IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 11, Issue 5 Ser. II (Sep. – Oct. 2022), PP 06-11
www.iosrjournals.org

To Find the Cut off Value for Balance In Adults Between 50-70 Years Using Sensa Minibalance Software an observational study

Dr Tanvi P Dalvi, Dr Siraj Ahmed
Trusha Bhatt, Stuti Vaghela, Shivani Panchal
- K. M. Patel Institute of Physiotherapy, Bhai kaka University, Gokal Nagar, Karamsad, Anan Gujarat,)

Abstract:
Background*: Ageing is natural and continuous process that occurs due to various intrinsic & extrinsic factors. With ageing, the ability of central nervous system to process external stimuli, and make necessary postural adjustments to maintain balance reduces, increasing the fall risk. Aim of this study was to find cut off value for balance in adults between 50-70 years age, using sensa mini balance software. Materials & Methods: Observational study was carried on 67 adults between 50 to 70 years of age and cut of values were recorded for- range of motion (degrees), static balance (degrees), proprioception- angle difference and radial difference (degrees), static balance, co-ordination, reaction & travel time (seconds) using sensa balance software. Results: The cut off value for each component which is inbuilt in this software are as follows: Range of Motion in degrees- front (11.49), back (8.19), left (10.03), and right (9.45). Static balance in degrees- Centre (0.58), front (0.50), back (0.48), left (0.48), right (0.45). Proprioception: Angle Difference in degrees- front (80.46), back (55.56), left (63.38), right (62.86) and radial difference in degrees- front (8.16), back (4.92), left (6.10), right (6.03), Reaction time in seconds for front (2.05), back (1.65), left (2.01), right (1.62), for travel time in seconds for front (3.35), back (2.12), left (3.55), right (2.85) Coordination angle in degree for front and back (0.58), for left right (2.50). Conclusion: The cut off value for balance in adults between 50-70 years can be found using Sensa Mini balance software and, in this age group sway increases linearly with age.*

Key Word*: Balance, Wii balance board, Sensa balance Mini board, balance assessment software.*

Date of Submission: 03-09-2022 Date of Acceptance: 17-09-2022

I. Introduction

Normal ageing process and its relationship with balance control: Balance can be defined, as ability to maintain stable posture for maximum time with minimal sway or ability to maintain body's COG within BOS. Maintaining steady a balance is the utmost requirement to accomplish any goal oriented functional activity. Due to ageing, capability of central nervous system to process the inputs from visual, vestibular, proprioceptive receptors reduces leading to imbalances. Balance dysfunction increases the risk of fall adding to disability in elderly thus deteriorating the quality of life.

Assessing balance: Balance tests can provide information that helps to estimate recovery and predict falls. Clinically, different balance assessment tools like- BEST, TUG, SET etc. are available which helps to quantify balance deficits6

II. Material And Methods

Observational study was carried on 67 adults between 50 to 70 years of age and cut of values were recorded for- range of motion (degrees), static balance (degrees), proprioception- angle difference and radial difference (degrees), static balance, co-ordination, reaction & travel time (seconds) using sensabalance software

Study Design:: observational study- cross sectional study

Study Location: This was a tertiary care teaching hospital-based study done in Shree Krishna Hospital, Adult Neuro Physiotherapy department, Gokal Nagar, Karamsad, Anan

Study Duration: January 2021 to May 2021

Sample size: 67 adults between 50-70 years of age.

Sample size calculation: As an observational- cross sectional study was to be carried out, data needed to be collected from maximum samples n= 300, but owing to the outbreak of covid pandemic, sample size was reduced to 67. **Subjects & selection method**: The study population was drawn from Anand and Karamsad

district, who visited the hospital and voluntarily agreed to participate in the study were included after they met the inclusion criteria.

Inclusion criteria:
• adults between 50-70 years without any co-morbidities like diabetes which can potentially affect balance.
• Participants having no audio-visual defect.
• Participants who can stand and walk independently.

Exclusion criteria:
• Non- ambulatory persons
• On any substance abuse.
• Cognitive and neurological disorder, leading to balance impairment
• Musculoskeletal disorders.

Procedure methodology

IEC- (Institutional ethics committee) approval was taken, and observational study was done. A written consent was taken after the subject voluntarily agreed to participate in the study. The entire procedure and instructions were explained to them. The participants visited ANPT department of SKH, where a baseline history and neurological assessment focusing on sensory examination was taken. The participants then stood on the wobble board of the machine, which was connected to the laptop software, and the readings were taken- Range of motion, static balance, and proprioception: angle difference, radial difference, reaction time, travel time and coordination angle.

Data sources/ measurements:

The sensa balance Mini board software shows the sensor signal as a red cursor within concentric circles on the screen either during or right after the exercise (red cursor indicates the center point of individual's static balance and an orange cursor indicates the individual's position and measures sway when standing on wobble board- figure 2). The tilting measure's reaction time on the screen (Figure 6) which is recorded with other parameters- Range of motion [figure 4], co-ordination [figure 3], static balance [figure 5], proprioception [figure 6] which enabled us to find the cut off value of balance. The data was analyzed using software STATA 14.2 and the frequency (%) and mean (SD-Standard deviation) would be calculated for the same.

Statistical analysis

Software used: STATA 14.2 for descriptive statistics [Mean, SD (standard deviation), Frequency (%)] to depict the baseline profile of participants. Reference range was calculated by using mean +/- 2 SD for each variable. The data was assessed by finding the mean, SD, Minimum and Maximum values are mentioned in the tables below.

Data analysis and interpretation:

Gender	Male	Female	Total
Numbers	32	35	67
Mean age	57	58	58
%	48%	52%	100%

III. Result

Total 67 samples were analyzed one time for- range of motion (degrees), static balance (degrees), proprioception- angle difference and radial difference (degrees), static balance, co-ordination, reaction & travel time (seconds)

The cut off value was found for each component which is inbuilt in this software which were, Range of Motion in degrees for front (11.49), back (8.19), left (10.03), and right (9.45). Static balance in degrees for center (0.58), front (0.50), back (0.48), left (0.48), right (0.45). Proprioception: Angle Difference in degrees for front (80.46), back (55.56), left (63.38), right (62.86) and radial difference front (8.16), back (4.92), left (6.10), right (6.03), Reaction time in seconds for front (2.05), back (1.65), left (2.01), right (1.62), for travel time in seconds for front (3.35), back (2.12), left (3.55), right (2.85) Coordination angle in degree for front and back (0.58), for left right (2.50) were the results curated in our study.

Table includes variables of range of motion, static balance, proprioception, Reaction Time, Travel Time, and their values.

Variable	Mean	SD	MIN	MAX
Range of motion Front	11.49	2.70	5.1	19.2
Range of motion Back	8.19	2.13	3.5	17
Range of motion Left	10.03	2.82	5.6	17.2
Range of motion Right	9.45	2.37	6	17.4
Static balance (degrees) Centre	0.58	0.32	0.23	1.8
Static balance Front	0.50	0.29	0.23	1.76
Static balance Back	0.48	0.31	0.15	1.38
Static balance Left	0.48	0.19	0.19	1.2
Static balance Right	0.45	0.22	0.2	1.38
Proprioception angle difference (degrees) Front	80.46	9.48	60.1	94.2
Proprioception angle difference Back	55.56	10.01	40.2	84.4
Proprioception angle difference Left	63.38	7.66	51.1	87.1
Proprioception angle difference Right	62.86	5.60	50.4	70.9
Proprioception radial difference (degrees) Right	8.16	2.08	5.1	12.6
Proprioception radial difference Back	4.92	1.98	1.1	11.6
Proprioception radial difference Left	6.10	1.95	2.2	11.5
Proprioception radial difference Right	6.03	2.01	0.5	8.7
Reaction time (seconds) Front	2.05	1.09	0.5	7
Reaction time Back	1.65	0.81	0.3	3.8
Reaction time Left	2.01	0.93	1.1	4.6
Reaction time Right	1.62	1.53	0.5	8.8
Travel time (seconds) Front	3.35	1.38	0.9	7.6
Travel time Back	2.12	1.14	1	5.9
Travel time Left	3.55	1.95	1.3	9.6
Travel time Right	2.85	1.53	0.9	8.9
Coordination angle (degrees) Front, back	0.58	0.68	0.1	3.8
Coordination angle Left, right	2.50	1.10	1.1	4.3

Illustrations:

Fig. 1 wooden wobble board connected with laptop having software

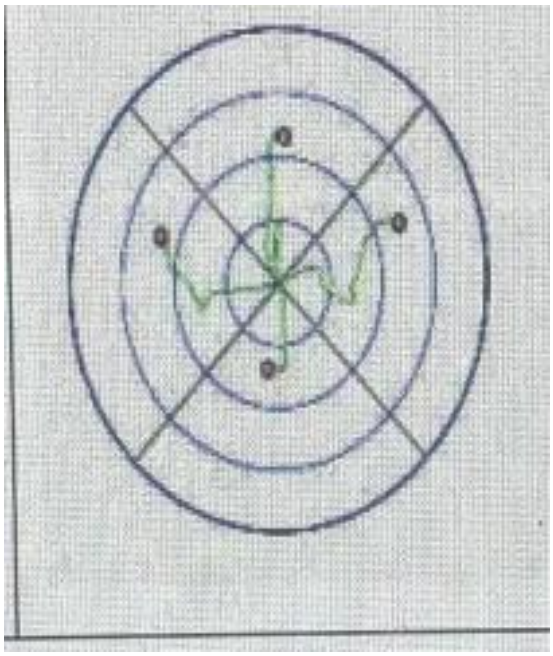

Fig. 2 shows concentric circles, red and orange cursor on the laptop screen

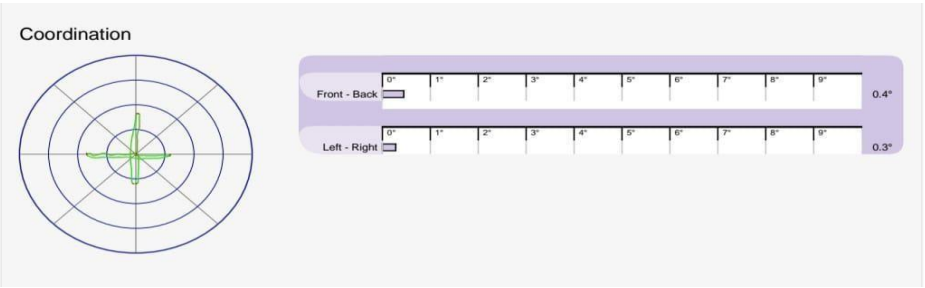

Figure 3 indicates coordination in front, right, back in degrees.

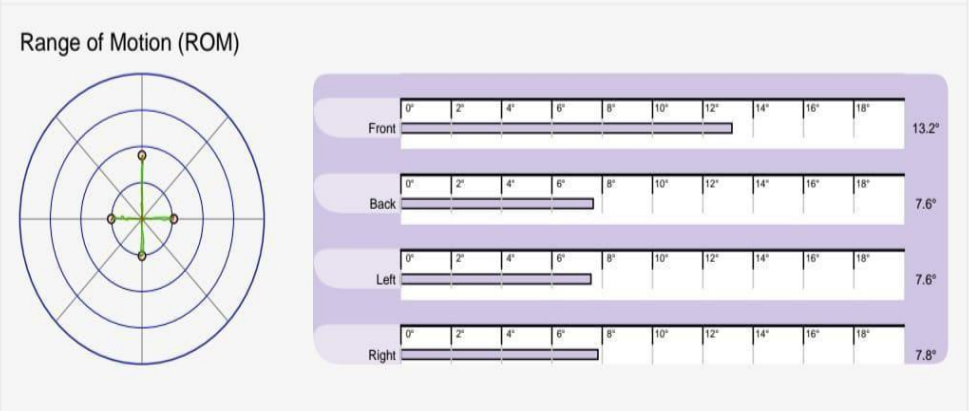

Figure 4 indicates range of motion in front, right, back, left in degrees

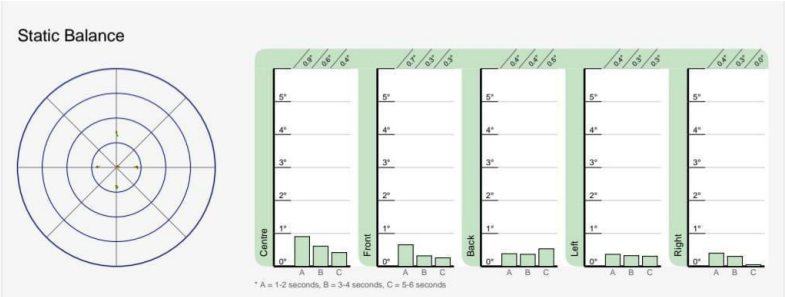

Figure.5. indicates static balance in Centre, front, back, left, right.

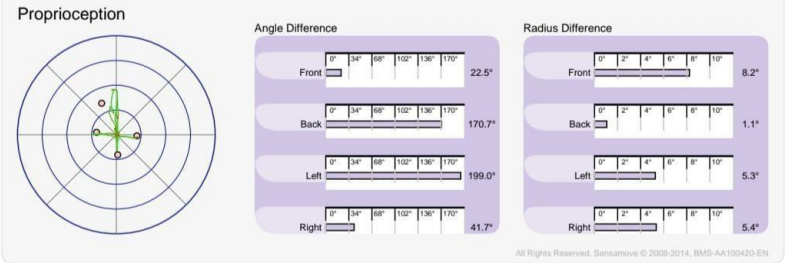

Figure.6. Proprioception: angle difference & radial difference

IV. Discussion

This research was focused on finding the cut off value (Min-max) for static and dynamic balance in the adult population between 50-70 years of age by using sensa Mini balance board. The results are based on data provided by the software that is expressed in four directions: front, back, left, and right (F, B, L, and R) according to transverse and sagittal plane. By analyzing these results, we found that in static balance there is increase in postural sway in all directions (F, B, L, R), also there was highest postural deviation determined in the case of dynamic balance test, compared to young adults between 20-40 years of age in a study by Ayesha Mulla, Jadeja Urvashiba Narendra Sinha in 2013 "Balance capacity assessment in sports individuals. Results indicate that postural adjustment required cognitive processing and more attention10. Ageing is associated with declining balance. Meta-analysis of worldwide study results has confirmed that range of body sway and its velocity increases with age4.Elderly subjects show a decline in the performance during motor and cognitive tasks. A key role is played by the structural neurodegenerative and neurochemical changes occurring as a part of the normal ageing process5.

By finding cut off value for balance in adult population, it can be helpful in using sensa balance mini board in future as a diagnostic and therapeutic tool. Thus, each component's minimum and maximum value was found, after finding individual mean for all the five components inbuilt in the software, and its maximum and minimum value was derived which was helpful in finding the cut off value.

The limitations of the study were that the equipment could not be taken to various places where potential samples would have been easily found limiting the data collection to Shree Krishna hospital. Other

major hurdle was the outbreak of world-wide covid- 19 pandemic, due to which most of the people were reluctant to participate in the study, as they had to visit the hospital premises for participating in the study. Further study can be done on sense-balance mini board by gathering larger sample size. By gathering larger sample size further study can be done to find out the individual cut off value for both male and female. Cut off value for balance can be found out in various age groups from pediatrics to geriatrics using sense-balance mini board.

V. Conclusion

It can be concluded that, the cut off value for balance in adults of 50-70 years can be found using Sensa balanceMini board and in the above-mentioned aged group sway increases linearly with age.

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Dr Tanvi P Dalvi, et. al. "To Find the Cut off Value for Balance In Adults Between 50-70 Years Using Sensa Minibalance Software an observational study." *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 11(5), 2022, pp. 06-11.