peak MNI coordinate, related regions and intensity in the activation clusters during FCF connection. The activation clusters with no. of voxels in thousand order are highlighted in grey.

Activation clusters	Number of voxels	Peak MNI coordinate	Cerebrum	Lobe	Peak MNI region	Peak intensity
1	173	-4 34 -28	Left	Frontal	Rectal Gyrus (BA11)	4.1921
2	16	-10 24 -20	Left	Frontal	Medial Frontal Gyrus	3.6603
3	18	12 22 0	Right	Sub-lobar	Caudate_R (aal)	3.5045
4	14	-14 22 2	Left	Sub-lobar	Caudate_L (aal)	3.3306
5	6	-32 -48 2	Left	Sub-lobar	Lateral Ventricle	3.563
6	33	-16 62 6	Left	Frontal	Medial Frontal Gyrus	3.8461
7	56	20 64 6	Right	Frontal	Superior Frontal Gyrus (BA10)	3.963
8	396	-20 -38 14	Left	Sub-lobar	Lateral Ventricle	5.2362
9	225	18 -28 20	Right	Sub-lobar	Caudate	4.7855
10	8993	14 -24 72	Right	Frontal	Precentral Gyrus	9.1736

As can be seen in Table 1, the right and left frontal lobes as well as the sub lobar regions of the brain are remarkably activated activates during the FCF connection (more than 50 voxels). The most activated areas are observed in the Precentral Gyrus in white matter of the right frontal lobe

(BA6). Subsequently, the left and right sub-lobar regions, BA11 and BA10 are also activated regions.

Table 2. Number of voxels, peak MNI coordinate, related regions and intensity of deactivation clusters during FCF connection. The activation clusters with no. of voxels in thousand order are highlighted in grey.

Deactivation clusters	Number of voxels	Peak MNI coordinate	Cerebellum	Lobe	Peak MNI coordinate region	Peak intensity
1	45	28 -52 -52	Right	Cerebellum Posterior	Cerebellar Tonsil	-3.6114
2	29	20 -42 -42	Right	Cerebellum Posterior	Cerebellar Tonsil	-3.7023
3	36	-32 -48 -34	Left	Cerebellum Anterior	Culmen	-3.5606
4	121	26 0 -34	Right	Limbic	ParaHippocampal_R (aal)	-4.5244
5	1293	-24 -22 -6	Left	Sub-lobar	Optic Tract	-5.1218
6	193	32 -44 -34	Right	Cerebellum Anterior	Culmen	-3.837
7	11	2 -54 -34	Right	Cerebellum Anterior	Vermis_9 (aal)	-3.3818
8	6	10 -26 -34	Right Brainstem	undefined	Pons	-3.1819
9	43	46 -50 -28	Right	Cerebellum Anterior	Culmen	-3.8079
10	8	-28 -56 -24	Left	Cerebellum Posterior	Declive	-3.3039
11	2023	58 -18 0	Right	Temporal	Superior Temporal Gyrus	-7.3881
12	51	8 -20 -16	Right Brainstem	undefined	Midbrain	-3.7833
13	39	-32 -72 -14	Left	Occipital	brodmann area 18 // Fusiform_L (aal)	-3.6249
14	145	30 -16 -12	Right	Sub-lobar	Hippocampus_R (aal)	-4.4384
15	4271	12 -60 10	Right	Limbic	Calcarine_R (aal)	-5.3935
16	491	18 2 -8	Right	Sub-lobar	Extra-Nuclear	-4.2654
17	2153	-54 -14 0	Left	Temporal	Superior Temporal Gyrus	-6.6313
18	15	32 -80 -10	Right	Occipital	Inferior Occipital Gyrus	-3.57
19	23	-34 -8 18	Left	Sub-lobar	Insula // brodmann area 13	-3.6764
20	14	-44 14 18	Left	Frontal	Sub-Gyral	-3.392
21	17	56 -62 22	Right	Temporal	Superior Temporal Gyrus // brodmann area 39	-3.4743
22	9	34 -28 22	Right	Sub-lobar	Extra-Nuclear	-3.4575

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The most deactivated areas (more than one thousand voxels) in the FCF connection are shown in Table 2. The deactivation is highest in the white matter of the right limbic lobe in the Calcarine region, followed by the gray and white matter of the right and left temporal lobe, in the superior temporal gyrus (BA22). Finally, deactivation was also observed in the white matter of sub lobar region of left cerebrum in the optic tract.

2. Functional connectivity analysis

2.1 Functionally related regions in the activated areas

The results of seed-to-voxel analysis are shown in Table 3. These measurements consider the peak activity points of the analyzed fMRI in Task > Rest with uncorrected P-value <0.001.

Table 3. Activity peak in *Task-Rest* contrast of fMRI data considering cluster threshold 50 voxels and FWE = 0.05.

#	X	Y	Z	Voxel
Cluster 1	-4	34	-28	173
Cluster 2	20	64	6	56
Cluster 3	-20	-38	14	396
Cluster 4	18	-28	20	225
Cluster 5	14	-24	72	8993

The information of the voxels that were functionally related to the peak of the activated areas with p-value uncorrected <0.001 is provided in Table 4.

Table 4. Activation of functionally related clusters in the related voxels and regions.

Cluster No.	1
Dimension	x: -4 y: -30 z: +42
Related regions	128 voxels covering 5% of atlas.PC (Cingulate Gyrus, posterior division) 18 voxels covering 0% of atlas.PreCG l (Precentral Gyrus Left) 30 voxels covering 0% of atlas.not-labeled

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As shown in the Table 4, there is an increased connectivity between activated clusters during FCF connection (Table 3) and the posterior cingulate gyrus (left BA31). The sagittal view of the functionally related clusters are detected and its effect size is shown in Figure 6.

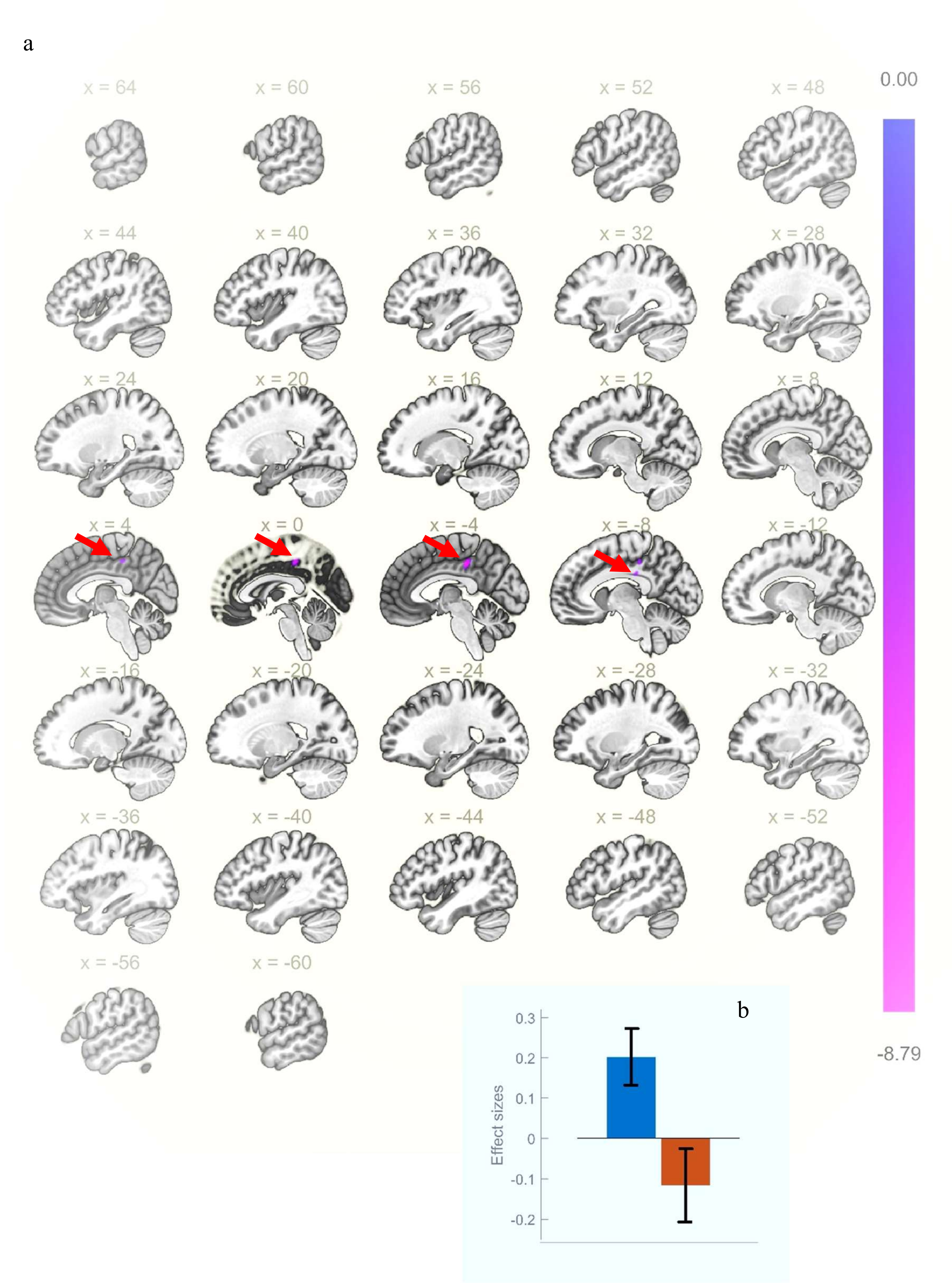

Figure 6. Area associated with functionally related activation clusters (red arrows) from the (a) sagittal view, and (b) its effect size diagram that shows FCF connection with red bar.

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2.2 Functionally related regions in the deactivated areas

The results of seed-to-voxel analysis, considering the peak activity points of the analyzed fMRI data as seed (Table 5), in Rest1 >Task and p-value uncorrected <0.001, are as follows.

Table 5. Activity peak in the *Rest-Task* contrast of fMRI data considering cluster threshold 50 voxels and FWE = 0.05.

Cluster Number	X	Y	Z	# Voxel
1	26	0	-34	121
2	-24	-22	-6	1293
3	32	-44	-34	193
4	58	-18	0	2023
5	8	-20	-16	51
6	30	-16	-12	145
7	12	-60	10	4271
8	18	2	-8	491
9	-54	-14	0	2153

The information of the clusters and voxels that were functionally related to the peak of the deactivated areas in rest condition in comparison with task (Rest-Task contrast), with p-value uncorrected <0.001 is given in the Tables 6 and 7.

Table 6. Deactivation in the functionally related clusters.

Cluster	Cluster (x,y,z)	size	size p-FWE	size p-FDR	size p-unc	peak p-FWE	peak p-unc
1	+50 +18 -12	136	0.021966	0.032768	0.000799	0.994287	0.000090
2	+10 +60 -14	147	0.026336	0.045301	0.001105	0.998435	0.000149

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Table 7. Deactivation in the functionally related clusters in voxels and related regions.

Cluster	No. of Voxels	Related Regions
1	47	covering 3% of atlas.IC r (Insular Cortex Right)
	34	covering 1% of atlas.TP r (Temporal Pole Right)
	8	covering 1% of atlas.FOrb r (Frontal Orbital Cortex Right)
	4	covering 0% of atlas.Putamen r
	2	covering 1% of atlas.FO r (Frontal Operculum Cortex Right)
	41	covering 0% of atlas.not-labeled
2	61	covering 1% of atlas.FP r (Frontal Pole Right)
	52	covering 1% of atlas.FP l (Frontal Pole Left)
	34	covering 0% of atlas.not-labeled

As shown in the cluster dimension of Table 6, two clusters with increased connectivity between deactivated clusters during FCF connection (Table 5), corresponds to BA47 and BA11 regions in right frontal lobe. The sagittal view of the detected functionally related clusters and their effect size can be seen in Figures 8 and 9.

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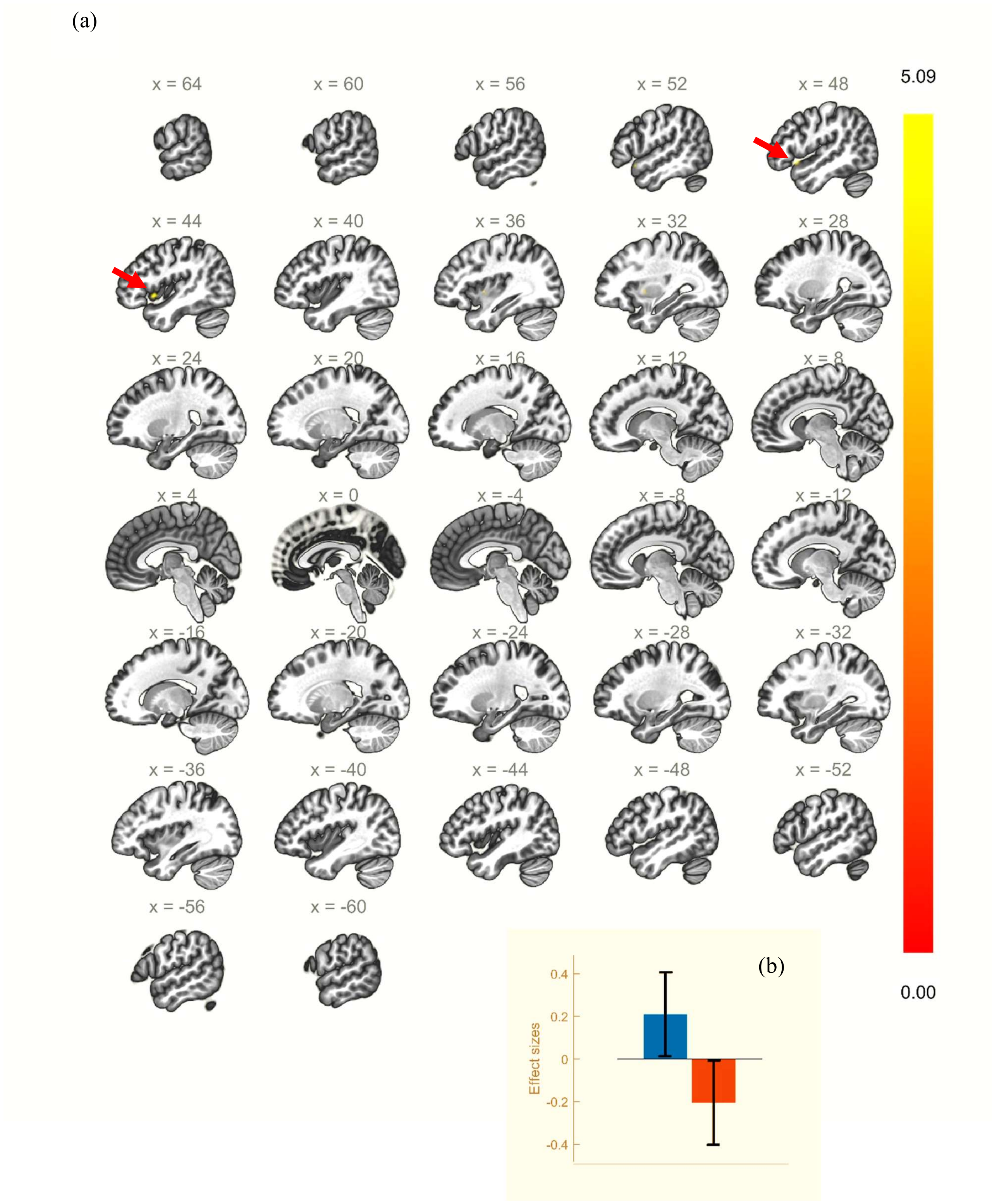

Figure 8. Areas associated with deactivation of functionally regions in cluster1 (red arrows) from the (a) sagittal view, and (b) its effect size diagram that shows FCF connection with red bar.

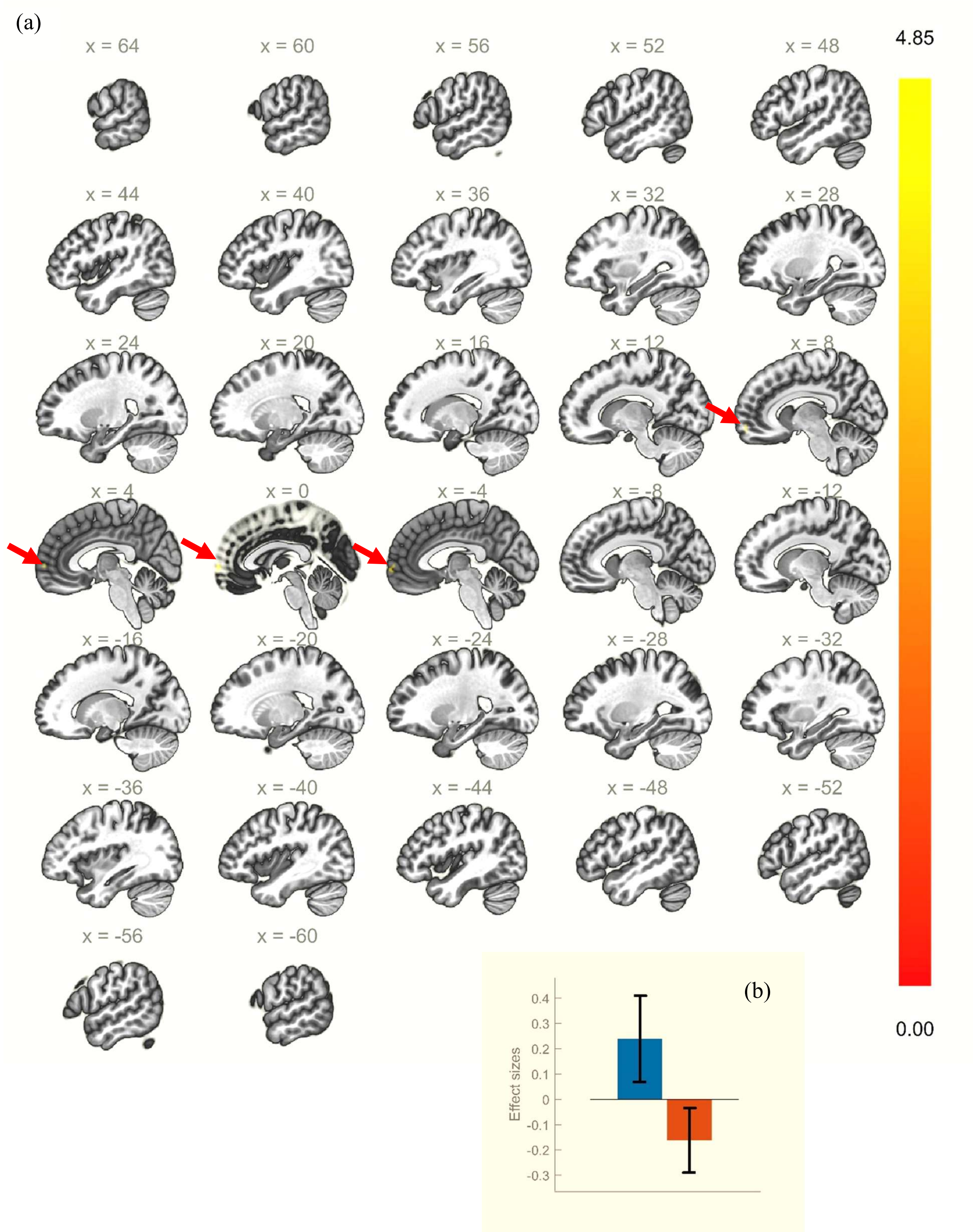

Figure 9. Areas associated with deactivation of functionally related regions in cluster2 (red arrows) from the (a) sagittal view and (b) its effect size diagram that shows FCF connection with red bar.

Discussion

In this study, we measured the activation and deactivation of brain regions and analyzed the results using task fMRI and functional connectivity analyses. According to the results, connection to the CF leads to activation of frontal lobe regions of the brain. These results are in alignment with the previous studies on the examination of Faradarmangar's brain (Taheri et al 2020) where the majority of the activity occurred in BA6 regions. On the other hand, connection to the FCF led to decreases in the activities of calcarine limbic lobes and BA22 temporal lobes. The analyses of functional connectivity in activated and deactivated regions of the brain shows that functional connectivity is increased during FCF connection within the BA31 region. Conversely, upon disconnection from FCF, functional connectivity is increased in the BA11/47 region instead.

Similar to previous findings (Taheri et al 2020), the electrical activities of the brain are activated in the frontal lobes upon connection to FCF. The distinguishing characteristic of the frontal lobe is its property as a traffic hub within the nervous system that connects to other regions of the brain and vice versa (Baars and Fage 2013). In our study, the BA6 region within the frontal lobe shows the highest activity during FCF connection. The BA6 region is the biggest part of Broadman region and commonly referred to as the premotor cortex which plays a role in motor sequencing and planning movements (Catalan et al 1998). Even though many functions are attributed to this region, playing a role in cognitive functioning is amongst them (Tanaka et al 2005). Other roles suggested for the BA6 region include memory (Ranganath et al 2003) and attention (Nobre et al 1997).

After BA6, the BA10/11 part of the frontal lobe is the next region that is highly activated. BA10/11 is also a part of the prefrontal cortex (PFC) and located in the frontal region of frontal lobe. This region is developed in one of the final timepoints during evolution and constitutes more than 1/4th

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of the cortex (Fuster 2009). The functions attributed to BA10 involve memory encoding (Ranganath et al 2003), memory retrieval (Tulving et al 1994), and working memory (Zhang et al 2003). It is also reported to play a role in personality integrity (Ciorciari et al 2019). To date, there has not been many examinations on the style of reacting and correlations of this region with personality due to the difficulty of studying the association between these regions when using fMRI tests.

The reduction in functional connectivity between BA10/11 and BA31 is one of the interesting findings in this study. As suggested in DMN literature, the default network hubs are commonly between mFPC and the PCC cortex (Buckner et al 2008). The observed decrease may be due to the absence of correlation between the activated regions and the default network. It also rejects the possible synchronicity and connection between the default network and brain activity during FCF connection.

In this study, we also observe deactivated brain regions during connection with FCF. The limbic brain region, located on the left and right medial sides of the brain, is the most primitive part of the brain and is shared with other mammals, reptiles, amphibians, and fish. The main functions of this region are the regulation of emotions, sexual responses, and homeostasis in humans (Michael et al 2010). The decreases in the limbic regions during FCF connection are within the calcarine parts which houses the primary visual cortex (Johns 2014). Additionally, the optical tracts located within the lobes in the left cortex shows reduced activity under connection with FCF. This decrease is concomitant within the BA22 regions which is the same as auditory association cortex (Mirz et al 1999).

This decrease in activity in the visual and auditory areas of the brain is related to the opening of the eyes in the rest mode and the voice message heard at the end of it and entering the task mode.

On the other hand, the increase in functional connectivity is observed within the deactivated regions and parts of PFC (BA47/11) which in the case of BA11, there is correlation with part of the activated areas of the brain. This result clearly indicates a change in brain activity between the state associated with the FCF and disconnection from it, as a result of the task and rest designed in the present study.

As a whole, we can summarize our findings in four parts: (1) FCF connection has a distinct characteristic effect on the human brain, (2) FCF leads to the activation of the human brain regions and changes various brain connectivity networks, (3) the activated parts of the brain are mostly associated with the more advanced brain frontal lobe regions and functional connectivity is activated opposite to the default networks (due to reductions in BA31 hub), and (4) the correlation between the deactivated and activated regions suggest a switch in Faradarmangar's brain during FCF connection, specially within the BA11 region.

Examining the other brain regions and comparing the various regional activities in larger and more diverse study populations can help shed light on the significance of FCF connection and its effects findings. Additionally, investigating the effects of FCF on brain functions in neurological diseases are the future considerations of the authors of this study.

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