DETERMINATION OF NORMATIVE VALUE FOR GANS SOP TEST BY USING BAL EX FOAM AMONG NORMAL ADULT: PRELIMINARY STUDY

by

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Dissertation submitted in partial fulfilment of the requirements for the degree of Bachelor of Health Science (Honours) (Audiology)

May 2017

CERTIFICATE

This is to certify that the dissertation entitled “Determination of Normative Value for Gans SOP Test by Using Bal Ex Foam Among Normal Adults” is the bona fide record of research work done by Ms Syarifah Nurul Athira Bt Syed Ahmad during the period from October 2016 to May 2017 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment for the degree of Bachelor of Health Science (Honours) (Audiology).

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.

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ACKNOWLEDGEMENT

In the name of Allah The Most Gracious, The Most Merciful

I would like to express the deepest appreciation to my supervisor Dr Zuraida Zainun for giving me guidance, support and encouragement throughout my final year project. She continually and convincingly conveyed a spirit of adventure in regard to do a research. Without her guidance and persistent help, this dissertation would not have been possible.

I would like to thank to my co-supervisor Dr Mohd Normani Bin Zakaria for his help and support. He also gave suggestions about this research.

In addition, heartfelt thanks to my family members especially my mother, Mrs Hasbi Binti Ismail and my brothers for their never ending love, wise counsel and sympathetic ear. Finally, for my friends who are always supporting each other by deliberating over our problems and findings.

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- SOP Sensory Organization Performance
- VNG Vestibulonystagmography
- ECOCG Electrocochleography
- CTSIB Clinical test of sensory integration and balance

ABSTRAK

Sistem keseimbangan badan merupakan system yang sangat penting dalam kehidupan kita. Hal ini kerana system keseimbangan badan ini membantu kita untuk menjalani aktiviti kehidupan seharian. Contohnya, berjalan, berlari, dan berdiri tanpa sebarang masalah. Ujian *Gans Sensory Organization (SOP)* merupakan ujian yang ringkas serta melibatkan perbelanjaan yang sedikit untuk mengetahui status keseimbangan badan. Dalam ujian *Gans SOP* ini, terdapat tujuh langkah yang harus diikuti. Setiap langkah tersebut penting untuk mendiagnos serta memberikan intervensi yang efektif untuk memulihkan masalah keseimbangan badan. Kajian awal iaitu menentukan nilai normative bagi ujian *Gans SOP* dengan menggunakan kusyen BAL EX dalam kalangan dewasa yang normal telah dijalankan. Sebanyak 47 subjek diambil bagi kajian ini yang kebanyakkannya terdiri daripada pelajar Sains Kesihatan dan staf. Kesemua subjek tersebut telah mengisi borang soal selidik MVSS. Ujian seperti masa bermula subjek merasakan diri bergoyang dan sebanyak mana darjah subjek tersebut bergoyang dikira sepanjang langkah 1 hingga langkah 7. Berlainan pula dengan langkah ke 7, hanya darjah subjek tersebut bergoyang sahaja diambil. Data analisis telah dibuat dan menunjukkan tiada hubungan antara umur, tinggi, berat dan jantina dengan langkah ke 7. Oleh itu, kusyen BAL EX boleh digunakan oleh kesemua masyarakat tanpa mengira umur, berat, tinggi dan jantina. Kesimpulannya, kusyen BAL EX merupakan jalan penyelesaian serta alternative baru memandangkan ia tidak memberikan kesan terhadap umur, berat, tinggi dan jantina.

ABSTRACT

Balance system is one of important body system that enables us to perform our daily activities such as walking, running and standing without any difficulties. Gans Sensory Organization Performance (SOP) Test is one of the simple and cost-effective tools to evaluate the body balance status. In this test, there are seven conditions that are important for the evaluation of the ability to utilize and integrate sensory input for postural control. This preliminary study was performed to determine the normative value for Gans Sensory Organization Performance Test using Bal Ex Foam among normal adult. We recruited 47 normal subjects among health sciences student and staff. All subjects completed the MVSS questionnaire and GAN SOP test using BAL EX foam. Assessment of starting time of swaying and degree of swaying in condition 1 to condition 6. In condition 7, the participants will be assessed only in the degree of swaying. Statistical analysis showed no significant difference in age, gender, weight and height with the results of starting time of swaying and degree of swaying in condition 1 to condition 6. Besides, there is also no relationship between age, weight, and height with the degree of swaying in condition 7. Hence, this test can be used in clinical setting regardless of age, gender, weight, and height. The results also showed there is no relationship between age, gender, weight, and height with starting time of swaying and degree of swaying when standing on BAL EX Foam with eyes closed. In conclusion, BAL EX Foam is one of an alternative foam since it shows no effect in term of different age, weight, height, and gender.

CHAPTER 1
INTRODUCTION

1.0 Background of study

Good balance is an essential skill in life for every human. Balance is important as it will prevent us from falling. It needs contribution from vision, vestibular sense, proprioception and muscle strength (Sturnieks et al., 2008). As our age increases, balance can be affected due to various factors. Commonly, the vestibular sensory end organs become deteriorate because of aging among adult. According to NIH Senior Health in 2014, balance disorder is a disturbance that causes a person to feel unsteady, giddy, woozy, or have a sensation of movement, spinning, or floating. It also can be caused by certain health condition or from the inner ear itself (MedicineNet, n.d.).

Good balance is often taken for granted as it is obviously play a major role in our daily life. An individual that do not have any problem with vestibular system would not find a difficulty in walking across a driveway, transition positional of head, or get out of bed in the middle of the night without stumbling (Hanes, D. A. & McCollum, G., 2006). However, those that have balance disorder, they have limitation to carry out the activities. They can be extremely dangerous and greatly impaired. They will experience nausea, fatigue and dizzy (Hanes, D. A. & McCollum, G., 2006). In most severe cases, it takes few days to recover back in each episode of attack. Later, symptoms such as reduce in hearing and vertigo will present in each episode of attack.

Balance disorder or also known as Vestibular disorder in medical term can be classified into some categories according to the type of dizziness and symptoms that an individual experienced. Dizziness can be divided into 4 main categories which are vertigo, disequilibrium, presyncope and psychological. Each category has different type of sensation and characteristics. A person may elicit true vertigo by describe it as *"The room is spinning"* or *"I'm tilting or rocking"*. He or she also may experience presyncope where they feel a lightheaded, faint feeling, as though one were about to pass out. In other words, they experienced a feeling such as *"I am giddy"*. In this situation, it might due to medical problem. Example, cardiovascular problem. Next, disequilibrium. This type of dizziness usually nonvestibular neurologic disorders. If there is none related to the categories that mentioned before, an individual might fit in the psychological group. This may be due to anxiety or depression that usually associate with Psychiatric disorders.

Few tests are needed to confirm an individual has true vertigo that associate with vestibular disorder. Some of the tests that can be done are vestibulonystagmography (VNG), electrocochleography (ECOCG), rotational chair test and Gans Sensory Organization Performance (SOP) Test (Timothy C. Hain, 2012). Common test such as Gans Sensory Organization Performance or also known as Gans SOP test is easy and portable. It also widely use in clinical setting. It is a test of combination Romberg test, modified Romberg test and Fukuda stepping. Each test are carried out with both eyes open and close. Duration of each step are about 1 minute and postural sway will be recorded. Through this test, we can tell the severity and how it impacts an individual's daily life (The American Institute of Balance, 2011) .

In this study the participants will be examined to see any changes movement such as sway or fall in each Gans SOP Test their postural control conditions. This study is to determine normative data by using Bal Ex Foam. This product was patterned under Bal Ex groups. None of study that had be conduct to evaluate the specific normative value for sway among normal adult.

1.1The Vestibular System and Their Roles in Balance

The vestibular system also known as the balance organ in the inner ear that constitutes our sixth sense. Sensory input is needed in order to achieve good balance (Hanes, D. A. & McCollum, G.,2006). Example of sensory input such as vision (sight), proprioception (touch), and the vestibular system (motion, equilibrium, spatial orientation); integration of that sensory input; and motor output to the eye and body muscles. If there is provoking factors such as injury, disease, certain drugs, or the aging process can affect one or more of vestibular system. Other than that, psychological factor such as stress also can contribute to the sensory information (Hanes, D. A. & McCollum, G.,2006).

There are three vestibular organ that helps in maintaining balance. The vestibular organ are semicircular canals which can sense rotational movements and the other two is utricle that responsible for horizontal movements while saccule responsible for information of vertical acceleration. This can be seen when a person is in elevator with the movement goes up and down (Vestibular lecture note, n.d). Each signal from semicircular canals and otolith organ must be complementary to each other. It is because their combine activation would provide wide range of physical activity in daily life (Angelaki, D. E. & Cullen, K. E., 2008).

1.2 Research Problem Statement

There is no normative value for Gans SOP Test using Bal Ex Foam among normal adult. In this study, we will evaluate the normative value of Gans SOP Test on Bal Ex Foam.

1.3 Objectives

1.3.1 General Objective:

To determine the normative value for Gans Sensory Organization Performance Test by using Bal Ex Foam among normal adult.

1.3.2 Specific Objectives :

a. To determine the association between height and the result of Gans SOP Test.
b. To determine the association between weight and the result of Gans SOP Test.
c. To determine the balance status using Gans SOP Test among normal adult
d. To determine the association between gender and the result of Gans SOP Test
e. To determine the association between age and the result of Gans SOP Test

1.4 Hypothesis

1.4.1 Null hypothesis, Ho

- There is no association between height and the result of Gans SOP Test

Alternative hypothesis, Ha

- There is association between height and the result of Gans SOP Test

1.5.2 Null hypothesis, Ho

- There is no association between weight and the result of Gans SOP Test

Alternative hypothesis, Ha

- There is association between weight and (Cantarovich, 2002) the result of Gans SOP Test

1.5.3 Null hypothesis, Ho

- There is no association between gender and the result of Gans SOP Test

Alternative hypothesis, Ha

- There is association between gender and the result of Gans SOP Test

1.5.4 Null hypothesis, Ho

- There is no association between age and the result of Gans SOP Test

Alternative hypothesis, Ha

- There is association between age and the result of Gans SOP Test.

CHAPTER 2

LITERATURE REVIEW

2.0 Effect of age on Vestibular System

When reaching at the age of 60 years old and above, our hearing and vision will be affected because of aging. In other words, our senses have been interrupted. However, other sensory system which is vestibular system also begin to function poorly as age increases. Thus, it will lead to balance problems where elderly are easily to fall. (Vestibular Disorders Association, n.d.). Studies on anatomical have proved that number of nerve cells in the vestibular system decreases when we are in 55 years old.

If the vestibular system is damaged by any cause, an individual may experience dizziness and balance problems. (Vestibular Disorders Association, n.d.). A situation such as you or your surroundings are spinning or moving (vertigo), dizziness after woke up and vomiting can happen in anytime and even worse, this symptoms can happen everyday. However, not all elderly will experience dizziness. As stated in article of Vestibular Disorders Association, the age related loss of vestibular nerve endings can lead to severe balance problems without associated dizziness.

For elderly, fall has become a strong impact in their life. According to a research by Deandrea S. et al in 2010, the strongest association in risk factors for falls were vertigo, Parkinson disease and fear of falling and age. Gomez F.et al in 2011 stated in her research that dizziness become a common complaint among elderly. Prevalence of dizziness shown increases significantly with age (de Moraes SA et al, 2011). Frequently, their complaint of dizziness will present at least one year and it is lasting for a few seconds. (Gomez F. et al, 2011).

In a study by de Moraes SA et al (2011), the rate of falls in elderly with vestibular disease is higher. The amount estimated around 50 % compared to the reported rate in community-dwelling elderly patients. A lot of activities could not be done completely and the elderly feels restricted. More limitations on daily activities such as walking close to home, taking a shower, and driving which require coordinated head and eye movement and demand more of the vestibular system. (de Moraes SA et al, 2011). Other that that, a study assessed on elderly found that turning the head and maintain the head in a specific conditions were the most common movements with dizziness (de Moraes SA et al, 2011). Standing and lying position such as waking up from bed were even more frequent of having dizziness in Gassmann & Rupprecht's study.

Of all vestibular disorders, Benign Paroxysmal Positional Vertigo (BPPV) is the most common disorders among elderly (Vestibular Disorders Association, n.d.). BPPV mainly happened in the inner ear where calcium carbonate crystals (otoconia) that are normally embedded in the utricle has migrate into one or more of the 3 fluid-filled semicircular canals. There are not supposed to be in there that eventually interfere with the normal fluid movement that these canals use to sense head motion, causing the inner ear to send false signals to the brain. (Vestibular Disorders Association, n.d.). Symptoms of BPPV can be seen during changes of head position and getting out of bed and rolling over in bed. Other than that, they likely to feel dizzy and unsteady when they tip their heads back to look up (Vestibular Disorders Association, n.d.).

2.1 The General Vestibular Testing

It is known that the vestibular problem (vertigo and dizziness) are among the most frequent symptomps, not only in neurology. A few researches made a survey of over 30 000 persons showed a prevalence of all ages lies around 17% and it continue to rise to 39% in those over 80 (Davis and Moorjani, 2003). Vertigo and dizziness are not an unique disease. It can be attribute to vestibular disorders, while dizziness is not (Neuhauser and Lempert, 2004). A dysfunction of the vestibular usually happens characterized by a combination of perceptual, ocular motor, postural, and autonomic manifestations such as vertigo/dizziness, nystagmus, ataxia, and nausea

To accurately diagnose vestibular disorders among patients, several tests will be carried to differentiate type of vestibular disorders. Vestibular function tests are part of clinical assessment and helps in management of patients with dizziness and balance problems (Timothy, 2014). The first thing is to detect the site of lesion especially in the inner ear. According to Timothy (2014) if the dizziness is not from inner ear problems, it might be caused by disorders of the brain or by medical disorders such as low blood pressure or anxiety.

Timothy (2014) also stated that recent studies has shown that vestibular testing are more accurate more accurate than clinical examination in identifying inner ear disorders. Hearing test such as audiometry, Auditory Brainstem Response Test and ECochG can be used. Frequently, these hearing test will be combines with vestibular test to help to determine the diagnosis. More expensive test such as MRI (Magnetic Resonance Imaging) would be difficult because patient need to wait for a long queue. Thus, cost-effectiveness analysis for evaluation for vertigo such as posturography or ENG (electronystagmography) will be more

effective and can be done in a short time (Celebisoy, 2008). Simple vestibular tests are more effective than MRI at detecting strokes that cause dizziness (Timothy, 2014)

Clinical examination to diagnose vestibular-related disorder involve seven steps. This include dix-hallpike test, head thrust test, roll test, head shaking test, straight line test, Romberg test and Fukuda test (Zainun, 2010)

2.2.1 Clinical Test of Sensory Interaction and Balance (CTSIB)

The CTSIB is a timed test that assess the influence of visual, vestibular and somatosensory input on standing balance and was described Shumway-Cook and Horak in 1986 (Susan, 2004). It has been widely use by physical and occupational therapist. The aim of this test is to assist evaluation and monitoring of persons with vestibular dysfunction (Susan, 2004). Clinically, this test also used to determine falls risk in older adults (Susan, 2004).

Shumway-Cook and Horak described it as six conditions. Firstly, standing with eyes open on a firm surface. Secondly, standing with eyes closed on a firm surface. Thirdly, standing with a visual conflict dome on a firm surface. Fourthly, standing with eyes open on a compliant surface. Then, standing with eyes closed on a compliant surface lastly standing with a visual conflict dome on a compliant surface (Susan, 2004)

The CTSIB has been modified into 4 conditions. The modified version eliminated 2 conditions which are conditions 2 and 5 and conditions 5 and 6 because no difference was found in scores between these steps. The new modified CTSIB consists of 4 conditions: (1) standing with eyes open on a firm surface, (2) standing with eyes closed on a firm surface, (3) standing with eyes open on a compliant surface, and (4) standing with eyes closed on a compliant surface (Susan, 2004)

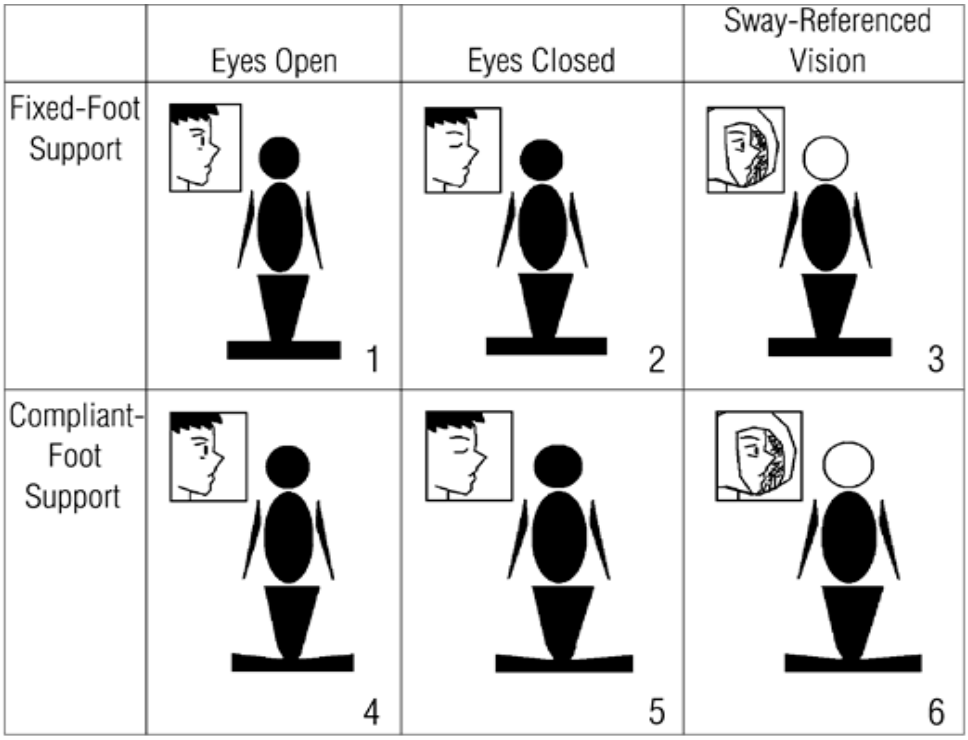


Figure 2.2.1 Clinical Test of Sensory Interaction and Balance (CTSIB)

2.2.2 Gans Sensory Organization Performance Test

The Gans Sensory Organization Performance Test is an important tool for all clinician when involve patients with vestibular problem. It comprised of Romberg, CTSIB (Clinical Test of Sensory Interaction and Balance) and Fukuda. Overal, there are seven steps for each participants to follow . These steps as showed in Figure 2.2 are carried out with eyes open and eyes closed.

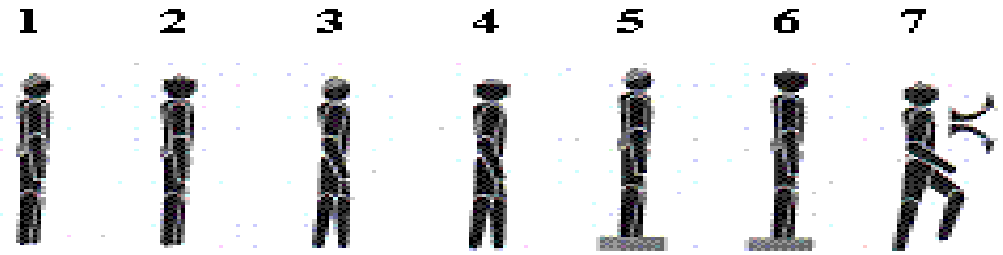


Figure 2.2.2 Gans Sensory Organization Performance Test

Note. From Dizziness & Balance Services, n.d, Hearing and Balance

CTSIB is a test to developed the influence of visual, vestibular and somatosensory input when the participants is standing condition (Shunway & Horak, 1996). This will be carried out during step five and six. The participants required to stand on Bal Ex Foam with eyes open. At this time, the participants will be test on how well the participants maintaining balance without presence of somatosensory input. Meanwhile, during step six, participants require to close their eyes which means they are only depending the presence of vestibular function.

Note : From AIB Balance Performance by The American Institute of Balance

CHAPTER 3

MATERIALS AND METHODOLOGY

3.0 Research Design

This is a cross sectional study to determine the normative value for Gans Sensory Organization Performance Test by using Bal Ex Foam among normal adults. The flow chart of the study is in Figure 3.4

3.1 Participants

3.1.1 Sample Size

The sample size was calculated using Medcalc software (version12.10, 2011). Based on study by Mohamad Ekhbal, 2015, by taking alpha value 0.05, power of study of 80% r value of 0.45 the minimum sample size is 47. By considering 10% drop out, this study will recruit 52 participants**.**

3.1.2 Inclusion and exclusion criteria

Table 3.1.2 Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Age of 20 to 55 years old	Pregnant woman
No history of balance disorder	Balance problem
No hip or knee injury	Central lesion
No history of osteoarthritis	Chronic disease (eg. Diabetes Mellitus)

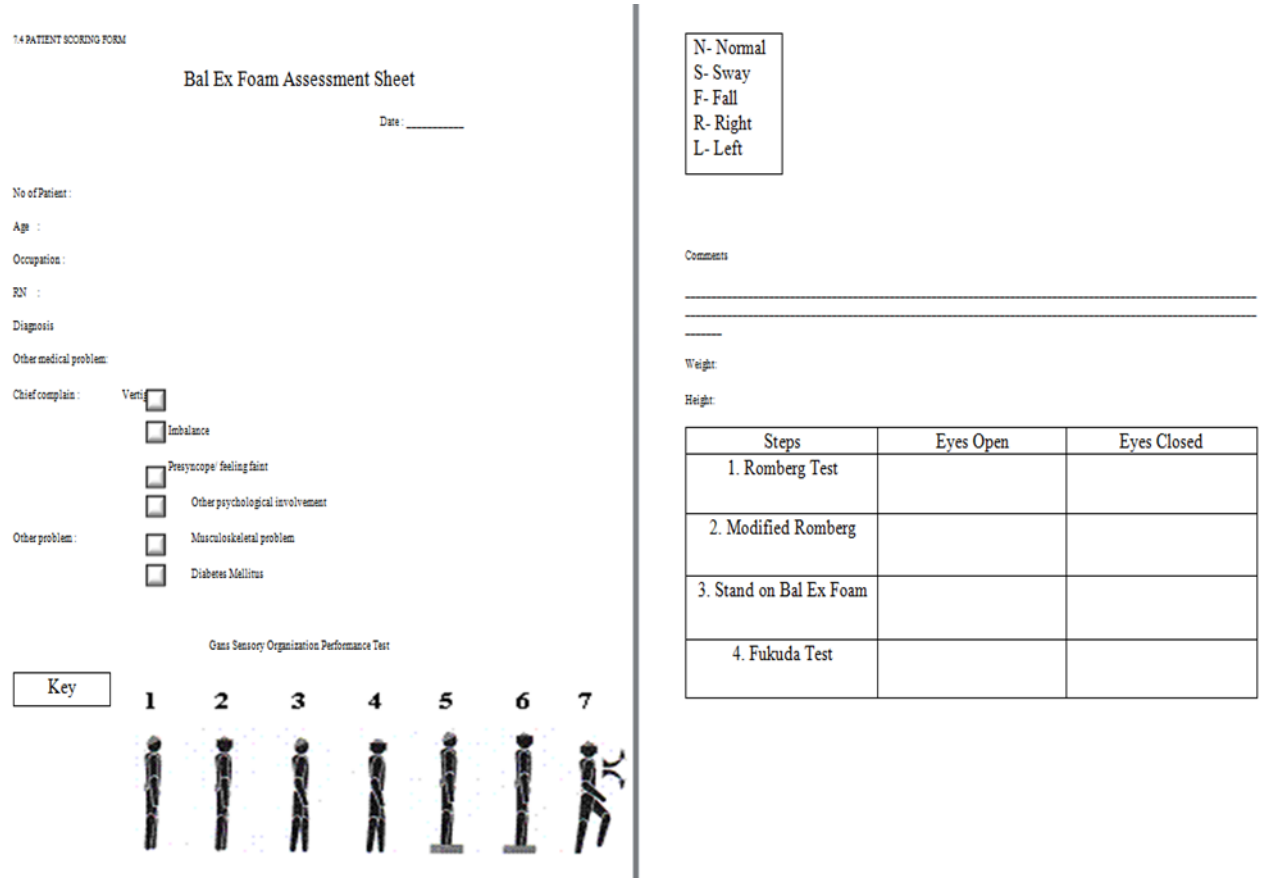
No history of chronic medical illness	-

3.2 Instrument Used

In this study, Bal Ex Foam will be use to measure the normative value among normal adults. This Bal Ex Foam also will be use in Clinical Test of Sensory Integration of Balance (CTSIB). Besides, this Bal Ex Foam is beneficial because it allow testing for even tall patients with a widened base of support. The Bal Ex Foam has a shaped of octagon and the texture of foam is a bit heavy compared with AIB Balance Performance Foam that was invented by American Institute of Balance. This assessment tool will be used in this study and it is mobile. It also easy to perform and can be use in short duration. The dimensions of the foam This Bal Ex Foam is consider one of the screening assessment and diagnostic equipment for balance disorder patients.

Figure 3.2: Bal Ex Foam

- **3.2.1 Participants scoring form**



7.4 PATIENT SCORING FORM

Bal Ex Foam Assessment Sheet

Date : _____

No of Patient :

Age :

Occupation :

RN :

Diagnosis

Other medical problem:

Chief complain : Verti

Imbalance

Presyncope/ feeling faint

Other psychological involvement

Other problem : Musculoskeletal problem

Diabetes Mellitus

Gaus Sensory Organization Performance Test

Key

1 2 3 4 5 6 7

N- Normal
S- Sway
F- Fall
R- Right
L- Left

Comments

Weight:

Height:

Steps	Eyes Open	Eyes Closed
1. Romberg Test		
2. Modified Romberg		
3. Stand on Bal Ex Foam		
4. Fukuda Test		

Figure 3.2.1: Patient scoring form

This form is used to evaluate the participant in the conditions as listed.

- **3.2.2 Malay Version Modified Vertigo Symptom Scale (MVMVSS)**

Participants need to answer the questionnaires as measure for a subject that consists of 14 items. These questionnaires are suitable for all ages and easy to understand.

- **3.2.3 Laser Light**

Figure 3.2.3: Laser Light

It is to use to point the degree of swaying of participants. The point will be marked on mahjong paper.

- **3.2.4 Mahjong Paper**

Participants' movement (swaying) will be marked on the paper during the test.

- **3.2.5 Stopwatch**

Each condition will be recorded using digital stopwatch

- **3.2.6 Location of Study**

The location of study is in Hospital USM and around Kota Bharu area.

- **3.2.7 Measuring angle**

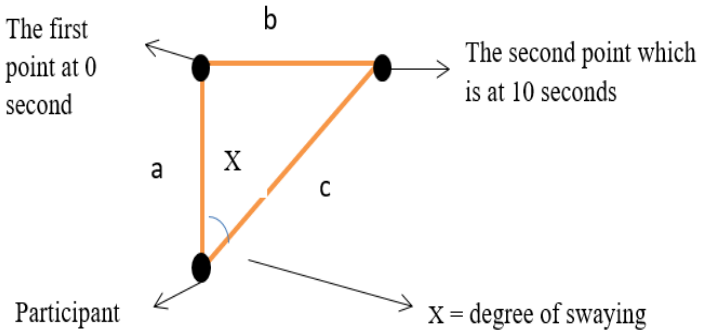


Figure 3.2.7: The measurement of degree of swaying that will be marked on Mahjong paper

Finding X ;

Tan X = opposite (a) / Adjacent (b)

X = Tan-1 (opposite (a) / Adjacent (b)

3.3 Procedure

The participants were selected randomly and approached personally. Next, the participants will be given a consent form. After they fill in the form, a history taking was carried out to ensure the participants were suitable for this study. Those participants that were not meet the requirements would excluded from this study. Voluntary participation were stressed and the subjects confidentiality was guaranteed.

Then, the participants answered the MVMVSS questionnaires after obtaining the written consent. The Gans SOP Test proceeded when there was a confirmation of no vertigo based on answers in MVMVSS. The estimated duration of the study was around 30 minutes. Break was given during the test upon participant's request. The Gans SOP Test conducted in 7 conditions which were:

1. Romberg test (Eyes open)

   In 10 seconds, participants were standing with feet together. In this condition, participants has to stand on firm, flat surface with eyes open. This condition serves as a baseline measures of the subject`s stability.

2. Romberg test (Eyes closed)

   This condition was same as the first step. The difference was that participants need to close their eyes. No visual input available in this step.

3. Modified Romberg Test (Eyes open)

   Participant would place his feet in heel-to-toe position with one foot directly in front of other. Hold it for 10 seconds

4. Modified Romberg Test (Eye closed)

   For 10 seconds, subject need to close their eyes and stand as in step 3.

5. Standing on the foam (Eyes open)

   Participants need to stand on the Bal Ex foam for 10 seconds. In this step, there was no somatosensory input.

6. Standing on the foam (Eyes closed)

   This step was same as step 5 except participants need to close their eyes in 10 seconds.

7. Fukuda Test

Participants marched 15 steps with eyes closed. After 15 steps, the participants must stay same as step 1 to remeasure the distance especially when there was movement during the marching.

3.4 Flowchart

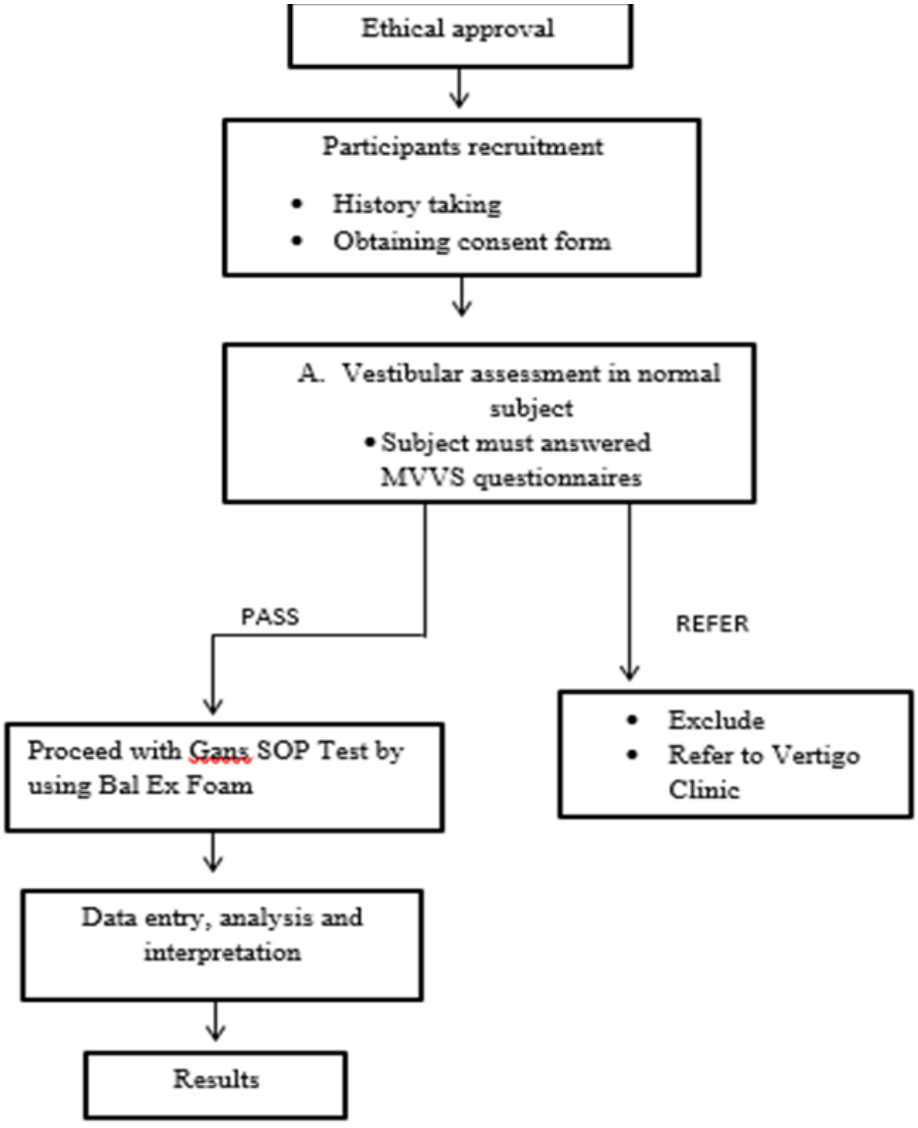


Figure 3.4: Flowchart of study procedure

CHAPTER 4

RESULTS

In this chapter, the results of the data analysis are presented. The data were collected and then analysed in response to the objectives of this study posed in chapter 1 of this thesis

4.0 Descriptions of subjects

A total of 47 subjects were recruited to join in this study based on inclusion and exclusion criteria. Prior to this study, all participants who agreed to participate in this study answered Malay Version Modified Vertigo Symptom Scale (MVMVSS). All of them had no balance problem, no hip or knee injury based on intensive history taking.

There are 63.83% (30 females) and 36.17% (17 males) in this study as shown in figure 4.0. The mean of ages ranging from 20 to 60 years old is 1.34.

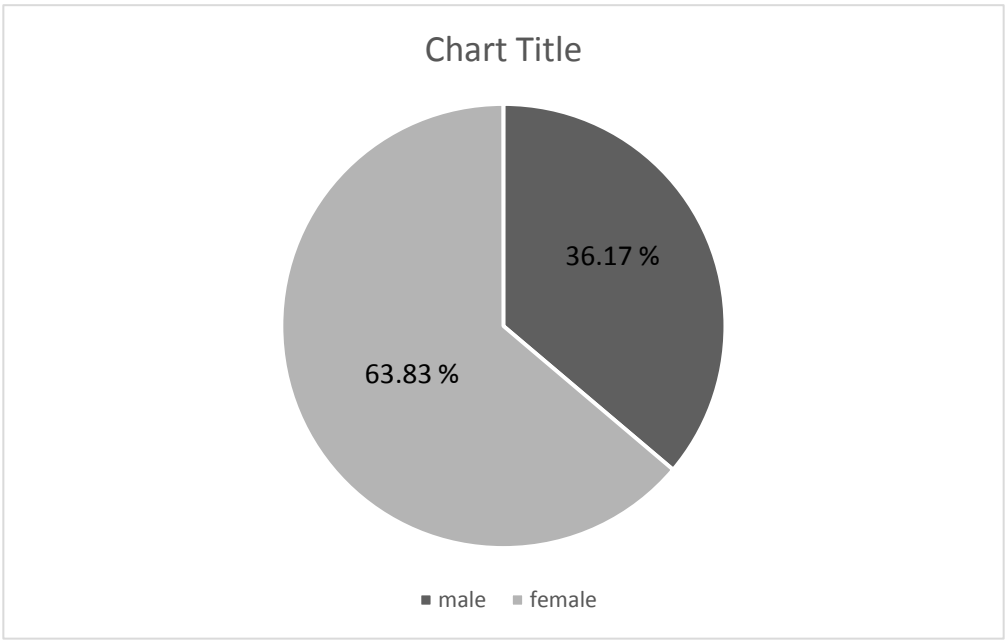


Figure 4.0: Gender distribution of participants

Meanwhile, in figure 4.0 (a) is the age distribution in percentage. The percentage for age 20-29 years old is 36%. Other than that, age of 30-39 years old has percentage of 6% and the least percentage for age distribution for this study would be 40 to 49 years old.

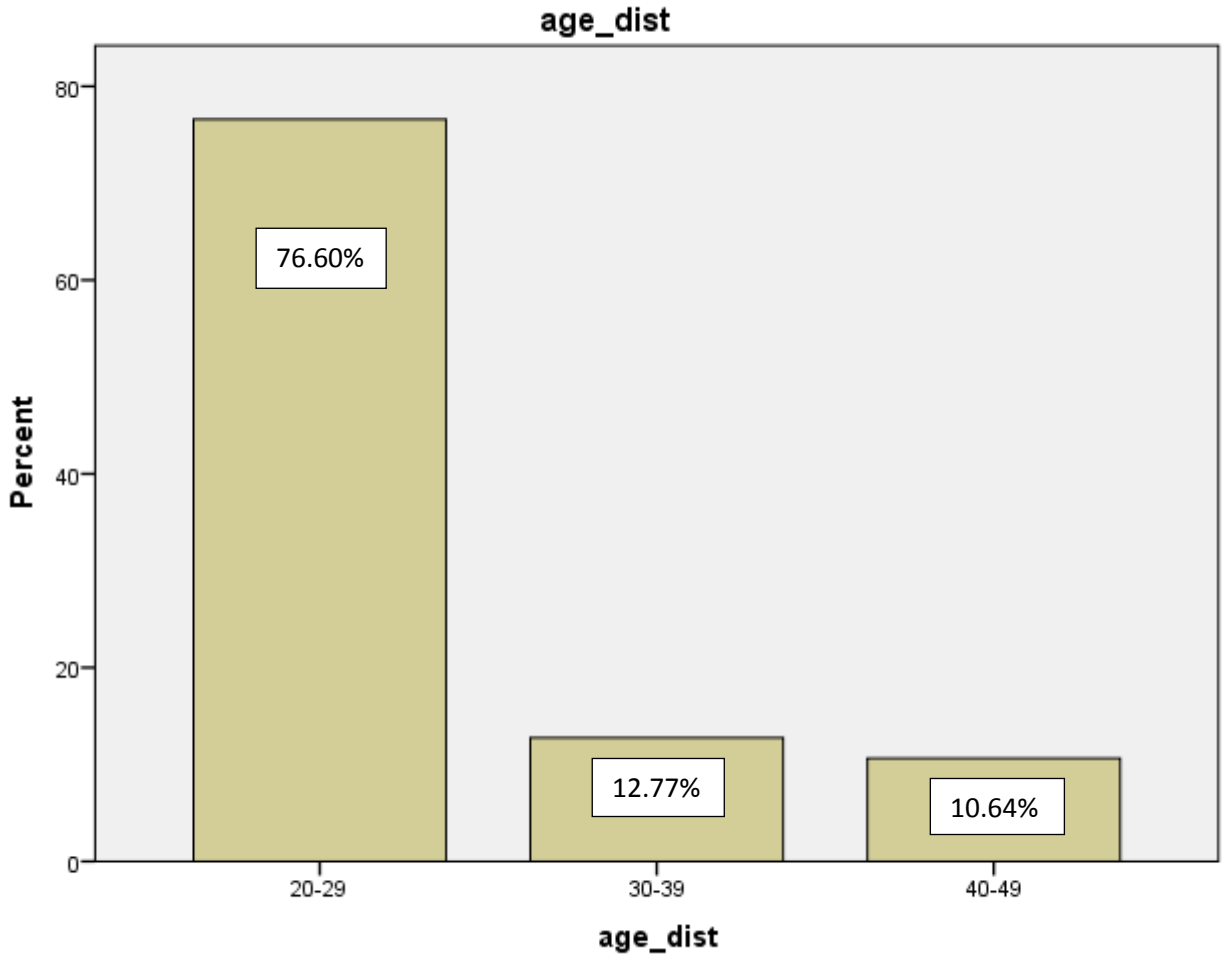


Figure 4.0 (a): Age distribution of participants in percentage

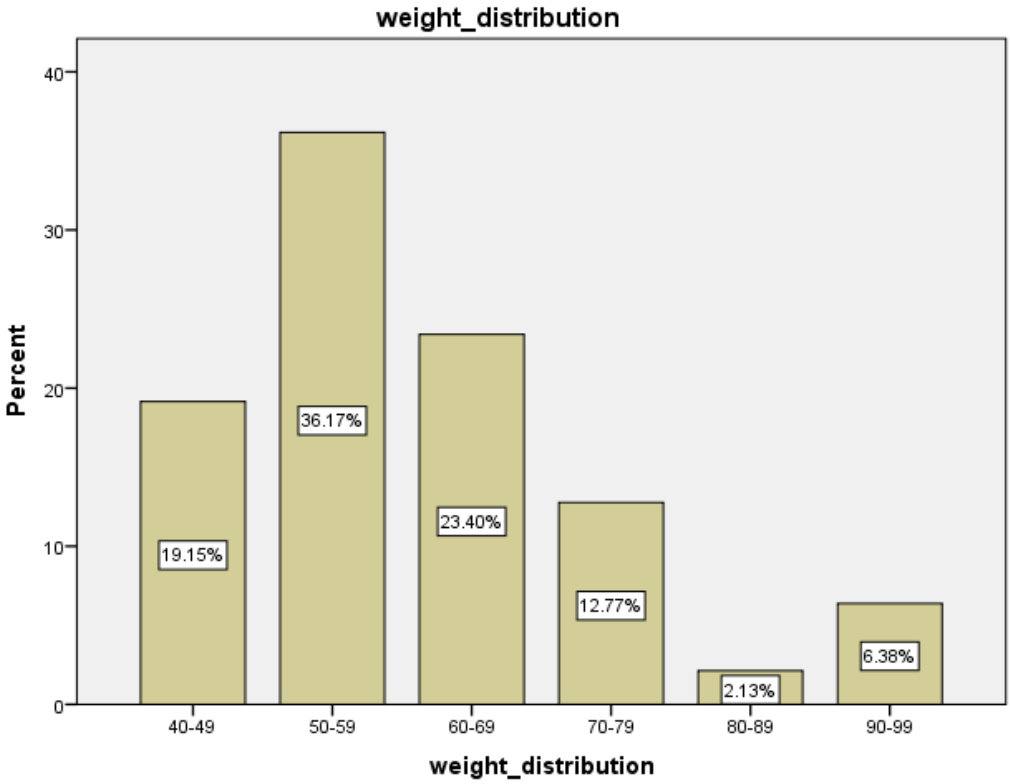


Figure 4.0 (b): Weight distribution of participants

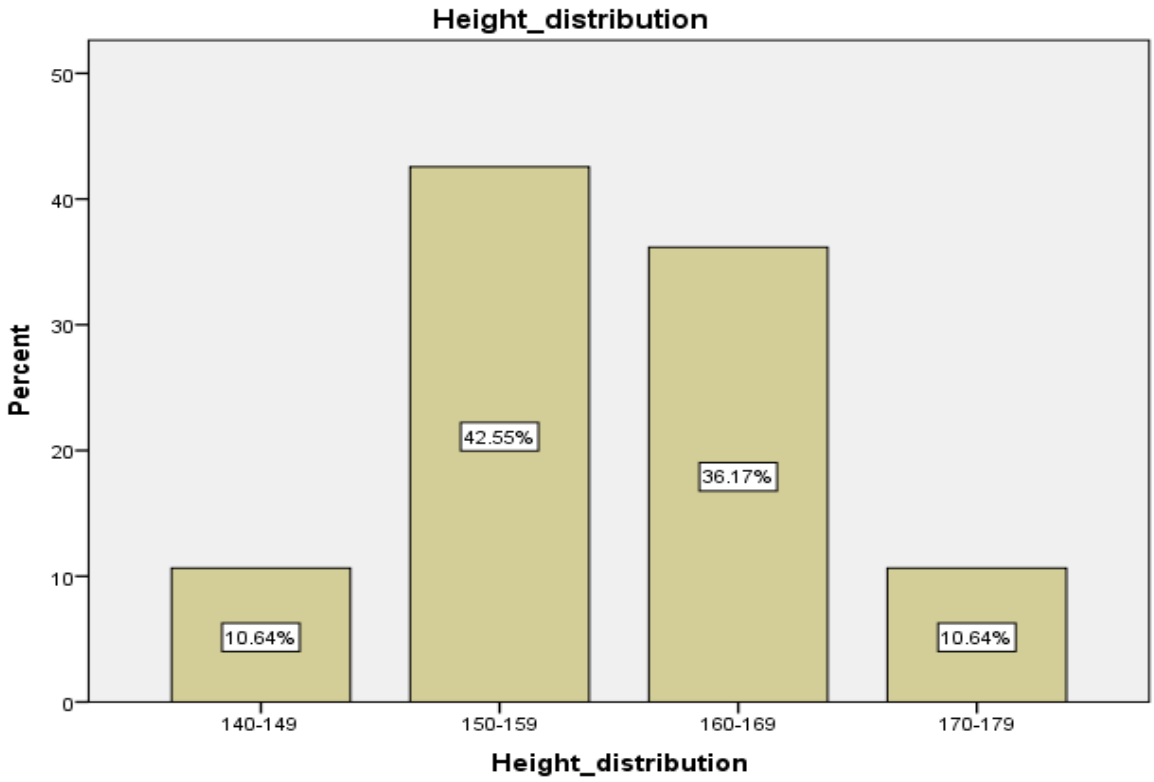


Figure 4.0 (b): Height distribution of participants

Figure 4.0 (b) shows weight distribution among participants. The highest percentage is 36.17% which is in category of 50 to 59 kg. The least category is in 80 to 89 kg with 2.13% and the mean is 1.67. Majority participants in this study have height of 150 to 159 cm with percentage of 42.55%. Mean for height distribution 1.47. Next, the height distribution varies across the study. Majority of the participants have height of 150-159 cm with the percentage of 42.55% and the minor group of participants have height of 140-149 cm and 170-179 cm with both percentage 10.64%.

(A) RELATIONSHIP BETWEEN WEIGHT AND GANS SOP TEST

4.1 Weight and Original Romberg Test

4.1.1 Relationship between weight and original Romberg test with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As shown in Table 4.1.1, no correlation was found between weight and the original Romberg test with eyes opened ($r=-0.037$, $p=0.802$).

Table 4.1.1 Correlational analysis between weight and start swaying of original Romberg test with eyes opened

Variables	**r**	**p-values**
Weight	-0.037	0.802
Start of swaying standing of Original Romberg with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.1.2 Relationship between weight and start swaying of Original Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.1.2, no correlation was found between weight and start swaying of original Romberg test with eyes closed ($r=-0.104$, $p=0.488$).

Table 4.1.2 Correlational analysis between weight and start swaying of Original Romberg Test with eyes closed

Variables	**r**	**p-values**
Weight	-0.104	0.488
Start of swaying Original Romberg with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.1.3 Relationship between weight and degree of swaying Original Romberg Test with eyes opened

The relationship between weight and the degree of original Romberg test with eyes opened could not be determined statistically as the data were invalid (all were “0”). However, based on the data, it can be concluded that there was no correlation between weight and degree of original Romberg test with eyes opened.

4.1.4 Relationship between weight and degree of swaying Original Romberg Test with eyes closed.

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As shown in Table 4.1.4, there is correlation was found between weight and degree of swaying original Romberg test with eyes closed ($r=-0.347$, $p=0.019$).

Table 4.1.4 Correlational analysis between weight and degree of swaying Original Romberg Test with eyes closed

Variables	r	p-values
Weight	-0.347	0.019
Degree of swaying Original Romberg with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.2 Weight and Modified Romberg Test

4.2.1 Relationship between weight and start swaying of Modified Romberg Test with eyes opened

The data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.2.1, no correlation was found between weight and start swaying of original Romberg test with eyes closed ($r=-0.133$, $p=0.372$).

Table 4.2.1 Correlational analysis between weight and start of swaying Modified Romberg Test with eyes opened

Variables	r	p-values
Weight	-0.133	0.372
Start swaying of modified Romberg with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.2.2 Relationship between weight and start of swaying Modified Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.2.2, no correlation was found between weight and start swaying of original Romberg test with eyes closed ($r=-0.189$, $p=0.204$).

Table 4.2.2 Correlational analysis between weight and start of swaying Modified Romberg Test with eyes closed

Variables	r	p-values
Weight	0.189	0.204
Start swaying of modified Romberg with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.2.3 Relationship between weight and degree of swaying Modified Romberg Test with eyes opened

The relationship between weight and the degree of modified Romberg test with eyes opened could not be determined statistically as the data were invalid (all were "0"). However, based on the data, it can be concluded that there was no correlation between weight and degree of Modified Romberg Test with eyes opened.

4.2.4 Relationship between weight and degree of swaying Modified Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.2.4, no correlation was found between weight and degree of swaying Modified Romberg Test with eyes closed ($r= 0.130$, $p=0.385$).

Table 4.2.4: Correlational analysis between weight and degree of swaying Modified Romberg Test with eyes closed

Variables	**r**	**p-values**
Weight	0.130	0.385
Start swaying of modified Romberg with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.3 Weight and standing on Bal Ex Foam

4.3.1 Relationship between weight and start swaying of standing on Bal Ex Foam with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.3.1, no correlation was found between weight and start swaying of standing on Bal Ex foam test with eyes opened ($r=-0.064$, $p=0.668$).

Table 4.3.1: Correlational analysis between weight and start of swaying standing on Bal Ex foam Test with eyes opened

Variables	**r**	**p-values**
Weight	-0.064	0.668
Start swaying of standing Bal Ex Foam with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.3.2 Relationship between weight and start swaying of standing on Bal Ex Foam with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.3.2, no correlation was found between weight and start swaying of original Romberg test with eyes closed ($r=0.128$, $p=0.390$).

Table 4.3.2 Correlational analysis between weight and start of swaying standing on Bal Ex foam Test with eyes opened.

Variables	r	p-values
Weight	0.128	0.390
Start swaying of standing Bal Ex Foam with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.3.3 Relationship between weight and degree of standing on Bal Ex Foam with eyes opened

The relationship between weight and the degree of standing on Bal Ex foam with eyes opened could not be determined statistically as the data were invalid (all were "0"). However, based on the data, it can be concluded that there was no correlation between weight and degree of standing on Bal Ex Foam with eyes opened.

4.3.4 Relationship between weight and degree of standing on Bal Ex Foam with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As shown in Table 4.3.4, no correlation was found between weight and degree of swaying standing on Bal Ex Foam test with eyes closed ($r=-0.065$, $p=0.667$).

Table 4.3.4: Correlational analysis between weight and degree of standing on Bal Ex Foam with eyes closed.

Variables	r	p-values
Weight	-0.065	0.667
Degree of standing Bal Ex Foam with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.3.5 Relationship between weight and degree of Fukuda Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.3.5, no correlation was found between weight and degree of Fukuda test with eyes closed ($r=0.189$, $p=0.204$).

Table 4.3.5: Correlational analysis between weight and degree of Fukuda Test with eyes closed

Variables	r	p-values
Weight	0.189	0.204
Degree of Fukuda Test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

(B) RELATIONSHIP BETWEEN HEIGHT AND GANS SOP TEST

4.4 Height and Original Romberg Test

4.4.1 Relationship between height and start of swaying original Romberg Test with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.4.1, no correlation was found between height and start swaying of original Romberg test with eyes opened ($r=0.106$, $p=0.478$).

Table 4.4.1 Correlational analysis between height and start of swaying original Romberg Test with eyes opened

Variables	**r**	**p-values**
Height	0.106	0.478
Start of sway original Romberg test with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.4.2 Relationship between height and start of swaying original Romberg test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As shown in Table 4.4.2, no correlation was found between height and start swaying of original Romberg test with eyes closed ($r=-0.001$, $p=0.966$).

Table 4.4.2 Correlational analysis between height and start of swaying original Romberg Test with eyes closed.

Variables	**r**	**p-values**
Height	-0.001	0.996
Start of sway original Romberg test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.4.3 Relationship between height and degree of swaying original Romberg test with eyes opened

The relationship between height and the degree of swaying Original Romberg Test with eyes opened could not be determined statistically as the data were invalid (all were “0”). However, based on the data, it can be concluded that there was no correlation between height and with degree of swaying Original Romberg Test with eyes opened.

4.4.4 Relationship between Height and degree of swaying original Romberg test with eyes closed.

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.4.4, no correlation was found between height and degree swaying of Original Romberg Test with eyes closed ($r=0.371$, $p=0.030$).

Table 4.4.4 Correlational analysis between height and degree of swaying Original Romberg Test with eyes closed

Variables	r	p-values
Height **Degree of sway original Romberg test with eyes closed**	0.371	0.030

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.5 Height and modified Romberg

4.5.1 Relationship between height and start swaying of modified Romberg test with eyes opened.

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.5.1, no correlation was found between height and start swaying of modified Romberg Test with eyes opened ($r=-0.061$, $p=0.683$).

Table 4.5.1 Correlational analysis between height and start of swaying of modified Romberg Test with eyes opened.

Variables	r	p-values
Height	-0.061	0.683
Start of swaying modified Romberg test with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.5.2 Relationship between height and start swaying of modified Romberg test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.5.2, no correlation was found between height and start swaying of Modified Romberg Test with eyes closed ($r=-0.101$, $p=0.501$).

Table 4.5.2: Correlational analysis between height and start of swaying Modified Romberg Test with eyes closed.

Variables	r	p-values
Height	0.101	0.501
Start of swaying modified Romberg test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.5.3 Relationship between height and degree of swaying modified Romberg test with eyes opened.

The relationship between height and the degree of swaying Modified Romberg Test with eyes opened could not be determined statistically as the data were invalid (all were "0"). However, based on the data, it can be concluded that there was no correlation between height and degree of swaying modified Romberg Test with eyes opened.

4.5.4 Relationship between height and degree of swaying modified Romberg test with eyes closed

Since the data were normally distributed ($p<0.05$), parametric test Pearson Correlation Test twas used for analysing the data. As revealed in Table 4.5.4, no correlation was found between height and start swaying of Modified Romberg Test with eyes closed ($r=0.226$, $p=0.127$).

Table 4.5.4 Correlational analysis between height and degree of swaying Modified Romberg Test with eyes closed

Variables	**r**	**p-values**
Height **degree of swaying modified Romberg test with eyes closed**	0.226	0.127

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.6 Height and standing on Bal Ex Foam

4.6.1 Relationship between height and start of swaying standing on Bal Ex Foam with eyes opened

Since the data were normally distributed ($p<0.05$), parametric test using Pearson Correlation Test was used for analysing the data. As revealed in Table 4.6.1, no correlation was found between height and start swaying of standing on Bal Ex foam with eyes opened ($r=-0.017$, $p=0.908$).

Table 4.6.1 Correlational analysis between height and start of swaying standing on Bal Ex foam with eyes opened.

Variables	**r**	**p-values**
Height	-0.017	0.908
Start of swaying standing on Bal Ex Foam test with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.6.2 Relationship between height and start of swaying standing on Bal Ex Foam with eyes closed

Since the data were normally distributed ($p<0.05$), using parametric test Pearson Correlation Test was used for analysing the data. As revealed in Table 4.6.2, no correlation was found between height Start of swaying standing on Bal Ex Foam test with eyes closed ($r=-0.102$, $p=0.494$).

Table 4.6.2 Correlational analysis between Height and start of swaying standing on Bal Ex foam Test with eyes closed.

Variables	r	p-values
Height	-0.102	0.494
Start of swaying standing on Bal Ex Foam test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.6.3 Relationship between height and degree of swaying standing on Bal Ex Foam with eyes opened

The relationship between height and the degree of swaying standing on Bal Ex Foam eyes opened could not be determined statistically as the data were invalid (all were "0"). However, based on the data, it can be concluded that there was no correlation between height and the degree of swaying standing on Bal Ex Foam eyes opened

4.6.4 Relationship between height and degree of swaying standing on Bal Ex Foam with eyes closed

Since the data were normally distributed ($p<0.05$), using parametric test Pearson Correlation Test was used for analysing the data. As revealed in Table 4.6.2, no correlation was found between height and Start of swaying standing on Bal Ex Foam test with eyes closed ($r=-0.102$, $p=0.494$).

Table 4.6.4 Correlational analysis between height and degree of swaying standing on Bal Ex foam with eyes closed.

Variables	r	p-values
Height	-0.017	0.908
Degree of swaying standing on Bal Ex Foam test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.7 Height and Fukuda Test

4.7.1 Relationship between height and degree of swaying Fukuda Test with eyes closed.

Since the data were normally distributed ($p<0.05$), using parametric test Pearson Correlation Test was used for analysing the data. As revealed in Table 4.7.1, no correlation was found between height and Degree of swaying standing on Bal Ex Foam test with eyes closed ($r=0.089$, $p=0.553$).

Table 4.7.1: Correlational analysis between height and degree of swaying Fukuda Test with eyes closed.

Variables	r	p-values
Height	0.089	0.553
Degree of swaying Fukuda test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

(C) RELATIONSHIP BETWEEN AGE AND GANS SOP TEST

4.8 Age and original Romberg test

4.8.1 Relationship between age and original Romberg Test with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As shown in Table 4.8.1, no correlation was found between age and start swaying of original Romberg test with eyes opened ($r=-0.203$, $p=0.171$).

Table 4.8.1 Correlational analysis between age and start of swaying original Romberg Test with eyes opened

Variables	r	p-values
Age	-0.203	0.171
Start of swaying original romberg test with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.8.2 Relationship between age and start of swaying original Romberg test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As shown in Table 4.8.2, no correlation was found between age and start swaying of original Romberg test with eyes closed ($r=-0.155$, $p=0.297$).

Table 4.8.2 Correlational analysis between age and start of swaying Original Romberg Test with eyes closed

Variables	R	p-values
Age	-0.155	0.297
Start of swaying original romberg test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.8.3 Relationship between age and degree of swaying original Romberg test with eyes opened

The relationship between age and degree of swaying original Romberg test with eyes opened could not be determined statistically as the data were invalid (all were "0"). However, based on the data, it can be concluded that there was no correlation between age and degree of swaying original Romberg test with eyes opened.

4.8.4 Relationship between age and degree of swaying original Romberg test with eyes closed.

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As shown in Table 4.8.4, no correlation was found between between age and degree of swaying original Romberg test with eyes closed.

($r=0.036$, $p=0.809$).

Table 4.8.4 Correlational analysis between age and degree of swaying original Romberg Test with eyes closed.

Variables	**r**	**p-values**
Age	0.036	0.809
degree of swaying original romberg test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.9 Age and Modified Romberg Test

4.9.1 Relationship between age and start of swaying modified Romberg test with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.9.1, there is correlation was found between age and start of swaying Modified Romberg Test with eyes opened ($r=-0.347$, $p=0.017$).

Table 4.9.1 Correlational analysis between age and start of swaying Modified Romberg Test with eyes opened

Variables	**r**	**p-values**
Age	-0.347	0.017
start of swaying Modified Romberg Test with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.9.2 Relationship between age and start of swaying Modified Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test using Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.9.2, no correlation was found between age and start of swaying Modified Romberg Test with eyes closed ($r=-0.069$, $p=0.647$).

Table 4.9.2 Correlational analysis between age and start of swaying Modified Romberg Test with eyes closed

Variables	r	p-values
Age **start of swaying Modified Romberg Test with eyes closed**	-0.069	0.647

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.9.3 Relationship between age and degree of swaying Modified Romberg Test with eyes opened.

The relationship between age and degree of swaying Modified Romberg Test with eyes opened could not be determined statistically as the data were invalid (all were “0”). However, based on the data, it can be concluded that there was no correlation between age and degree of swaying Modified Romberg Test with eyes opened.

4.9.4 Relationship between age and degree of swaying Modified Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test using Spearman Rank Correlation test was used for analysing the data. As shown in Table 4.9.4, no correlation was found between age and degree of swaying Modified Romberg Test with eyes closed($r=0.038$, $p=0.801$).

Table 4.9.4 Correlational analysis between age and degree of swaying Modified Romberg Test with eyes closed.

Variables	r	p-values
Age	0.038	0.801
Degree of swaying Modified Romberg Test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.10 Age and Standing on Bal Ex Foam

4.10.1 Relationship between age and start of swaying standing on Bal Ex Foam Test with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test using Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.10.1 no correlation was found between age and start of swaying standing on Bal Ex Foam Test with eyes opened ($r=-0.152$, $p=0.307$).

Table 4.10.1 Correlational analysis between age and start of swaying standing on Bal Ex foam with eyes opened.

Variables	r	p-values
Age	-0.152	0.307
Start of swaying standing on Bal Ex Foam Test with eyes opened		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.10.2 Relationship between sge and start of swaying standing on Bal Ex Foam Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test using Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.10.2, no correlation was found between age and start of swaying standing on Bal Ex Foam Test with eyes closed ($r=-0.024$, $p=0.837$).

Table 4.10.2 Correlational analysis between age and start of swaying standing on Bal Ex Foam Test with eyes closed.

Variables	**r**	**p-values**
Age	-0.024	0.837
Start of swaying standing on Bal Ex Foam Test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.10.3 Relationship between age and degree of swaying standing on Bal Ex Foam Test with eyes opened

The relationship between age and degree of swaying standing on Bal Ex Foam Test with eyes opened could not be determined statistically as the data were invalid (all were “0”). However, based on the data, it can be concluded that there was no correlation between age and degree of swaying standing on Bal Ex Foam Test with eyes opened

4.10.4 Relationship between age and degree of swaying standing on Bal Ex Foam with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test using Spearman Rank Correlation test was used for analysing the data. As revealed in Table 4.10.4, no correlation was found between age and degree of swaying standing on Bal Ex Foam with eyes closed ($r=0.147$, $p=0.324$).

Table 4.10.4 Correlational analysis between age and degree of swaying standing on Bal Ex Foam with eyes closed

Variables	**r**	**p-values**
Age	0.147	0.324
Degree of swaying standing on Bal Ex Foam Test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

4.11 Age and Fukuda Test

4.11.1 Relationship between age and degree of swaying Fukuda Test with eyes closed

Since the data were normally distributed ($p<0.05$), parametric test using Pearson Correlation Test was used for analysing the data. As revealed in Table 4.11.1, no correlation was found between age and degree of swaying Fukuda Test with eyes closed ($r=0.273$, $p=0.063$).

Table 4.11.1 Correlational analysis between age and degree of swaying Fukuda Test with eyes closed

Variables	r	p-values
Age	0.273	0.063
Degree of swaying Fukuda Test with eyes closed		

Correlation coefficient was significant at the 0.05 level (2-tailed)

(D) RELATIONSHIP BETWEEN GENDER AND GANS SOP TEST

4.12 Gender and original Romberg Test

4.12.1 Relationship between gender and start of swaying original Romberg Test with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test using Mann-Whitney Test was used for analysing the data. As revealed in Table 4.12.1, no correlation was found between gender and start of swaying original Romberg Test with eyes opened ($Z=-0.137$, $p=0.891$).

Table 4.12.1 Correlational analysis between gender and start of swaying original Romberg Test with eyes opened

Variable	Median (IQR)		Z statistic	p value
Start of swaying original Romberg Test with eyes opened	Male	Female	-0.137	0.891
	5.00 (3.5)	5.00 (2.0)		

4.12.2 Relationship between gender and start of swaying original Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.12.2, no correlation was found between gender and start of swaying Original Romberg Test with eyes closed ($Z=-0.633$, $p=0.527$).

Table 4.12.2 Correlational analysis between gender and start of swaying Original Romberg Test with eyes closed.

Variable	**Median (IQR)**		**Z statistic**	**p value**
Start of swaying original Romberg Test with eyes closed	Male	Female	-0.633	0.527
	3.00 (2.5)	3.00 (1.5)		

4.12.3 Relationship between gender and degree of swaying original Romberg Test with eyes opened

The relationship between gender and degree of swaying original Romberg Test with eyes opened could not be determined statistically as the data were invalid (all were “0”). However, based on the data, it can be concluded that there was no correlation between gender and degree of swaying original Romberg Test with eyes opened

4.12.4 Relationship between gender and degree of swaying original Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.12.2, there is correlation was found between gender and degree of swaying Original Romberg Test with eyes closed ($Z=-2.351$, $p=0.019$).

Table 4.12.4 Correlational analysis between gender and degree of swaying Original Romberg Test with eyes closed

Variable	**Median (IQR)**		**Z statistic**	**p value**
Degree of swaying original Romberg Test with eyes closed	Male	Female	-2.351	0.019
	0(0)	-		

4.13 Gender and Modified Romberg Test

4.13.1 Relationship between gender and Start of swaying modified Romberg Test with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.13.1 , no correlation was found between Gender and Start of swaying modified Romberg Test with eyes opened ($Z=-0.782$, $p=0.434$).

Table 4.13.1 Correlational analysis between Gender and Start of swaying modified Romberg Test with eyes opened

Variable	Median (IQR)		Z statistic	p value
Start of swaying Modified Romberg Test with eyes opened	Male	Female	-0.782	0.434
	4.00(2)	4.00(2)		

4.13.2 Relationship between gender and start of swaying modified Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.13.2, no correlation was found between gender and start of swaying modified Romberg Test with eyes closed ($Z=-0.326$, $p=0.745$).

Table 4.13.2 Correlational analysis between gender and start of swaying modified Romberg Test with eyes closed

Variable	**Median (IQR)**		**Z statistic**	**p value**
Start of swaying Modified Romberg Test with eyes closed	Male	Female	-0.326	0.745
	2.00(1)	2.00(0)		

4.13.3 Relationship between gender and degree of swaying Modified Romberg Test with eyes opened

The relationship between gender and degree of swaying Modified Romberg Test with eyes opened could not be determined statistically as the data were invalid (all were "0"). However, based on the data, it can be concluded that there was no correlation between gender and degree of swaying Modified Romberg Test with eyes opened

4.13.4 Relationship between gender and degree of swaying Modified Romberg Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.13.4, there is correlation was found between gender and degree of swaying Modified Romberg Test with eyes closed ($Z=-2.799$, $p=0.005$).

Table 4.13.4 Correlational analysis between gender and degree of swaying Modified Romberg Test with eyes closed

Variable	Median (IQR)		Z statistic	p value
Degree of swaying Modified Romberg Test with eyes closed	Male	Female	-2.799	0.005
	39.73(52.72)	0.00(0)		

4.14 Gender and standing on Bal Ex Foam

4.14.1 Relationship between gender and start of swaying standing on Bal Ex Foam Test with eyes opened

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.14.1, no correlation was found between gender and start of swaying standing on Bal Ex foam test with eyes opened closed ($Z=-0.414$, $p=0.679$)

Table 4.14.1 Correlational analysis between gender and start of swaying standing on Bal Ex foam test with eyes opened

Variable	**Median (IQR)**		**Z statistic**	**p value**
Start of swaying standing on Bal Ex Foam Test with eyes opened	Male	Female	-0.414	0.679
	4.00(2)	4.00 (1)		

4.14.2 Relationship between gender and start of swaying standing on Bal Ex Foam Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.14.2, no correlation was found between gender and start of swaying standing on Bal Ex foam test with eyes closed ($Z=-0.514$, $p=-0.653$)

Table 4.14.2 Correlational analysis between gender and start of swaying standing on Bal Ex foam test with eyes closed.

Variable	**Median (IQR)**		**Z statistic**	**p value**
Start of swaying standing on Bal Ex Foam Test with eyes closed	Male	Female	0.514	-0.653
	2.00 (1)	2.00 (2)		

4.14.3 Relationship between gender and degree of swaying standing on Bal Ex Foam Test with eyes opened

The relationship between gender and degree of swaying standing on Bal Ex Foam Test with eyes opened could not be determined statistically as the data were invalid (all were “0”). However, based on the data, it can be concluded that there was no correlation between gender and degree of swaying standing on Bal Ex Foam Test with eyes opened.

4.14.4 Relationship between gender and degree of swaying standing on Bal Ex Foam Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.14.4, no correlation was found between gender and degree of swaying standing on Bal Ex Foam Test with eyes closed ($Z=-1.340$, $p=0.180$)

Table 4.14.4 Correlational analysis between gender and degree of swaying standing on Bal Ex foam test with eyes closed.

Variable	**Median (IQR)**		**Z statistic**	**p value**
Degree of swaying standing on Bal Ex Foam Test with eyes closed	Male	Female	-1.340	0.180
	21.25 (63.82)	50.69 (20.61)		

4.15 Gender and Fukuda Test

4.15.1 Relationship between gender and degree of swaying Fukuda Test with eyes closed

Since the data were not normally distributed ($p<0.05$), non-parametric test Mann-Whitney Test was used for analysing the data. As revealed in Table 4.15.1, no correlation was found between gender and degree of swaying Fukuda Test with eyes closed. ($Z=2.004$, $p=0.051$)

Table 4.15.1 Correlational analysis between gender and degree of swaying Fukuda Test with eyes closed.

Variable	Median (IQR)		t statistic	p value
Degree of swaying Fukuda Test with eyes closed	Male	Female	2.004	0.051
	51.74(14.02)	43.39(13.55)		

4.16 Establishing Normative Value

Based on our study, we derived normative values for Gans Sensory Performance Test by using 90% range as illustrated in table 4.16.

Conditions	**Starting time of swaying (seconds)**	**Degree of swaying (^{0})**
Original Romberg (eyes opened)	3.00-10.00	0.00
Original Romberg (eyes closed)	1.00-7.40	0.00-27.06
Modified Romberg (eyes opened)	3.00-6.00	0.00
Modified Romberg (eyes closed)	1.00-4.00	0.00-58.01
Standing on Bal Ex Foam (eyes opened)	1.00-4.00	0.00
Standing on Bal Ex Foam (eyes closed)	1.00-2.34	0.00-72.53
Fukuda Test	-	26.60-70.91

Table 4.16: Normative values for Gans Sensory Organization Performance Test among normal adult for different ages, weight and height

CHAPTER 5

DISCUSSION

The purpose of this study is to determine normative values for Gans Sensory Organization Performance (SOP) Test by using Bal Ex foam among normal adults. Other than that, we would like to know the correlation between age, gender, weight and height with the results of Gans Sensory Organization Performance Test in all 7 conditions.

5.1 Balance Evaluation

The main purpose to evaluate balance as stated by Horak (as cited by Mancini, 2010) are to identify whether the patient has a balance problem or not and to determine the underlying causes of balance problem. Patient need to know if there is problem with balance. This is to decrease the risk of falls for a patient (Mancini, 2010). Apart from this, balance evaluation helps medical practitioners directly to suitable intervention and proper management. Once again, balance evaluation helps to determine whether the intervention is effective or not (Mancini, 2010). Dejardin (2008) revealed that head position influences the direction of postural deviation. This is because it is usually opposite to the direction of the fast phase of nystagmus.

After years, Romberg test has been used widely for assessment and screening balance problems (Cohen, 2014). There are a lot of clinical balance test to assess balance. These approaches can be divided into 3 groups: functional assessments, a systems/physiological assessments, and quantitative assessments by Horak (as cited by Mancini, 2010). Computerize versions such as computerized dynamic posturography is not suitable for clinical setting for situations requiring rapid screening (Cohen, 2014). Thus, it would be helpful if there is equipment that are portable and small to comprehend a hectic situations that will include Clinical Test of Sensory Interaction and Balance (CTSIB)

5.2 The correlational between age, gender, height and weight in Gans SOP Test among normal adults.

Spearman Rank Correlation Test and Pearson's Correlation Test were used to determine the correlational between age, gender, height and weight Gans SOP Test. In this findings, there is no correlation between weight and Gans SOP Test. Meanwhile, height, gender, and age shows there were significant difference in degree of swaying original Romberg Test with eyes closed, degree of swaying modified Romberg Test with eyes opened and closed . However, the correlation were weak, thus, specific normative value could not be obtained. It can be summarised as follows:

1. Gender and degree of swaying original Romberg eyes closed (condition 1)
2. Height and degree of swaying Original Romberg Test eyes closed (condition 2)
3. Age and start of swaying modified Romberg Test eyes opened (condition 3)
4. Gender and degree of modified Romberg eyes closed (condition 4)

This topic of study is not widely discussed. Thus, it can only be compared with a few research only.

5.3 The normative value for Gans SOP Test

5.3.1 Normative values in Original Romberg with eyes open (condition 1) and eyes closed (condition 2)

In original Romberg test with eyes opened, the starting time of swaying, 3.00-10.00 seconds was delayed compared to eyes closed, 1.00-7.40. While in degree of swaying, the value for original Romberg with eyes closed, 0.00^{o}-$27.06^{o\ I}$ is greater than original Romberg Test with eyes opened 0.00^{o}

5.3.2 Normative values in modified Romberg Test with eyes opened (condition 3) and eyes closed (condition 4)

Starting time of swaying in Modified Romberg Test with eyes closed 1.00-4.00 seconds which is much faster that during eyes opened 3.00-6.00 seconds. Next, the degree of swaying with eyes closed shows 0.00^{o}- 58.50^{o} compared to during eyes opened with 0.00^{o}.

This correspond to the previous findings by Horlings in 2009 stated that vestibular and proprioceptive sensory information is considered essential for stable balance. If one of the proprioceptive sensory information is missing, stance suddenly becomes unstable due to not properly generated and a fall will occur (Horlings, 2009). This may result in a faster time of swaying and greater degree of swaying during eyes closed.

5.3.3 Normative values when standing on Bal Ex Foam with eyes opened (conditions 5) and eyes closed (condition 6)

The normative value showed that starting time of swaying during eyes closed 1.00-4.00 seconds compared during eyes opened 3.00-6.00 seconds. Next, the degree of swaying with eyes closed shows 0.00^{o}-72.53^{o} while during eyes opened shows 0.00^{0}

If we compared during eyes closed and eyes opened, the starting time and degree of swaying during eyes closed is greater than eyes opened. Condition 6 is much more challenging than condition 5 where one of the proprioceptive sensory input is missing (Horlings, 2009). It depends mostly on the vestibular system.

5.3.4 Normative values in Fukuda Test (condition 7)

Degree of swaying in Fukuda Test shows 26.60^{o}- 70.90^{o}. According to Dejarding (2008), an individual that rotate for more than 30^{o} during the test indicate positive findings. In this study, we can say it is within normal range which is less than 30^{o}.

5.4 Relationship between age, gender, height and weight in Romberg Test with eyes opened and eyes closed

This study indicate that weight has no relationship with Romberg Test during eyes opened and eyes closed. This is similar with previous study (Siddiqah, 2015) that shows no relationship in terms of weight and Romberg Test during eyes opened and eyes closed. However, it contradicts with the study that shows there is a relationship in terms of age, height and gender. This is due to unequal group of gender and range of age and height.

5.5 Relationship between age, gender, height and weight in Modified Romberg Test with eyes opened and eyes closed.

Results in this study shows that height and weight has no correlation with Modified Romberg Test with eyes opened and eyes closed. Meanwhile, there is correlation between age and starting of swaying eyes opened. There is correlation between gender and the degree of swaying during eyes closed. The gender correlation is similar with previous study by Stansberry et al (2009) that did not differentiate between young and older adults but opposite with (Speers, 1998) where it shows significant difference in performance between young and older healthy woman.

5.6 Relationship between age, gender, height and weight when standing on the Bal Ex Foam with eyes opened and closed

The results in this study showed there were no correlation between age, gender, height and weight with starting time of swaying eyes opened and eyes closed. There were also no correlation between age, gender, height and weight with the degree of swaying eyes opened and eyes closed. Previous study by Siddiqah (2015) shows similar results with AIB Performance Foam. It does not affected by the age, gender, height and weight.

Thus, it shows the Bal Ex Foam is suitable for all types of people and does not affected by other factors. It also indicate Bal Ex foam also show similar function as AIB Performance foam.

5.7 Relationship between age, gender, height and weight with Fukuda Test

The results in this study shows that there were no correlation between age, gender, height and weight with Fukuda Test. However, the study contradict with the previous study. According to Dejardin (2008), the test-retest reliability has been questioned by a few authors. There was significant correlation between age and angle rotation (Dejardin, 2008). This is because a new protocol has be established which included 45 steps, with arms alongside the body. This study only involved 15 steps which we do not see the significant of angle.

5.9 Study limitation and recommendations

After carried out this study, there are some limitations throughout conducted this study. This study was carried out as preliminary study where the amount of participant is small. This is because of certain limitation that could not be done with bigger sample size. The small sample size that were used in this study is smaller thus it may not represent the actual population. Besides, participants of aged 40 years old and above refused to join in this study because they were not interested to know their balance condition. A lot of participants need to

consider before recruit them according to inclusion and exclusion criteria. Thus, this study need to conduct in a bigger sample size to accurately determine the normative value.

Next, time limitation. Hopefully, collection data period can be longer. This is because participants mostly from 20 to 30 years old. Participants with aged 40 years old and above were not easy to recruit because they were not interested. If there is enough time, more participants can be recruit especially with aged 40 years old and above.

Other than that, mostly participants were recruited in the clinic. Vestibular testing room was quite far from the clinic in hospital. Hence, they refused to join in this study. There was no available room in the clinic. It is important to have small room to accommodate for this study.

CHAPTER 6

CONCLUSION

The main purpose of this study is to determine the normative value for Gans SOP Test by Bal Ex Foam among normal adults. In order to find out the normative value, few factors need to eliminate. Weight, height and age need to be consider because it might be associated the results Gans SOP Test. In this study, we can say that there is no significant difference between weight, height and age with the results Gans SOP Test. Hence, this test can be use in clinical setting regardless of age, weight, and height.

During the test with eyes opened and closed, it can be observed that there is effect on each test. This is because of eyes opened are one of the sensory input to maintain good balance. When eyes are closed, there is no input from eyes. An individual will depend on input from muscle and joints, and input from the vestibular system.

Input from the muscle and joints is the proprioceptive information from the skin, muscles, and joints involves sensory receptors that are sensitive to stretch or pressure in the surrounding tissues. Cues from the ankles indicate the body's movement or sway relative to both the standing surface (floor or ground) and the quality of that surface (for example, hard, soft, slippery, or uneven). Meanwhile, input from vestibular system. It is sensory information about motion, equilibrium, and spatial orientation is provided by the vestibular apparatus, which in each ear includes the utricle, saccule, and three semicircular canals.

To conclude, this Bal Ex Test can be apply to the clinical setting because of easy, mobile and cost-effective.

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APPENDICES

Appendix A: Consent Form

JAWATANKUASA ETIKA PENYELIDIKAN (MANUSIA) - JEPeM

JEPeM-USM

BORANG ETIKA - 02

BORANG MAKLUMAT DAN KEIZINAN PESAKIT/ SUBJEK
PATIENT INFORMATION AND CONSENT FORM
(PROJEK PENYELIDIKAN)
(RESEARCH PROJECT)

LAMPIRAN A

MAKLUMAT KAJIAN

Tajuk Kajian: **Penentuan Nilai Normatif Ujian Organisasi Sensori Gans Menggunakan 'Bal Ex Foam' dalam Kalangan Dewasa: Pengenalan Kajian**

Nama Penyelidik: **Syarifah Nurul Athira Bt Syed Ahmad**
Penyelia Projek: **Dr Zuraida bt Zainun (No. MMC: 39997)**
Penyelia Bersama: Dr Mohammad Normani Zakaria

PENGENALAN

Anda dipelawa untuk menyertai satu kajian penyelidikan secara sukarela yang akan melibatkan ujian keseimbangan. Adalah penting untuk ada membaca dan memahami borang ini sebelum anda menyertai kajian yang akn dijalankan ini. Anda akan dapat melihat di dalam borang ini berkenaan tujuan kajian, kelayakan penyertaan, prosedur kajian, melaporkan sejarah kesihatan anda serta manfaat terhadap individu, komuniti dan universiti malah kerahsiaan di dalam maklumat perubatan. Penyertaan anda dalam kajian ini dijangka mengambil masa hanya selama 30 minit. Seramai 52 orang peserta akan menyertai kajian ini.

TUJUAN KAJIAN

Tujuan kajian ini diadakan adalah untuk mencari penentuan nilai normatif ujian Organisasi Sensori Gans dengan menggunakan 'Bal Ex Foam' dalam kalangan dewasa. Terdapat kemungkinan maklumat yang dikumpulkan semasa kajian akan dianalisis oleh pihak penyelidik pada masa depan untuk penambahbaikan keberkesanan ujian ini atau untuk tujuan perubatan.

KELAYAKAN PENYERTAAN

Adalah penting anda berterus terang kepada penyelidik atau penyelia tentang sejarah kesihatan anda. Ini bagi mengelakkan perkara yang tidak diingini berlaku. Anda tidak seharusnya menyertai kajian ini sekiranya anda tidak memenuhi semua syarat kelayakan.

Anda **layak** menyertai kajian ini sekiranya anda :

- Berumur 20-55 tahun
- Tidak mengalami masalah dengan situasi yang bergerak
- Tiada masalah kesihatan yang kronik
- Tiada mengalami masalah keseimbangan badan
- Tiada kecederaan di lutut atau peha
- Tiada masalah tulang

Anda tidak boleh menyertai kajian ini sekiranya –

- Mengandung
- Mempunyai masalah penyakit lutut
- Mempunyai masalah keseimbangan
- Mempunyai masalah penyakit kronik

PROSEDUR-PROSEDUR KAJIAN

Kajian ini akan dilakukan dalam kalangan mereka yang tidak mengalami masalah dalam persekitaran yang bergerak dan dewasa yang normal di Hospital Universiti Sains Malaysia (HUSM). Kajian hanya akan dijalankan setelah mendapat kelulusan daripada pihak jawatankuasa etika penyelidikan.

Apabila anda bersetuju untuk menyertai kajian ini, anda perlu membaca dan mengisi borang maklumat dan keizinan responden. Setelah itu, akan ditanya beberapa soalan dan diminta untuk melengkapkan Skala Simptom “Modified Vertigo”. Jika anda tidak mengalami masalah dalam persekitaran yang bergerak dan memenuhi kriteria yang diperlukan, anda akan dikategorikan di dalam kumpulan normal.Selepas itu, anda akan menjalani ujian Gans SOP yang mempunyai 7 keadaan yang berbeza. Anda akan diminta untuk menanggalkan kasut, stoking dan berdiri tegak. Kemudian, anda akan dipakai topi yang mempunyai lampu laser. Anda juga akan berdiri dalam jarak 1 meter dari dinding. Secara umumnya, percakapan tidak dibenarkan semasa ujian dijalankan. Tujuh langkah tersebut ialah:

a. Ujian Romberg (mata dibuka)

b. Ujian Romberg (mata ditutup)

c. Modified Romberg test (eyes open)

d. Modified Romberg test (eyes closed)

e. Berdiri di atas span (mata dibuka)

f. Berdiri di atas span (mata ditutup)

g. Ujian Fukuda

RISIKO

Secara keseluruhan, kajian ini tidak mempunyai apa-apa risiko yang berbahaya. Kajian ini hanya melibatkan beberapa penggunan borang soal selidik dan span lembut yang digunakan untuk peserta kajian berdiri di atasnya kurang satu minit.

MELAPORKAN PENGALAMAN KESIHATAN

Jika anda mengalami kecederaan, kesan buruk atau pengalaman kesihatan yang luar biasa semasa kajian ini, pastikan anda memberitahu Cik Syarifah Nurul Athira Bt Syed Ahmad (012 575 2995) atau Dr. Zuraida bt Zainun (017 942 7395). Anda boleh membuat pnggilan pada bila-bila masa untuk melaporkan.

PENYERTAAN DALAM KAJIAN

Penyertaan anda dalam kajian ini adalah secara sukarela. Pada bila-bila masa anda berhak menolak untuk menyertai kajian ini atau anda boleh menamatkan penyertaan anda tanpa sebarang hukuman atau kehilangan manfaat yang sepatutnya anda perolehi. Kakitangan yang terlibat dalam kajian ini juga boleh memberhentikan penyertaan anda tanpa persetujuan anda. Kakitangan yang terlibat dalam kajian ini juga akan berbincang dengan anda mengenai apa-apa isu perubatan berkenaan dengan pemberhentian penyertaan anda.

MANFAAT YANG MUNGKIN [Manfaat terhadap Individu, Masyarakat, Universiti]

Prosedur yang dijalankan akan diberikan tidak melibat sebarang kos. Anda juga menerima maklumat tentang kesihatan anda daripada pemeriksaan fizikal dan ujian makmal yang dilakukan dalam kajian ini. Hasil atau maklumat kajian ini diharapkan, dapat memberi manfaat kepada responden-responden lain pada masa hadapan. Selain itu, hasil kajian yng diperoleh akan membantu ahli klinikal mengesan pesakit yang mempunyai masalah berkaitan keseimbangan dengan mudah dan cepat.

PERSOALAN

Sekiranya anda mempunyai sebarang soalan mengenai prosedur kajian ini atau hak-hak anda, sila hubungi;

Dr Zuraida bt Zainun (No. MMC: 39997)
Pensyarah Audiologi
Pusat Pengajian Sains Kesihatan
USM Kampus Kesihatan
017-9427395

Sekiranya anda mempunyai sebarang soalan berkaitan kelulusan Etika atau sebarang pertanyaan dan masalah berkaitan kajian ini, sila hubungi;

En. Mohd Bazlan Hafidz Mukrim
Setiausaha Jawatankuasa Etika Penyelidikan (Manusia) USM
Pusat Inisiatif Penyelidikan -Sains Klinikal & Kesihatan
USM Kampus Kesihatan.
No. Tel: 09-767 2354 / 09-767 2362
Email : bazlan@usm.my/jepem@usm.my

KERAHSIAAN

Maklumat perubatan anda akan dirahsiakan oleh kakitangan kajian. Ianya tidak akan dedahkan secara umum melainkan jika ia dikehendaki oleh undang-undang. Data yang diperolehi dari kajian yang tidak mengenalpasti anda secara perseorangan mungkin akan diterbitkan untuk tujuan memberi pengetahuan baru. Rekod perubatan anda yang asal mungkin akan dilihat oleh penyelidik, Lembaga Etika kajian ini dan pihak berkuasa regulatori untuk tujuan mengesahkan prosedur dan/atau data kajian klinikal. Maklumat perubatan anda mungkin akan disimpan dalam komputer dan diproses dengannya. Dengan menandatangani borang persetujuan ini, anda membenarkan penelitian rekod, penyimpanan maklumat dan pemindahan data seperti yang dihuraikan di atas

TANDATANGAN

Untuk dimasukkan ke dalam kajian ini, anda atau wakil sah anda mesti menandatangani serta mencatatkan tarikh halaman tandatangan (Lihat contoh Borang Keizinan Pesakit di **LAMPIRAN S** atau **LAMPIRAN G (untuk sampel genetik)** atau **LAMPIRAN P**).

LAMPIRAN S

Borang Keizinan Pesakit/ Subjek (Halaman Tandatangan)

Tajuk Kajian: **Penentuan Nilai Normatif Ujian Organisasi Sensori Gans Menggunakan 'Bal Ex Foam' dalam Kalangan Dewasa: Pengenalan Kajian.**

Nama Penyelidik: **Syarifah Nurul Athira Bt Syed Ahmad**
Nama Penyelia: **Dr Zuraida bt Zainun (No. MMC: 39997)**
Penyelia Bersama: **Dr Mohammad Normani Zakaria**

Untuk menyertai kajian ini, anda atau wakil sah anda mesti menandatangani mukasurat ini. Dengan menandatangani mukasurat ini, saya mengesahkan yang berikut:

- Saya telah membaca semua maklumat dalam Borang Maklumat dan Keizinan Pesakit ini **termasuk apa-apa maklumat berkaitan risiko yang ada dalam kajian** dan saya telah pun diberi masa yang mencukupi untuk mempertimbangkan maklumat tersebut.
- Semua soalan-soalan saya telah dijawab dengan memuaskan.
- Saya, secara sukarela, bersetuju menyertai kajian penyelidikan ini, mematuhi segala prosedur kajian dan memberi maklumat yang diperlukan kepada doktor, para jururawat dan juga kakitangan lain yang berkaitan apabila diminta.
- Saya boleh menamatkan penyertaan saya dalam kajian ini pada bila-bila masa.
- Saya telah pun menerima satu salinan Borang Maklumat dan Keizinan Pesakit untuk simpanan peribadi saya.

Nama Pesakit (Dicetak atau Ditaip)	**Nama Singkatan & No. Pesakit**
No. Kad Pengenalan Pesakit (Baru)	**No. K/P** (Lama)
Tandatangan Pesakit atau Wakil Sah	**Tarikh** (dd/MM/yy) (Masa jika perlu)
Nama & Tandatangan Individu yang Mengendalikan Perbincangan Keizinan (Dicetak atau Ditaip)	**Tarikh** (dd/MM/yy)

Nama Saksi dan Tandatangan **Tarikh** (dd/MM/yy)

Nota: i) Semua subjek/pesakit yang mengambil bahagian dalam projek penyelidikan ini tidak dilindungi insuran.

LAMPIRAN P

Borang Keizinan bagi Penerbitan Bahan yang berkaitan dengan Pesakit/ Subjek
(Halaman Tandatangan)

Tajuk Kajian: **Penentuan Nilai Normatif Ujian Organisasi Sensori Gans Menggunakan 'Bal Ex Foam' dalam Kalangan Dewasa: Pengenalan Kajian.**

Nama Penyelidik: **Syarifah Nurul Athira Bt Syed Ahmad**
Nama Penyelia: **Dr Zuraida bt Zainun (No.MMC: 39997)**
Penyelia Bersama: **Dr Mohammad Normani Zakaria**

Untuk menyertai kajian ini, anda atau wakil sah anda mesti menandatangani mukasurat ini.

Dengan menandatangani mukasurat ini, saya memahami yang berikut:

- Bahan yang akan diterbitkan tanpa dilampirkan dengan nama saya dan setiap percubaan yang akan dibuat untuk memastikan ketanpanamaan saya. Saya memahami, walaubagaimanapun, ketanpanamaan yang sempurna tidak dapat dijamin. Kemungkinan sesiapa yang menjaga saya di hospital atau saudara dapat mengenali saya.
- Bahan yang akan diterbitkan dalam penerbitan mingguan/bulanan/dwibulanan/suku tahunan/dwi tahunan merupakan satu penyebaran yang luas dan tersebar ke seluruh dunia. Kebanyakan penerbitan ini akan tersebar kepada doktor-doktor dan juga bukan doktor termasuk ahli sains dan ahli jurnal.
- Bahan tersebut juga akan dilampirkan pada laman web jurnal di seluruh dunia. Sesetengah laman web ini bebas dikunjungi oleh semua orang.
- Bahan tersebut juga akan digunakan sebagai penerbitan tempatan dan disampaikan oleh ramai doktor dan ahli sains di seluruh dunia.
- Bahan tersebut juga akan digunakan sebagai penerbitan buku oleh penerbit jurnal.
- Bahan tersebut tidak akan digunakan untuk pengiklanan ataupun bahan untuk membungkus.

Saya juga memberi keizinan bahawa bahan tersebut boleh digunakan sebagai penerbitan lain yang diminta oleh penerbit dengan kriteria berikut:

- Bahan tersebut tidak akan digunakan untuk pengiklanan atau bahan untuk membungkus.
- Bahan tersebut tidak akan digunakan di luar konteks – contohnya: Gambar tidak akan digunakan untuk menggambarkan sesuatu artikel yang tidak berkaitan dengan subjek dalam foto tersebut.

Nama Pesakit (Dicetak atau Ditaip)	**Nama Singkatan** atau **No. Pesakit**

No. Kad Pengenalan Pesakit	T/tangan Pesakit	**Tarikh** (dd/MM/yy)

Nama & Tandatangan Individu yang Mengendalikan Perbincangan Keizinan (Dicetak atau Ditaip)

Tarikh (dd/MM/yy)

Nota: i) Semua subjek/pesakit yang mengambil bahagian dalam projek penyelidikan ini tidak dilindungi insuran.

APPENDIX B: MALAY VERSION VERTIGO SYMPTOM SCALE

SKALA SIMPTOM 'MODIIED VERTIGO' OLEH DAVIES et al. 1998

(Z Zuraida, C A Mohd Riduan, Z Mohd Normani, N O Nik Adilah Unpublished undergraduate thesis, 2010)

No :_____ Umur:_____ Jantina:_____
Status: Kahwin/Bujang/Janda/Duda

No.Telefon : Rumah:_____Pejabat:_____Bimbit:_____

Alamat Rumah:_____

Diagnosa Penyakit:_____

Tarikh mula mendapat simptom masalah keseimbangan badan : _____

Tempoh mengalami masalah keseimbangan badan:_____

Soalan berikutnya bertanyakan mengenai jenis simptom yang anda alami dan bilangan berapa kali anda mengalami simptom yang disenaraikan di bawah sejak 12 bulan yang lalu. (atau sejak vertigo(benda atau keadaan sekeliling berpusing atau bergerak) bermula, sekiranya anda mengalami vertigo kurang dari setahun)

Nilai bagi setiap respon ialah:

0	**1**	**2**	**3**	**4**
Tidak pernah	**Beberapa kali (1-3 kali setahun**	**Banyak kali (4-12 kali setahun)**	**Agak kerap (secara purata lebih dari sekali dalam sebulan)**	**Sangat kerap (secara purata, lebih dari sekali dalam seminggu**

1. Perasaan seolah-olah benda atau keadaan sekeliling berpusing atau bergerak, selama kurang dari dua minit	0	1	2	3	4
2. Berasa telinga tersumbat	0	1	2	3	4
3. Menggigil, menggeletar	0	1	2	3	4
4. Perasaan berasa pening-pening lalat, terapung-apung atau badan tidak seimbang, selama lebih dari 12 jam	0	1	2	3	4
5. Kesukaran untuk bernafas, bernafas dengan tercungap-cungap:	0	1	2	3	4
6. Berpeluh berlebihan:	0	1	2	3	4

7. Adakah anda mengalami perasaan seolah-olah benda berpusing-pusing atau bergerak sekeliling anda untuk jangka masa beberapa minit ke satu jam	0	1	2	3	4
8. Muntah	0	1	2	3	4
9. Sakit kepala atau berasa berat dalam kepala	0	1	2	3	4
10. Berasa hilang keseimbangan badan sehingga ingin terjatuh, berpanjangan lebih dari 12 jam	0	1	2	3	4
11. Berdenyut-denyut, mencucuk-cucuk atau kebas di bahagian badan tertentu	0	1	2	3	4
12. Berasa hilang keseimbagan badan sehingga ingin terjatuh, berpanjangan kurang dari dua minit	0	1	2	3	4
13. Sakit di bahagian jantung atau dada	0	1	2	3	4
14. Adakah anda mengalami perasaan pening-pening lalat, hanyut atau badan tidak seimbang untuk jangka masa beberapa minit ke satu jam	0	1	2	3	4

APPENDIX C: PATIENT SCORING FORM

Bal Ex Foam Assessment Sheet

Date : _____

No of Patient :

Age :

Occupation :

RN :

Diagnosis

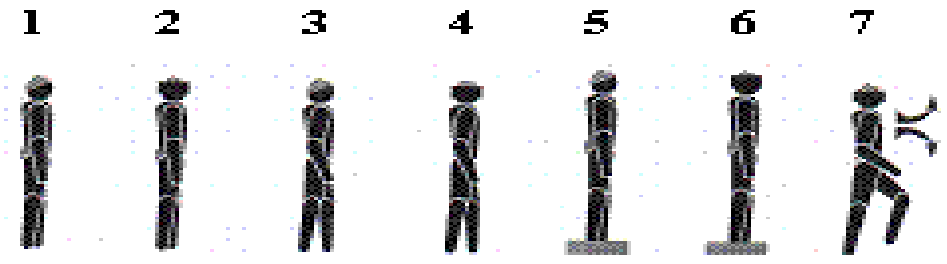
Other medical problem:

Chief complain :
- ☐ Vertigo
- ☐ Imbalance
- ☐ Presyncope/ feeling faint
- ☐ Other psychological involvement

Other problem :
- ☐ Musculoskeletal problem
- ☐ Diabetes Mellitus

Gans Sensory Organization Performance Test

Key
N- Normal S- Sway F- Fall R- Right L- Left



Comments

_____

_____

_____

Weight:

Height:

Steps	Eyes Open	Eyes Closed
1. Romberg Test		
2. Modified Romberg		
3. Stand on Bal Ex Foam		
4. Fukuda Test		