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PROCEEDINGS

The 4th International Conference on Sustainable Innovation (ICoSI) 2020

Cutting Edge Innovations for Sustainable Development Goals

Universitas Muhammadiyah Yogyakarta (Indonesia)
October 13 - 14 2020

https://icosi.umy.ac.id/

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- **(ICOMS)** The 6th International Conference on Management Sciences
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Preface by the Chairperson of the 4th ICoSI 2020

Dr. Yeni Rosilawati, S.IP. S.E., MM.

Assalamu'alaikum Wr. Wb.

All praise is due to Allah, the Almighty, on whom we depend for sustenance and guidance. Prayers and peace be upon our Prophet, Muhammad SAW, his family and all of his companions.

On behalf of the organizing committee, it is my pleasure and privilege to welcome the honourable guests, distinguished keynote & invited speakers, and all the participants.

With the main theme of "Cutting-Edge Innovations on Sustainable Development Goals (SDGs)", the 4th International Conference on Sustainable Innovation (ICoSI) 2020 serves as a forum to facilitate scholars, policy makers, practitioners, and other interested parties at all levels from Indonesia and abroad to present their novel ideas, promote cutting-edge research, and to expand collaboration network. The conference has about 1373 participants participating from more than 8 countries 4 continents all over the world, making this conference a truly international conference in spirit.

This multidisciplinary conference was first held in 2012 and has undertaken various changes and adopted to the current technological trends of our education system. From having this conference with just 175 participants back in 2012 we have come a long way in making the conference a huge success with more than 1373 participants participating in this two-day conference.

Formerly, this conference consisted of only 9 (nine) focal conferences. This year, there are 14 focal conferences from various disciplines, namely: 1) The 2nd International Conference on Pharmaceutical Updates (ICPU), 2) The 6th International Conference on Management Sciences

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(ICoMS), 3) The 9th International Conference on Law and Society (ICLAS), 4) The 4th International Conference Medical and Health Sciences (ICMHS), 5) The 6th International Conference for Accounting and Finance (ICAF), 6) The 2nd International Language and Education Conference (ILEC), 7) The 2nd International Conference on Nursing (ICONURS), 8) The International Conference on Information Technology, Advanced Mechanical and Electrical Engineering (ICITAMEE), 9) The 2nd International Conference of Agribusiness and Rural Development (IConARD), 10) The 10th International Conference on Public Organization (ICONPO), 11) The 2nd International Symposium on Social Humanities Education and Religious Sciences (ISHERSS), 12) The 5th Dental Research and Exhibition Meeting (DREAM), 13) The International Conference on Hospital Administration (ICHA), and 14) The 3rd International Conference on Sustainable Agriculture (ICoSA).

Accordingly, We are proud to announce that this year, the 4th ICoSI 2020 breaks the Museum Rekor-Dunia Indonesia (MURI) record as the Virtual Multidisciplinary Conference with the Largest Number of Area of Fields in Indonesia

In addition, this year, this conference holds special value since this is the first conference in the history of our university where the entire conference is taking place remotely on a digital platform through the use of advance technologies due to the Covid-19 Pandemic.

I would take this opportunity to express my highest respect to the Rector of Universitas Muhammadiyah Yogyakarta, Dr. Gunawan Budiyanto who gave approval and ensured the maximal support from all the faculty members of Universitas Muhammadiyah Yogyakarta (UMY) that made this event a big success. In addition, my appreciation goes to all the support teams who have provided their valuable support and advice from planning, designing and executing the program.

Let me conclude my speech by encouraging the delegates to participate with an increasing number in all the activities and discussions through the digital platforms for the next two days. I wish everyone a successful, safe, and fruitful conference.

Thank you!

Wassalamu'alaikum Wr. Wb.

Yogyakarta, Indonesia, 14 October 2020

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Welcoming Remarks by the Rector of Universitas Muhammadiyah Yogyakarta

Assoc. Prof. Dr. Gunawan Budiyanto

Innovation is the beginning of the development of technology, and technology is a development machine that is expected to provide benefits to humans and provide the smallest possible impact on environmental quality. In the concept of sustainable development, development must improve the quality of human life without causing ecological damage and maintain the carrying capacity of natural resources.

International Conference on Sustainable Innovation (ICoSI) is an international conference which is an annual conference held by the University of Muhammadiyah Yogyakarta (UMY), Indonesia. In 2020 this raises the issue of "Cutting-Edge Innovations on Sustainable Development Goals." Therefore, on behalf of all UMY academics, I would like to congratulate you on joining the conference, hoping that during the Covid-19 Pandemic, we can still provide suggestions and frameworks for achieving sustainable development goals.

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About The 4th International Conference on Sustainable Innovation (ICoSI) 2020

Cutting Edge Innovations for Sustainable Development Goals

The 2030 Agenda for Sustainable Development is enacted by the United Nations as a shared blueprint for peace and prosperity for people and the planet, now and into the future. It consists of strategies to improve health and education, reduce inequality, and spur economic growth while also conserving natures by 2030.

This year, however, at the first one-third of its timeline, the SDG Reports shows that the outbreak of COVID-19 did hinder the achievement, or at least decelerate the progress of achieving the 17 goals. In fact, according to the report, "some number of people suffering from food insecurity was on the rise and dramatic levels of inequality persisted in all regions. Change was still not happening at the speed or scale required", accordingly.

Therefore, in this event of pandemic, the quantity and quality of research, innovation, and more importantly multi-disciplinary collaboration are indispensable. Furthermore, there needs to be clear ends of those works. That is how those research are applicable and benefits directly to the society. That is how those research is incorporated as the drivers of policy making, and used practically in the society. Hence, the stakeholders especially the triple helix of higher education institution, government, and industry must be re-comprehended and supported to reach the common goal of the SGD.

International Conference on Sustainable Innovation (ICoSI) has been essentially attempting to strengthen this regard since its first establishment. One of the goals of ICoSI is to provide primarily a platform where scholars, practitioners, and government could grasp the development and trends of research. Hopefully, meeting these actors altogether would result in stronger collaboration, sophisticated and advantageous research, and brighter ideas for further research. Based on these reasoning, this year, the 4th ICoSI 2020 UMY is themed 'Cutting-edge Innovations for Sustainable Development Goals".

Improving from last year conference which brought nine focal conference, this year ICoSI 2020 UMY brings 14 disciplines, from social sciences, natural sciences, and humanities. ICoSI 2020 received as much as 1005 papers. The paper works submitted in ICoSI 2020 UMY will be published in Atlantis Proceedings, IOP Proceedings, National/International Journals, and ICoSI ISBN-indexed Proceedings.

Nevertheless, ICoSI believes that publication is only the beginning of research dissemination. The publications will enhance the chance of the research known by wider audience, and then used, applied, and incorporated at either system, institutional, or personal level of human lives.

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TRACK ECONOMICS, LAW, EDUCATION, SOCIAL, AND HUMANITIES

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Comparison of Dominant and Non-Dominant Hemisphere Cortical Excitability Using Transcranial Magnetic Stimulation

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ABSTRACT

Background: TMS can directly assess cortical areas, providing a cheaper and faster way to determine the neurophysiological nature of cortical neurons. It becomes a question of whether cortical excitability of dominant and non-dominant hemispheres will have a difference considering that dominant hemispheres have more active motor activation of the dominant hand (1). This study is one of the neurophysiology study series using TMS that was held in RSUD Dr Moewardi using Indonesian population, especially Central Java population, considering other studies are still using the parameter of other races neurophysiology parameter. Objective: To determine the difference in cortical excitability between dominant and non-dominant hemispheres. Method: This research was an observational analytic study. This research was conducted at the Neurorestoration Polyclinic of Dr. Moewardi Regional Hospital from July to August 2019 using a Transcranial Magnetic Stimulation (TMS) tool with neuronavigation. The subject consisted of thirty-two samples that were declared healthy by neurology specialists with right-hand dominance. This study compares cortical excitability through the magnitude of resting motor threshold dominant and non-dominant hemispheres using TMS. Statistical analysis used paired T-test with a confidence level of 95% and p <0.05. Results: Subject of the study consisted of 17 male (53%) and 15 female (47%) with 100% dominance of the right hand (left hemisphere). The average ratio of the left and right motor threshold is the same, which is 48%. There is difference in cortical excitability between the left hemisphere and the right hemisphere (p = 0.015; P<0.05). Conclusion: There is a difference in cortical excitability between dominant and non-dominant hemispheres measured by resting motor threshold using TMS.

Keywords : cortical excitability, resting motor threshold, dominant and non-dominant hemisphere.

1. INTRODUCTION

Transcranial Magnetic Stimulation (TMS) is a non-invasive device that electrically stimulates the cerebral cortex, spinal cord, cranial nerves, and peripheral nerve tissue. TMS can directly assess cortical areas, providing a cheaper and faster way to assess the neurophysiology of cortical neurons. This method was introduced by Barker *et al*. Introduced in 1985 as a non-invasive method that stimulates the cerebral cortex and has become a viable method in the fields of neuroscience and psychiatry so that its use is being increasingly widely throughout the world, including in Indonesia (1,2).

A single TMS pulse against the motor cortex may directly induce motor evoked potentials (MEP) in peripheral muscles, and MEP amplitude itself is a component that measures corticospinal excitability directly. Right intensity stimulation at the right time using TMS to the motor cortex will generate motor evoked potentials (MEPs), which can be recorded from the muscles of the contralateral limb. (2–4).

The amount of this stimulation can be determined using the motor threshold, which is defined as the lowest intensity required to generate the motor evoke potential (MEP) in the target muscle following the stimulation to the motor cortex. Because the stimulation is proportionally direct to the motor evoked potential, the stimulation will pass throughout the neuron membrane and corticospinal interneurons to the motor cortex, as well as excitatory motor neurons in the spinal cord, neuromuscular junctions, and muscles. (2,4).

It is a question whether the cortical excitability of dominant and non-dominant hemispheres will be different, considering that the dominant hemisphere has more active motor activation of the dominant hand. The high motor activity in this dominant hemisphere may also indicate a lower cortical inhibition in the dominant hemisphere

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compared to the non-dominant hemisphere, as explained by Duque *et al* in his study that the interhemispheric inhibition (IHI) in the non-dominant hemisphere will be more significant than the dominant hemisphere. (5). Several study had already suggest a possibility of hemispheric differences in motor system between both hemisphere using several instrument like magnetoencephalography by Volkman and magneto resonance morphometry by Amunts that shows the difference between motor system in both hemisphere that suggest the hand dominance (6–8). Several study using TMS to determine the hemispheric difference between both hemisphere in motor system also already been held by Duque, Bernard, and Ridding (6,9,10) which interestingly showed different results that suggest there were no differences in motor excitability using TMS based on motor threshold (MT) parameter eventhough slight differences between cortical inhibition might be present which explain the hand dominance between hemisphere. This study might be essential to describe the physiology of interhemispheric relationship between hemisphere that explain the dominance of both hemisphere that influence the motor dominance in human body. Even more, this study is one of the neurophysiology study series using TMS that was held in RSUD Dr Moewardi using Indonesian population, especially Central Java population, considering other studies are still using the parameter of other races neurophysiology parameter. Therefore, the authors are interested in finding out whether there is a difference in cortical excitability of dominant and non-dominant hemispheres through stimulation of TMS.

2. METHOD

Research conducted in this study uses a quantitative analytic observational design. This study was held at the Neurorestoration Polyclinic Room at the Dr. Moewardi Hospital Surakarta. This study used Transcranial Magnetic Stimulation (TMS), which was equipped with neuronavigation. The number of samples involved in this study was determined using the relative constancy approach formula. The minimum sample size was 32 samples. This study used a purposive random sampling method. We included samples who were normal based on physical and neurological examination conducted by neurologist, over twenty years old but less than sixty, and were right-handed. We excluded samples who had neurological abnormalities, had history of epilepsy, had history of craniocerebral trauma, had undergo a craniotomy surgical operation, and were using pacemaker (1,11)

This study has been approved by ethical committee of RSUD Dr Moewardi. All subjects who were agreed to join this study were then examined by a neurology specialist. If abnormal examination results are found, the subject will be excluded from the study. The research subjects will be subjected to a biometric examination. The subjects were then fitted with a recording electrode with adhesive placed on the Abductor Policis Brevis muscle using the standard belly tendon method.

This study stimulated the right and left Musculus Abductor Policis Brevis. This study used Magstim (Machida, City Tokyo) TMS device with a Round Coil measuring 14 cm in diameter to deliver the stimulation. Then, transcranial stimulation was performed in which the position of the stimulus center was parallel to C3 for the left Abductor Policis Brevis muscle and C4 for the right Abductor Policis Brevis muscle with the Round Coil position parallel to the scalp. The magnitude of the motor threshold value is determined by providing a stimulus in stages where the stimulus is considered successful if a value of 50% is obtained from the standard experimental value. All these stimulations are repeated at least five times (1,12).

This study aims to determine whether there is a difference in motor cortical excitability between dominant and non-dominant hemispheres based on the motor threshold magnitude using TMS. The statistical program used for the analysis was SPSS version 26. The statistical analysis used was the paired T-test

3. RESULTS

The sample size was obtained based on the calculation of numerical data with the relative constancy approach resulting in 32 respondents who all met the inclusion and exclusion criteria set by the author with the following sample characteristics (table 1).

Table 1 show that respondents consist of 17 male and 15 female whom all the respondents are right-handed people. From this we can conclude that all of respondents have left hemisphere as their dominance hemisphere.

The motor threshold magnitude was divided into three category which are below 40%, 40%-50%, and more then 50% for each hemisphere. From table 1, we can see that most of the respondent has a motor threshold magnitude between 40% to 50%. Left hemisphere, as the dominance hemisphere, has more respondents on the more than 50% motor threshold group giving the possibility of the hemispheric dominance on the left side of the hemisphere.

Table 1. Sample Characteristic

Variable	Frequency	%
Sex		
Male	17	53%
Female	15	47%
Right Motor Threshold		
<40%	4	16%
40% - 50%	12	48%
>50%	9	36%
Left Motor Threshold		
<40%	6	17%
40% - 50%	10	48%
>50%	11	35%

Figure 1 shows that based on a simple mean average motor threshold taken, there is no difference between the motor threshold for the right and left hemispheres with a

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mean average motor threshold magnitude of 48%.

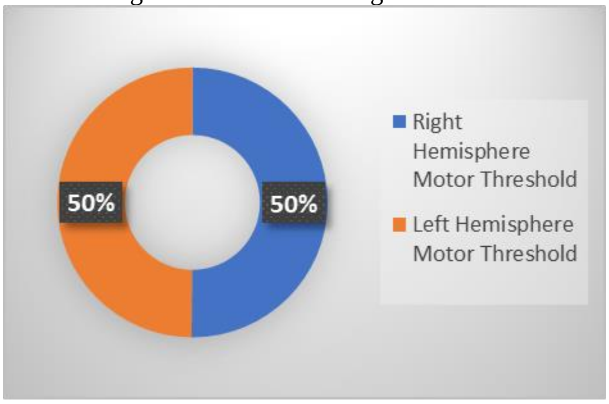

Fig1. Mean Average of Motor Threshold in Left and Right Hemisphere

In this study, the stimulation was carried out five times based on the determination of the motor threshold by Groppa *et al*., i.e., that suggest for at least 5-6 MEP recording in arow during contraction of the target muscle using the highest amplitude yet the shortest latency. Motor threshold magnitude data is presented on Table 2.

Table 2. Data Sample of Right and Left Motor Threshold Magnitude

No	Coordinate						Motor Threshold magnitude	
	Right			Left			Right	Left
	Xa	Ya	Za	Xi	Yi	Zi		
1	0,610	-5,550	-20,50	0,610	-5,550	-20,50	50%	50%
2	52,84	-14,98	70,30	-34,05	-12,15	78,37	50%	60%
3	36,37	-2,150	69,33	-46,30	-15,32	67,51	60%	25%
4	46,86	-19,64	67,14	-21,81	-17,06	-21,81	50%	50%
5	40,27	-26,78	64,84	-28,51	-14,83	72,06	25%	45%
6	43,61	-12,37	64,58	-28,52	-2,560	69,58	45%	30%
7	42,88	17,84	61,54	-43,02	5,850	68,00	60%	60%
8	47,00	-19,59	67,85	-44,07	-32,89	68,70	40%	50%
9	38,34	-6,490	66,91	-35,73	-5,960	67,03	35%	35%
10	35,49	-8,420	68,96	-40,77	-26,01	69,43	60%	50%
11	28,06	-17,07	73,94	-33,35	-4,300	69,51	40%	50%
12	34,04	-15,33	69,32	-27,31	-18,57	71,66	60%	55%
13	49,32	2,000	55,42	-35,50	-14,74	65,93	60%	50%
14	42,52	-4,420	57,33	-24,97	-22,14	72,52	60%	60%
15	43,32	-17,460	57,76	-27,81	-3,50	64,72	45%	45%
16	34,55	-13,480	70,63	-22,09	-11,30	74,9	20%	25%
17	49,07	-5,010	57,44	-36,22	-21,86	68,73	60%	55%
18	37,47	-19,010	71,02	-21,49	-8,84	78,72	45%	45%
19	24,64	-12,580	66,02	-32,55	-10,7	67,51	50%	50%
20	-26,70	-28,190	69,04	-26,70	-28,19	69,04	40%	60%
21	47,40	-16,650	60,1	-41,99	-21,48	68,4	70%	60%
22	49,49	-12,610	55,24	-35,41	-30,38	69,65	20%	40%
23	37,02	-15,590	72,76	-39,96	-12,3	64,84	50%	40%
24	43,45	-23,480	57,11	-41,9	-37,08	57,18	50%	50%
25	38,39	-8,290	70,19	-41,4	-30,39	71,81	60%	60%
26	39,46	-3,87	58,36	-32,32	-20,37	68,68	40%	40%
27	48,6	-10,85	59,01	-39,81	-15,39	70,78	30%	30%
28	36,5	20,86	70,39	-30,58	-27,89	71,62	60%	30%
29	36,52	-17,81	57,91	-28,65	-12,54	61,62	50%	30%
30	29,94	-26,42	55,15	-27,09	-19,37	64,73	50%	38%
31	40,47	-19,51	57,16	-41,55	-15,6	54,11	60%	30%
32	-28,51	5,34	70,98	33,48	3,95	70,37	60%	60%

The data obtained were then analyzed using a paired *T*-test. Comparison of cortical excitability between dominant and non-dominant hemispheres using TMS is described in Table 3

Table 3. Comparison of cortical excitability between dominant and non-dominant hemispheres using TMS

PAIRED T TEST		
	Correlation	Sig.
MT_Left & MT_Right	.425	.015

Table 3 shows the data analysis that tested the motor cortical excitability comparison of dominant and non-dominant hemispheres using the paired T-test gave a difference results using a simple average, which was a statistically difference in motor cortical excitability between the dominant and non-dominant hemispheres. From the statistical analyses we can conclude that there is a difference of motor cortical excitability between dominant hemisphere and non-dominant hemisphere.

3. DISCUSSION

The results showed that there was a difference between the right and left motor threshold, where the motor threshold used in the study used the resting motor threshold. The resting motor threshold is defined as the minimal stimulation intensity required to produce motion in the peripheral muscles (1,13,14)—the equations of cortical excitability between the left and right hemispheres in the concept of interhemispheric interactions. Interhemispheric interactions are facilitated by the corpus callosum and consist of two components, namely inhibitory and excitatory. The inhibitory theory states that the corpus callosum controls the processes of interaction between the hemispheres, prevents activation of the contralateral hemisphere, and allows asymmetry of the hemisphere. Voluntary unilateral activation of the motor cortex will increase inhibition of the interhemispheric in the inactive motor cortex. This process aims to avoid mirror activity of the inactivated motor cortex (9,15). Several studies have revealed that the interhemispheric inhibition of the dominant motor cortex is more potent than the non-dominant motor cortex, thus providing accurate control of the fine motor movements of the dominant hand by inhibiting interference from the motor cortex of the non-dominant hemispheres (5,6,15). The amount of inhibition received by the dominant hemisphere will correspond to the number of dominant motor excitability(9,10).

This study measured cortical excitability using the resting motor threshold parameter that stimulated by TMS. Stimulation using TMS will be carried from the motor cortex to the target muscle, which in this study, using the right and left Abductor Policis Brevis muscles. Stimulation using TMS will activate the motor cortex and trigger Motor Evoked Potential (MEP) from the target muscle. The amount of stimulation that triggers MEP from the target muscle is called the Motor Threshold and is used as a parameter of cortical excitability in this study. The stimulation of TMS will produce excitation and inhibit the motor cortex of the non-dominant hemisphere, which is the basis of interhemispheric inhibition (IHI) (9,14).

This study shows the difference between cortical

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excitability between dominant and non-dominant hemispheres, wherein this study, all samples has the left hemisphere as their dominant hemisphere. This phenomenon is probably because interhemispheric conduction velocity transcallosally is only limited to the *cerebrum* so that the transfer and integration of information between the two hemispheres via the corpus callosum requires more time and energy in humans. Therefore, it may be more efficient to use one hemisphere and inhibit the other hemisphere during simple tasks. This process may be the basis of intrahemispheric relationships and brain lateralization (15).

The results of this study were also presented by Dassonville (16), who assessed the dominance between hemispheres using fMRI. Research by Dassonville also showed that the dominant hemisphere exhibits greater activation than the non-dominant hemisphere based on fMRI studies during a movement. The magnitude of activation based on fMRI studies also indicates the magnitude of dominance in the hemisphere.

This study unfortunately showed different result compared to study by Duque, Bernard, and Ridding (6,9,10) which used a TMS to study the difference in motor system between hemisphere. These studies showed no differences in motor excitability between hemisphere using motor threshold. These studies found that the difference of motor cortical excitability was more determine by the interhemispheric inhibition (IHI) as stated by Duque (9) that the dominant hemisphere will provide greater inhibition to the non-dominant hemisphere and increase its excitability. This is what underlies the dominance of the hemisphere and the differences in cortical excitability between the dominant and non-dominant hemispheres. The differences between our study and these studies had become our drawback that our center still not provide for interhemispheric inhibition (IHI) measurement to re-evaluate the distinction between these studies. Beside interhemispheric measurement, we also consider several drawbacks which are: all of our samples are right-handed and our number of samples are still limited. We suggest for future studies to measure the interhemispheric inhibition, measure not only right-handed samples, but also left-handed samples, using larger number of samples.

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