ISBN 978-623-7054-43-6

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/

Focal Conferences

- **(ICPU)** The 2nd International Conference on Pharmaceutical Updates
- **(ICOMS)** The 6th International Conference on Management Sciences
- **(ICLAS)** The 9th International Conference on Law and Society
- **(ICMHS)** The 4th International Conference Medical and Health Sciences
- **(ICAF)** The 6th International Conference for Accounting and Finance
- **(ILEC)** The 2nd International Language and Education Conference
- **(ICONURS)** The 2nd International Conference on Nursing
- **(ICITAMEE)** The 1st International Conference on Information Technology, Advanced Mechanical and Electrical Engineering
- **(IConARD)** International Conference on Agribusiness and Rural Development
- **(ISHERSS)** The 2nd International Symposium on Social Humanities Education and Religious Sciences
- **(ICONPO)** The 10th International Conference on Public Organization
- **(DREAM)** The 5th Dental Research and Exhibition Meeting
- **(ICHA)** The 5th International Conference on Hospital Administration
- **(ICOSA)** The 3rd International Conference on Sustainable Agriculture

ISBN 978-623-7054-43-6

Proceedings

4th International Conference on Sustainable Innovation

2020

Publisher UMYPress

Lembaga Penelitian, Pengabdian, dan Pengembangan Masyarakat (LP3M)

Universitas Muhammadiyah Yogyakarta

Address

Gedung D Lantai 2

Universitas Muhammadiyah Yogyakarta

Jalan Brawijaya, Bantul,

55183 Indonesia

ISBN : 978-623-7054-43-6

ISBN 978-623-7054-43-6

The 4th ICoSI 2020 Commitees

Advisory Board

Dr. Ir. Gunawan Budiyanto, M.P, IPM
Prof. Dr. Ir. Sukamta, M.T., IPM
Prof. Dr. Nano Prawoto, S.E., M.Si
Dr. Suryo Pratolo, M.Si, Akt
Prof. Hilman Latief, MA., Ph.D
Prof. Dr. Achmad Nurmandi, M.Sc

Chairs

Dr. Yeni Rosilawati, S.IP., S.E., MM
Dr. Arie Paksi, S.IP., M.A
Dr. Dyah Dewanti

Secretariat

Abdul Rasyid Ghazali, M.Sc.
Mariska Intan Sari, S.S., M.A
Fitria Rahmawati, S.Pd. M.Hum.
Khanza Nabila Iftina, S.I.Kom
Qholiva Yuni Fadilla, S.I.Kom

Treasurer

Twediana Budi Hapsari, S.Sos., M.SI.,Ph.D
Safaroh Ivory Fananda, S.Sos

Scientific Committee

Prof. Agus Setyo Muntohar, S.T., M.Eng.Sc., Ph.D.(Eng.)
dr. Iman Permana, M.Kes., Ph.D
Dr. Sudarisman, M.T
Iwan Satriawan, Ph.D
Dr. Indira Prabasari, M.P
Eko Priyo Purnomo, S.IP., M.Si., M.Res., Ph.D
Dr Nuryakin, M.M
Prof. Dr. Achmad Nurmandi, M.Sc.
Rizal Yaya, S.E., M.Sc., Ph.D., Ak, CA
Dr. Mukti Fajar ND, SH., M.Hum

Proceedings and Journals

dr. Iman Permana, M.Kes., Ph.D
Dianita Sugiyo, S.Kep., Ns., MHID
Dr. Dyah Mutiarin, M.Si.

Program and Event

Hijriyah Oktaviani, S.IP, M.M
Krisna Mulawarman, S.Sos, M.Sn

ISBN 978-623-7054-43-6

IT Support

Miftahul Yaum
Winny Setyonugroho. S.Ked., M.T., Ph.D
Anhar Wahyu, S.E

Food and Beverages

Dr. Alni Rahmawati, M.M
Dr. Sri Handari Wahyuningsih, M.M
Siti Wijayanti
Dra. Luluk Chusniati

Equipment, Facilities and Infrastructure

Bagus Subandono, ST, M. Eng
Aris Nuryanta, S.H
Galuh Sudarsono

Assets and Logistics

Eko Wahyudi, S.E
Noor Fajari
Suparno

ISBN 978-623-7054-43-6

Reviewers of 4th ICoSI 2020

Ahmad Zaki, Ph.D.
Al Afik, S.Kep., Ns., M.Kep.
Ali Awaludin, Ph.D.
Ana Majdawati
Angga Fajar Setiawan, S.T., M.Eng., Ph.D.
Anita Rahmawati, S.T., M.T.
Anugrah Ilahi, Ph.D.
apt. Aji Winanta, M.Sc
apt. Binar Asrining Dhiani, Ph.D
apt. Didik Setiawan, Ph.D
apt. Erza Genatrika, M.Sc
apt. Hari Widada, M.Sc
apt. Indah Hairunisa, S. Farm., M.Botech
apt. Ingenida Hadning, M.Sc
apt. Lusi Putri Dwita, M.Si
apt. Nurul Maziyyah, M.Sc
apt. Raditya Weka, M.Farm
apt. Rifki Febriansah, M.Sc
Assoc. Prof. Dr. Khairil Azmin Mokhtar
Asti Widuri
Azizah Khoiriyati, S.Kep., Ns., M.Kep
Cahyu Septiwii, M.Kep., Sp.Kep., MB., Ph.D.
Dedi Suryadi
Dina Wahyu Trisnawati, Ph.D.
Dr. Ahim Abdurahin M.Si., SAS., Ak., CA
Dr. Anas Puri, S.T., M.T.
Dr. Ani Hairani
Dr. apt. Bangunawati Rahajeng, M.Si
Dr. apt. Dwi Utami, M.Si
Dr. apt. Ika Yuni Astuti, M.Si
Dr. apt. Nurkhasanah, M.Si
Dr. apt. Siska, M.Farm
Dr. apt. Supandi, M.Si
Dr. Arni Surwanti,M.Si.
Dr. Astuti Masdar
Dr. Birgit C. P. Koch, PharmD, Ph.D
Dr. dr. Arlina Dewi,M.Kes., AAK
Dr. Dr. Nur Hidayah,M.M.
Dr. dr. Sri Sundari, M.Kes.
Dr. drg. Dwi Aji Nugroho MDSc
Dr. Drh. Sapto Yuliani, M.P
Dr. Edi Soesanto, S.Kp., M.Kes
Dr. Eko Hanudin
Dr. Elsye Maria Rosa, M.Kep.
Dr. Fadia Fitiyanti
Dr. Firman Pribadi, M.Si.
Dr. Firman Pribadi,SE.,MM.
Dr. Hosam Alden Riyadh A.Alazeez, M.S.A
Dr. Ihsan Nurkomar
Dr. Ika Nurul Qamari,SE.,M.Si
Dr. Indah Fatmawati,M.Si
Dr. Innaka Ageng Rineksane
Dr. Istianah ZA
Dr. Lis Noer Aini
Dr. Lisa Musharyanti, S.Kep., Ns., M.Med.Ed
Dr. Mahendro Prasetyo Kusumo
dr. Maria Ulfa, MMR.,Ph.D.
Dr. Muhammad Ichsan
Dr. Muria Indah Sokowati, M.Si
Dr. Ns. Umi Solikhah, S.Pd., M.Kep,
Dr. Nur Chayati, S.Kep., Ns., M.Kep
Dr. Nuryakin,MM.
Dr. Qurratul Aini, S.KG., M.Kes.
Dr. Seplika Yadi
Dr. Siti Nur Aisyah
Dr. Titih Huriah, M.Kep., Sp., Kom
Dr. Yeni Rosilawati
Dr.Eng. Rahmita Sari Rafdinal, S.ST., M.Eng.
Dr.Eng.Pinta Astuti, S.T., M.Eng.
Drg Arya Adiningrat PhD
Drg Atiek Driana R Sp.KGA
Drg Dian Yosi A MDSc PhD
Drg Dwi Suhartiningtyas MDSc
Drg Edwyn Saleh Sp.BMM
Drg Erlina Sih Mahanani
Drg Fahmi Yunisa Sp. Pros
Drg Hartanti Sp.Perio
Drg Iwan Dewanto MMR PhD
drg Sartika Puspita MDSc
Dr. Dyah Ekaari Sekar J
Eko Purwanti
Eko Purwanti, Ph.D
Ema Waliyanti, S.Kep., Ns., MPH
Endro Dwi Hatmanto
Erna Rochimawati, Ph.D
Erna Rochmawati
Etik Kresnawati, Dr., M.Si.
Evi Rahmawati, S.E., M.Acc., Ph.D., Ak., CA.
Evy Rahman Utami, S.E., M.Sc.
Fanny Monika, S.T., M.Eng.
Ferika Indarwati, S.Kep., Ns., M.Ng
Fitri Arofiati, S.Kep., Ns., MAN., Ph.D
Galuh Suryandari
Genesiska, S.Si., M.Sc.
Gina Puspita
Hafiez Sofyani, S.E., M.Sc.
Harjanti Widiastuti, Dr., S.E., M.Si., Ak.
Hendy Setiawan, Ph.D.
Hidayatul Kurniawati
Ida Faridah, S.Kp., M.Kes
Ietje Nazaruddin, Dr., M.Si., Ak., CA.
Ika Setyawati
Ikhlas Muhammad Jenie
Iman Permana
Imaniar Ranti
Inayati
Indira Prabasari, Ph.D.
Ir. Latif Budi Suparma, M.Sc., Ph.D
Iwan Satriawan, Ph.D
Jebul Suroso, Ns. M.Kep
Jenita Doli Tine Donsu, S.KM. M.Si
Lilis Suryani

ISBN 978-623-7054-43-6

M. Bahrul Ilmi, S.E., M.E.Sy
M. Endriyo Susila, Ph.D.
M. Syifa Amin Widigdo, Ph.D
Mahendro Prasetyo Kusumo
Matyana Dwi Cahyati, S.T., M.Eng.
Meika Kurnia Puji, RDA,M.Si.,Ph.D."
Muhammad Chairunsyah Riskyta Akbar
Muhammad Hazyar Arumbinang, S.H., LL.M
Muhammad Ibnu Syamsi, S.T., M.Eng.
Mundakir, S,Kep. Ns. M.Kep
Naim Abdul Majid
Nasrullah, S.H., S.Ag., MCL.
Naufal Bagus Pratama, S.H.
Noriko Kuwano
Nurvita Risdiana, S.Kep., Ns., M.Sc
Prof. Djoko Legono
Prof. Dr. Alan Lau, Pharm.D., FCCP
Prof. Dr. apt. Dyah Aryani Perwitasari S.Si., M.Si
Prof. Dr. Arthorn Riewpaiboon
Prof. Heru Kurnianto
Tjahjono,MM"
Prof. Hilman Latief, Ph.D.
Prof. Hironori Yasuda
Prof. Iman Satyarno
Prof. Ir. Mochamad Teguh, MSCE., Ph.D.
Prof. Jamsari
Prof. Keith Walters
Prof. Kriengsak Panuwatwanich
Prof. Maria Rosa Mosquera Losada
Prof. Maurice S. B. Ku
Prof. Michael Henry Boehme
Prof. Normah Mohd Noor
Punang Amaripuja,SE.,ST.,M.IT
Ratna Indriawati
Retno Widowati PA.,M.Si.,Ph.D.
Rizal Yaya, S.E., M.Sc., Ph.D., Ak., CA.
Rizka Fakhriani
Rofi Aulia Rahman, S.H., LL.M
sabtanti harimurti
Shanti Wardaningsih, Ph.D
Sherly Usman
SN Nurul Makiyah
Sri Atmaja P. Rosyidi, S.T., MSc.Eng., Ph.D., PE
Sri Rejeki M
Sri Sundari
Sudarisman
Suryanto
Suryo Pratolo, Dr., S.E., M.Si., Ak., CA., AAP-A.
Sutantri, Ns., M. Sc.,Ph.D
Talqis Nurdianto
Taufiq Hidayat, S.P., M.Sc.
Taufiqur Rahman, S.IP, M.A, Ph.D.
Titiek Hidayati
Tri Pitara
Tri Wulandari Kesetyaningsih
Tumin, Ph.D
Twediana Budi Hapsari, Ph.D
Wantoro, M.Kep., Ns., Sp.Kep., M.B., Ph.D
Warih Andan
Winny Setyonugroho,Ph.D.
Yanuar Fahrizal., S.Kep., Ns., M.Kep., Sp.Kep.J
Dr. Yoni Astuti
Yordan Gunawan, S.H., Int.MBA., M.H

ISBN 978-623-7054-43-6

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

ISBN 978-623-7054-43-6

(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

ISBN 978-623-7054-43-6

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.

ISBN 978-623-7054-43-6

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.

ISBN 978-623-7054-43-6

CONTENTS

ISBN 978-623-7054-43-6

ISBN 978-623-7054-43-6

ISBN 978-623-7054-43-6

ISBN 978-623-7054-43-6

TRACK ECONOMICS, LAW, EDUCATION, SOCIAL, AND HUMANITIES

ISBN 978-623-7054-43-6

Influence of Body Height on Central Motor Conduction Time Using Transcranial Magnetic Stimulation

Yetty Hambarsari[1,*], Priyanka Ganesa Utami[2], Rivan Danuaji[3], Baarid Luqman Hamidi[4], Subandi[5], Sulistyani[6]

[1, 3, 4, 5] *Neurology Department Universitas Sebelas Maret Surakarta, Indonesia*
[2] *Neurology Department – Resident Universitas Sebelas Maret Surakarta, Indonesia*
[6]*Neurology Department Universitas Muhammadiyah Surakarta Surakarta, Indonesia*
** Corresponding Author. Email : dr.yetty.hambarsari@gmail.com*

ABSTRACT

Background: Transcranial Magnetic Stimulation (TMS) is a non-invasive device that has the ability to stimulates the cerebral cortex, spinal cord, cranial nerves, and peripheral nerves electrically. The right stimulation intensity and time in using TMS will activate the motor cortex to produce motor evoked potentials (MEPs) that can be recorded from the contralateral limb muscles. The motor threshold is the lowest TMS stimulation needed to evoke the motor evoked potential (MEP) in the target muscle after the stimulation heading through the motor cortex and cortical motor tract. Because of the significant influence of body height on the conduction time needed for impulses along the corticospinal tract, the authors are interested in finding out whether there is an influence of body height on central motor conduction time throughout TMS stimulation. Method: This was an observational analytic study held on the Neurology-restoration clinic of Dr. Moewardi General Hospital using Transcranial Magnetic Stimulation (TMS) with neuro navigation from May - June 2019. Our study samples consist of 32 normal healthy people based on the general physical and neurological examination performed by the neurologist who agrees to participate in this study. The Central Motor Conduction Time obtained from TMS stimulation. The Central Motor Conduction Time was then statistically analyzed with the relationship with body height using a nonparametric Spearman's Rho's Analysis with confidence level of 95% and P<0.05. Results: There were n (32) respondents with mean central conduction time of 10,06ms. From the analysis and discussion, it can be seen that there was a statistical relationship between body height and central motor conduction time (CMCT) based on stimulation performed on the Abductor Pollicies Brevis (APB) muscle with a significance value of p = 0.03 (p<0.05). This study concluded that height affects central motor conduction time (CMCT) on stimulation of the Abductor Policis Brevis (APB) muscle

Keywords : *Transcranial Magnetic Stimulation, motor evoked potential, central motor conduction time, body height*

1. INTRODUCTION

Transcranial Magnetic Stimulation (TMS) is a non-invasive device that has the ability to stimulates nerve tissue of the cerebral cortex and send the stimulation all the way down trough the cortical motor tract and peripheral nerve to the target muscle. Barker et al. in 1985 introduced this non-invasive method which able to stimulates the cerebral cortex which rapidly developed in neuroscience and psychiatry and increased widely throughout the world including Indonesia (1–3).

The right stimulation intensity and time in using TMS will provoke the motor cortex to produce motor evoked potentials (MEPs) that can be recorded from the contralateral limb muscles. The motor threshold is the lowest TMS stimulation needed to evoke the motor evoked potential (MEP) in the target muscle after the stimulation heading through the motor cortex and cortical motor tract. Stimulation of the neuron membrane and corticospinal interneurons in the right amount of motor threshold will project this stimulation to the motor cortex all the way down through the motor neurons in the spinal cord, neuromuscular junction, and muscles(1–6).

TMS stimulation will travel from the motor cortex to the target muscle along the way to the corticospinal tract. Electrophysiologically, this process can be evaluated using the Central Motor Conduction Time (CMCT), which is the time required for the stimulation to travel to the target muscle. The CMCT that passes through the corticospinal pathway is possible to be influenced by height, as it is influenced by the length of the path taken for conduction (4,7,8).

Research by Imajo et al and Chu et al (4,9) stated that there is a correlation between lower limb CMCT and height. Tobimatsu's research (10) stated that physical variables significantly affect MEPs. This study is one of the first neurophysiology study on TMS study series in the

ISBN 978-623-7054-43-6

Indonesian population, especially in the Central Java population held in RSUD Dr Moewardi Surakarta. This study may be useful in brain mapping studies and the establishment of Indonesian TMS guidelines specifically on general Indonesian physiques, in this case, the relationship between CMCT and a person's height. Because of the significant influence that height has on the conduction time required for impulses to pass on the corticospinal tract, the authors are interested in finding out whether there is an effect of height on CMCT through TMS stimulation.

2. RESEARCH METHOD

2.1. Sample

This study was carried out using a quantitative analytic observational design. Population in this study are normal healthy people based on general physical and neurological examination. This research was held at the Neurology-restoration clinic, Dr. Moewardi Hospital, Surakarta. We were using Transcranial Magnetic Stimulation (TMS) equipped by neuronavigation. We use the relative constancy approach formula to determine our sample number which resulted in minimum sample size of 32 samples. We used a purposive random sampling to achieve the target sample size. Inclusion and exclusion criteria in this study are explained below (2,5,7,11)

Inclusion criteria :

a. A person who is health without neurological abnormalities based on the results of a general physical and neurological examination performed by a neurologist
b. Are over 20 years of age
c. Height range of 140-190cm
d. Willing to take part in this research

Exclusion criteria :

a. Having a neurological deficit
b. Having a history of epilepsy
c. Having a history of craniocerebral trauma
d. Having undergone neurosurgical operation
e. Using a pacemaker
f. Using a dorsal column stimulator.
g. Having a history of peripheral neuropathy.
h. Having a history of diabetes mellitus

2.2. Procedure

The subjects first agreed to participate in this research by filling out the informed consent then examined by a neurologist. Biometric examination would be conducted on research subject.

We used Transcranial Magnetic Stimulation (TMS) device to measure the motor cortical to peripheral motor conduction time. The subjects had a a recording adhesive electrode with an adhesive placed on the tendon of the targeted muscle belly. This research was using stimulation to the right Abductor Pollicis Brevis muscle. We used a 14cm round coil to deliver the stimulation from the Transcranial Magnetic Stimulation (TMS) (Magstim, Machida City, Tokyo). The stimulation was then performed in which the position of the stimulus center for the right Abductor Pollicis Brevis Muscle was parallel to C4 on the scalp. The motor threshold magnitude was determined in stages where the stimulus is considered successful if a value of 50% is obtained from the standard experimental value. We repeated all the stimulation at least four times. The motor cortical to peripheral motor conduction time determined by the time needed from the TMS stimulation to provoke motor evoked potential which was shown from the monitor of the TMS (2,12).

We measured the peripheral motor conduction time using the F-Wave parameter using an EMG device with median nerve stimulation. For the F-Wave measurement, the electrode was also placed on the belly tendon of Abductor Policis Brevis muscle using the minimum amount of the stimulation to the median nerve that can generate the MEP. The F-Wave stimulation was at least repeated ten times.

CMCT was then determined by subtracting the total time needed by stimulation to travel from the motor cortex to the targeted muscle that was recorded in the TMS monitor with half period of time of the F-Wave minus 1msc that is recorded in the EMG device (13).

This study aims to determine if there is an effect of height on CMCT using TMS. The statistical analysis used was Spearman Rho's analysis. All statistical analyses used SPSS version 26.

3. RESULTS

Table I showed us the characteristic of our 32 respondents who all met the inclusion and exclusion criteria (Table I). The respondents are consisting of 17 males (53%) and 15 females (47%). Based on height range, most correspondent had height range between 160-169cm (52%) and between 170-179cm (29%). Table I also shows that there were weaknesses in data collection, which were the height ranges of 140-149cm and 180-189 cm height range because only 1 sample was included in these height range. From the data taken, the mean average of CMCT from this study is 10,6ms.

Sample Data Characteristic

Variable	Frequency	%
Sex		
Male	17	53%
Female	15	47%
Height		
140 – 149	1	3%
150 – 159	8	26%
160 – 169	15	52%
170 – 179	7	29%
180 – 189	1	4%
Upper Limb length		
70 – 75	6	18%
76 – 80	10	30%
81 – 85	11	33%
86 – 90	6	18%

The sampling was carried out in three examinations,

ISBN 978-623-7054-43-6

namely: (1) examination of height and weight (2) determination of CMCT on the right side of the body (3) determination of F-Wave of the right upper limb using median nerve stimulation. Central motor conduction time (CMCT) is the time required for the nerve impulses to travel through the cortical motor tract to the targeted muscle. CMCT is determined by subtracting the total time required for stimulation to travel from the motor cortex to the targeted muscle that recorded in the TMS monitor with the peripheral conduction time (PMCT) using the F-Wave parameter on median nerve stimulation. The data obtained were then analyzed using a Spearman's Rho analysis. The effect of height on the central motor conduction time (CMCT) using TMS is described in Table II.

Effect of Height on cmct using TMS

			CMCT	TB
Spearman's	CMCT	Sig. (2-tailed)	.	.030
		N	32	32
	TB	Sig. (2-tailed)	.03	.
		N	32	32

Table II shows the sig value—less than 0.05 (P<0.05), which explains the effect of height on CMCT. This study concluded that height affected CMCT of stimulation on the Abductor Pollicis Brevis (APB) muscle.

4. DISCUSSION

This study is one of the first neurophysiology study on TMS study series in the Indonesian population, especially in the Central Java population held in RSUD Dr Moewardi Surakarta. The neurophysiology TMS guidelines are still using the coordinate and latency patterns based on other race populations, even though several studies showed a morphological difference between different races (14–16)

Our study results showed an influence of height on central motor conduction time (CMCT) based on stimulation performed on the Abductor Pollicis Brevis (APB) muscle. Stimulation on APB was chosen in this study because such stimulation can be assessed easily through motor cortex (M1) stimulation based on the coordinates of the Montreal Neurological Institute (MNI). In comparison, the stimulation level was based on the resting motor threshold, which is defined as the lowest stimulation intensity needed to stimulate the motor cortex to provoke motor evoke potential in the peripheral muscles (17). CMCT is the time needed for stimulation to travel from the motor cortex to the spinal motor neurons so that the height that influenced by the length of the corticospinal tract will affect the conduction time to pass to the spinal motor neurons. This statement is consistent with Udupa and Tobimatsu (10,13), which stated a correlation between CMCT and height. CMCT in this study was measured by subtracting the latency of cortical stimulation with PMCT, where PMCT was measured using the F-Wave parameter with the median nerve that innervates the Abductor Pollicis Brevis (APB). Similar results were also obtained in the research of Claus (18) with the Abductor Digiti Minimi (ADM) stimulation method using the F-Wave parameter which stimulates ulnar nerve and Robinson's research (7) which compared the conduction times of the Cortex Motor to C8 and Cortex Motor to S1 and C8 to S1 using the F-Wave latency parameter. These two studies also showed similar results, which stated that height affected CMCT even though the three studies were conducted using different muscle benchmarks and different F-wave stimulation benchmarks. F-Wave as a parameter of PMCT itself has several drawbacks for example, F-wave is easily influenced by external variables because of the sensitivity of the F-Wave examination to peripheral nerve damage even though it has not experienced symptoms. Robinson (9) also wrote a similar statement that stated that the F-Wave examination as a parameter of peripheral conduction might differ from the motor cortex's central conduction to the spinal motorneuron due to large measurement disturbances in patients with peripheral nerve lesions, which significantly affects certain fibers. This study provides additional information regarding cortical stimulation's velocity to motor neurons in populations with varying height which is similar to Robinson's study despite the probability of morphological differences between the population race.

This study concluded that height affects central motor conduction time (CMCT) on stimulation of the Abductor Policis Brevis (APB) muscle. However, we recommended future study should use larger samples, the sample should examine the NCV to exclude peripheral nerve disorders if peripheral conduction is measure using the F-Wave parameter. We also recommend that other methods to measure PMCT should be considered.

REFERENCES

1. Kobayashi M, Pascual-Leone A. Transcranial magnetic stimulation in neurology. Lancet Neurology. 2003.

2. Groppa S, Oliviero A, Eisen A, Quartarone A, Cohen LG, Mall V, et al. A practical guide to diagnostic transcranial magnetic stimulation: Report of an IFCN committee. Clin Neurophysiol [Internet]. 2012;123(5):858–82. Available from: http://dx.doi.org/10.1016/j.clinph.2012.01.010

3. Ruohonen J, Ilmoniemi RJ. Modeling of the stimulating field generation in TMS. Electroencephalography and clinical neurophysiology. Supplement. 1999.

4. Chu NS. Motor evoked potentials with magnetic stimulation: correlations with height. Electroencephalogr Clin Neurophysiol Evoked Potentials. 1989;

5. Rossini PM, Burke D, Chen R, Cohen LG, Daskalakis Z, Di Iorio R, et al. Non-invasive electrical and magnetic stimulation of the brain, spinal cord, roots and peripheral nerves: Basic principles and procedures for routine

ISBN 978-623-7054-43-6

clinical and research application: An updated report from an I.F.C.N. Committee. Clinical Neurophysiology. 2015.

6. Abbruzzese G. Motor Evoked Potential. Encycl Mov Disord. 2010;194–5.

7. Robinson LR, Jantra P, MacLean IC. Central motor conduction times using transcranial stimulation and F Wave latencies. Muscle Nerve. 1988;

8. Snell RS. Clinical Anatomy by Regions. Journal of Chemical Information and Modeling. 2012.

9. Imajo Y, Kanchiku T, Suzuki H, Yoshida Y, Funaba M, Nishida N, et al. Effects of differences in age and body height on normal values of central motor conduction time determined by F-waves. J Spinal Cord Med. 2017;

10. Tobimatsu S, Sun SJ, Fukui R, Kato M. Effects of sex, height and age on motor evoked potentials with magnetic stimulation. J Neurol. 1998;

11. Rossini PM, Burke D, Chen R, Cohen LG, Daskalakis Z, Di Iorio R, et al. Non-invasive electrical and magnetic stimulation of the brain, spinal cord, roots and peripheral nerves: Basic principles and procedures for routine clinical and research application: An updated report from an I.F.C.N. Committee. Clinical Neurophysiology. 2015.

12. Awiszus F. TMS and threshold hunting. Clin Neurophysiol Supl. 2003;

13. Udupa K, Chen R. Central motor conduction time. 1st ed. Vol. 116, Handbook of Clinical Neurology. Elsevier B.V.; 2013. 375–386 p.

14. Tang Y, Hojatkashani C, Dinov ID, Sun B, Fan L, Lin X, et al. The construction of a Chinese MRI brain atlas: A morphometric comparison study between Chinese and Caucasian cohorts. Neuroimage. 2010;

15. Ball R, Shu C, Xi P, Rioux M, Luximon Y, Molenbroek J. A comparison between Chinese and Caucasian head shapes. Appl Ergon. 2010;

16. Chee MWL, Zheng H, Goh JOS, Park D, Sutton BP. Brain structure in young and old east asians and westerners: Comparisons of structural volume and cortical thickness. J Cogn Neurosci. 2011;

17. Fitzgerald PB, Fountain S, Daskalakis ZJ. A comprehensive review of the effects of rTMS on motor cortical excitability and inhibition. Clinical Neurophysiology. 2006.

18. Claus D. Central motor conduction: Method and normal results. Muscle Nerve. 1990;