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# Assessment of musculoskeletal problems in personal computer gamers by using REBA – a cross sectional study

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**ABSTRACT**
In this era of booming gaming industries, gamers are exposed to prolonged sitting which involves awkward posture and repetitive movements that are risky for developing musculoskeletal problems. However, there are only few studies done to know the effect of prolonged sitting on the trunk and neck posture in professional gamers but no studies have been done on the effect of prolonged sitting duration for the entire extremity on common gamers. The aim of this study is to assess musculoskeletal problems in personal computer gamers by using REBA and to assess the level of body discomfort by using body part discomfort scale. Two hundred normal healthy gamers between the age of 17-25 years were enrolled in the study who played computer games from Mumbai. They were observed prospectively to detect occurrence of discomfort and participants were asked to mark the area after completing the game and REBA scores were collected while they were playing on the basis of the posture they attend while playing the game. The results showed that the Mean REBA score of personal computer gamers was 6.48 ± 0.93 years. The finding shows that prolonged gaming duration does affect the gamers specifically on the lower back, neck due to awkward posture. Awareness should be spread among the pc gamers about the importance of use of proper equipment and computer set up.

**Keywords:** prolonged duration, posture, personal computer gamers

## I. INTRODUCTION

Musculoskeletal disorder (MSD) is a pain or injury that affect human's musculoskeletal system such as muscles, ligament, tendon, nerve, and join. In recent years, personal computer gaming has experienced a significant surge in popularity. The availability of powerful gaming hardware, immersive graphics, and online multiplayer capabilities has attracted a large and diverse player base. This rise in popularity has led to an increased number of individuals spending extended periods engaged in personal computer gaming activities. Musculoskeletal disorders have been shown to affect workers from various workplaces such as manufacturing company, university workers, bankers and healthcare provider.

Due to the growing number of players in the gaming industry, there has also been a rise of reports of musculoskeletal disorders among the gamers and e-sports professional. Among the contributing factors for this situation is a prolonged sitting duration that involves gamers during gaming activities. Prolonged sitting with and addition of adopting several awkward postures and repetitive activities during the gaming would make the situation worst.

However, there have been relatively few studies were made regarding the importance of the ergonomics application on competitive gaming as an industry. Among the few research have been done on the effect of gaming activities were on the hand problems such as trigger fingers and carpal tunnel syndrome, eye problems as well as the sleep problems.

The aim of the study is to evaluate the effect of prolonged gaming duration on the risk for musculoskeletal disorders in personal computer gamers. In order to achieve this aim, several objectives were considered, and they are (i) to evaluate the effect of prolonged gaming on the posture by using the REBA scale and (ii) to evaluate the discomfort level among the gamers post- gaming session by using the Corlett & Bishop's Scale which is a self-reported, subjective rating scale.

## II. METHODS

**Participants**

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Two hundred participants have completed the study. All participants were required to fulfil the eligibility criteria for the study which were, both female and male teenagers, who are between 17-25 years of age, with a healthy current condition at the time of the study (e.g., no history injuries or diagnosed case of carpal tunnel syndrome, trigger finger, lower back pain). These criteria were set so that all participants will have a similar demographic and daily routine activities and condition.

**Apparatus & Stimuli**

Data Collection Equipment: A standard computer workstation was set up by the participants and it consists of a CPU unit, an adjustable monitor, keyboard, mouse, and mouse pad. the height of the chair vary according to the comfort level of the participants.

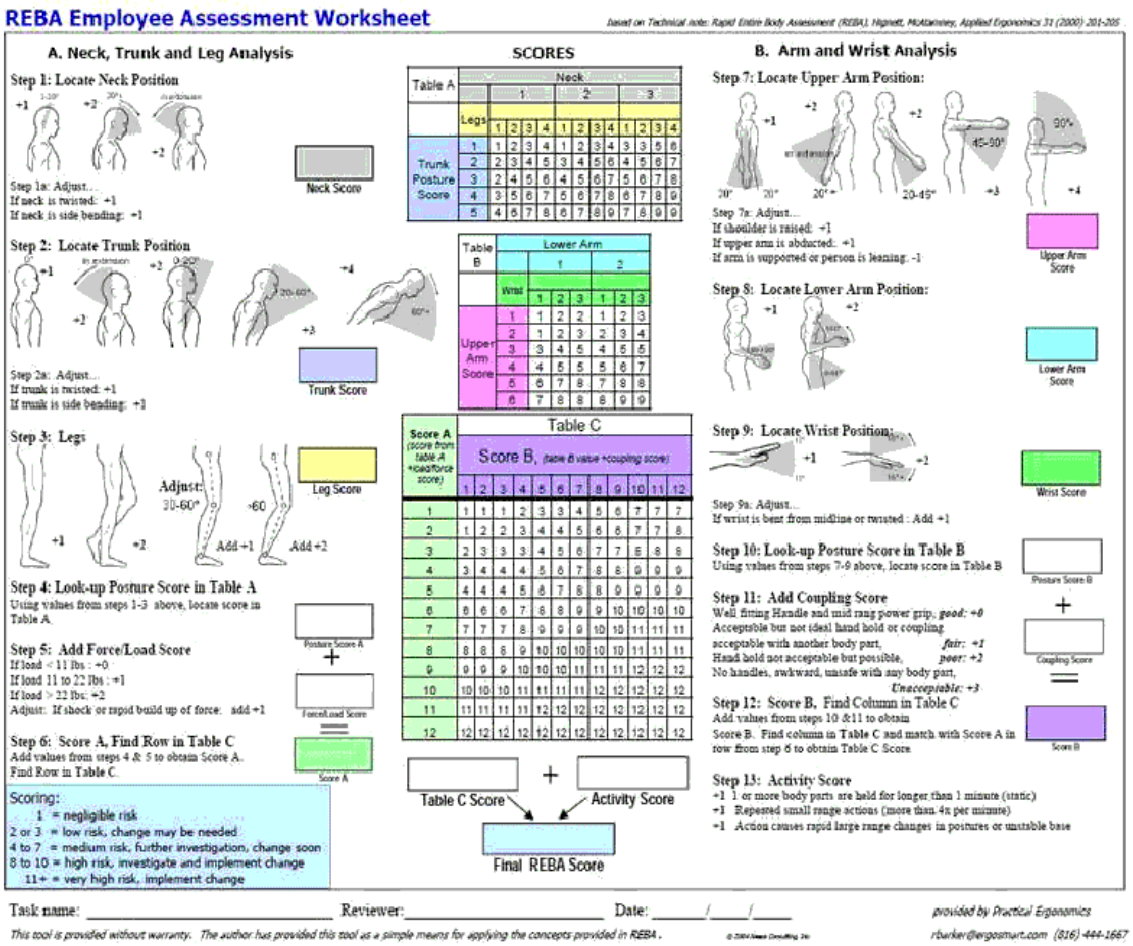


Figure 1: REBA scale

| Score | Level of MSD Risk |
|---|---|
| 1 | negligible risk, no action required |
| 2-3 | low risk, change may be needed |
| 4-7 | medium risk, further investigation, change soon |
| 8-10 | high risk, investigate and implement change |
| 11+ | very high risk, implement change |

Figure 1.1 interpretation of REBA scale

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REBA scale was used to analysis the posture while the participants were asked to continue playing their respectively games. Figure 1 illustrates the body position that were used to assess and collect the REBA score. The REBA scores were collected based on the position that the participants attend while playing the game for the most period of the time.as shown in the figure 1 step by step the position of the limb were observed and based on that the scores were calculated. After completing the all the steps as soon in the figure 1 the final scores were calculated and based on that score the participants were mentioned in the risk factor such as low, medium, high risk as shown in the figure 1.1 the level of risk was mentioned.

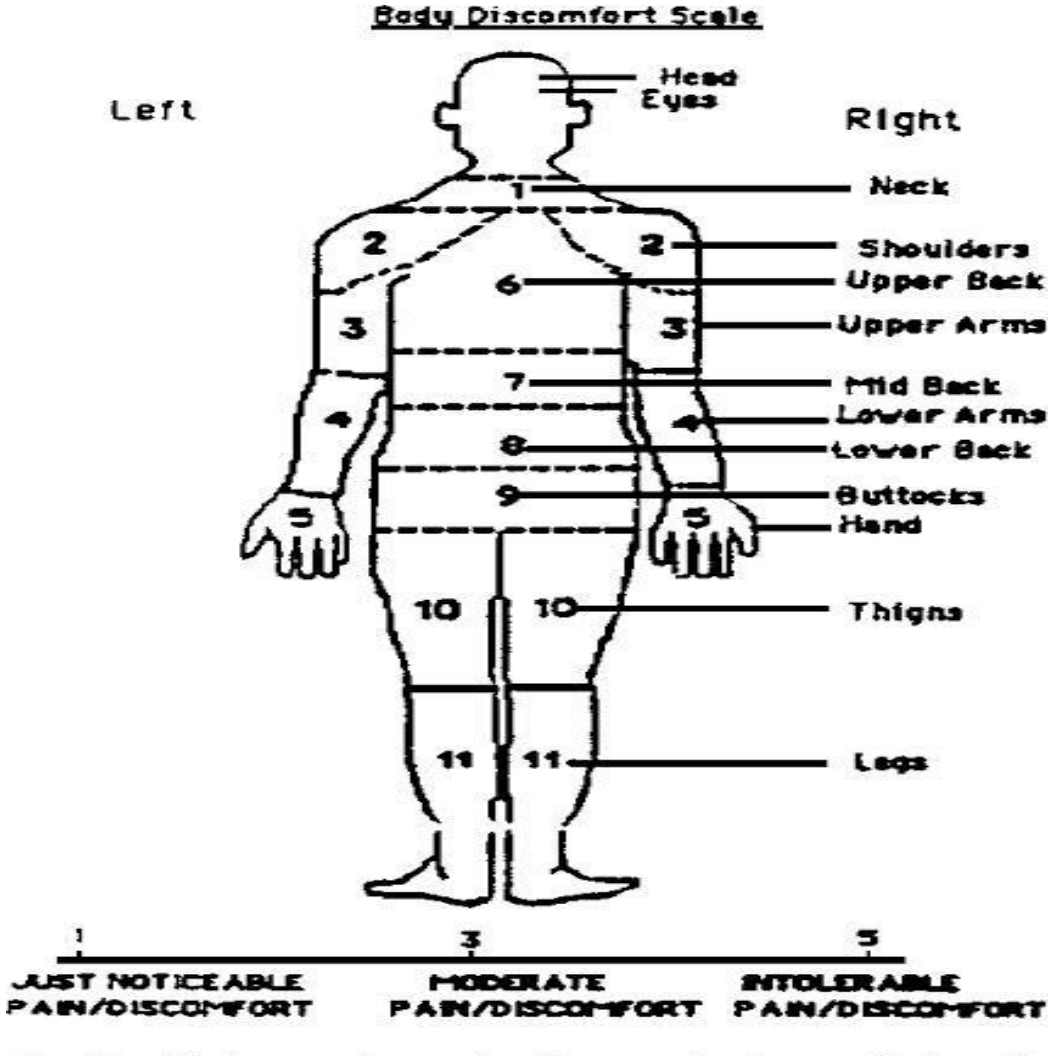


Fig. 2 A body diagram for assessing postural discomfort (Corlett & Bishop, 1976)

The body symptom survey used in the study was Corlett & Bishop's Scale (Corlett & Bishop, 1976). Figure 2 illustrates the body diagram that is used to assess postural discomfort in Corlett & Bishop's Scale. This subjective scale required the participant to evaluate if their feels discomfort on a particular part of their body regions. If a participant feels discomfort in that particular region, they were asked to mark the area on the number that represents their body region, and more than one area can be marked. The participant was required to give their response before and after the gaming session.

**Administrative Documents:**

In this study, there were several types of administrative documents were used. They are: (i) informed consent form; (ii) participant form - for data collection;

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**Experimental Design:**

Baseline posture setup: At the beginning of the gaming session, participant was asked to sit in the condition that their trunk and neck were straight and legs were well rested on the floor as this is the ergonomic posture for a human – anatomical position (The American Academy of Orthopaedic Surgeons,1965). This step was to ensure that a participant starts the gaming session with an ergonomic posture. Thus, it somehow would be the baseline to the score the posture throughout the gaming session.

Participants are free to adjust the chair during the gaming session so that they are comfortable while playing the game.

**Procedure:**

Screening: Participants' eligibility was checked in which had both male and female who are in between 17-25 years of age, with a healthy current condition at the time of the study (e.g., no history of none prior injuries to any joint, with minimum two years of experience playing games). If the participant did not fulfil all the recruitment criteria, they were dismissed.

**Informed Consent Form:**

Before the experiment starts, a participant was briefed about the study. Then, a participant was asked to read this form for a better understanding of the study in general so that they can have their consent in participating in the study. Then, the experimenter briefed the participant on the important information of the form – experiment purposes in general, the task that they have to do, confidentiality of the collected data, Then, a participant was asked to sign the copy of the form that given their consent to participate in the study.

**Participant Form:**

Demographic information – age, gender, number of years they have played the games, number of days they play games in a week and how many hours they play games in a day – was obtained. After that, several questionnaires related to the study were asked to the participants. These included the participant's health and gaming experiences information.

Corlett & Bishop's Scale Form: A participant was asked to fill in the Corlett & Bishop's Scale for Body Symptom Survey Form, and was asked to Mark at the region of body diagram that Their feel any discomfort of themselves at that period of time.

## III. RESULTS & DISCUSSION\

All statistical analysis is done by using SPSS 20.0 version.

A total of 200 participants in the age group 17 – 25 years were assessed. 147 males and 53 female normal computer gamers were analysed for REBA values. The number of years of experience in playing games for this sample population ranged from 4.29 ± 1.63 years. The number of hours each individual spent on playing games for this sample of population ranged from 3.21 ± 0.53 hours. The number of days this population spent on playing games were 3.66 ± 0.72 days. The mean REBA score for this sample population was 6.48 ± 0.93. Symptoms such as having discomfort of trapezius 49%, having discomfort of neck 32%, having discomfort of shoulder 13.5%, having discomfort of elbow 1.5%, having discomfort of wrist 32%, having discomfort of upper back 16.5%, having discomfort of lower back 44.5% and having discomfort of knee 2.5%.

| Variables | N | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
|---|---|---|---|---|---|
| Age | 200 | 15 | 25 | 20.85 | 2.53 |
| Height | 200 | 149 | 190 | 166.64 | 9.05 |
| Weight | 200 | 45 | 97 | 70.49 | 12.39 |
| BMI | 200 | 17.11 | 41.98 | 25.52 | 4.96 |
| Years of playing game | 200 | 2 | 12 | 4.29 | 1.63 |
| Hours of playing game | 200 | 2 | 5 | 3.21 | 0.53 |
| No. of days played per week | 200 | 2 | 7 | 3.66 | 0.72 |
| REBA scores | 200 | 2 | 10 | 6.48 | 0.93 |

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**Table 1. Demographic data**

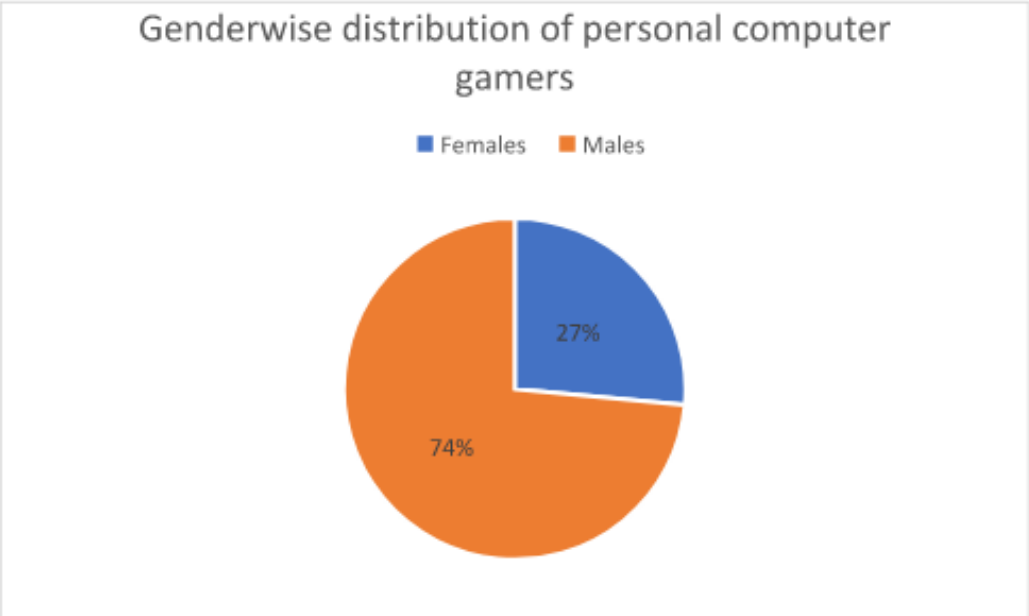


**Fig 3: Pie chart representing gender wise distribution of personal computer gamers**

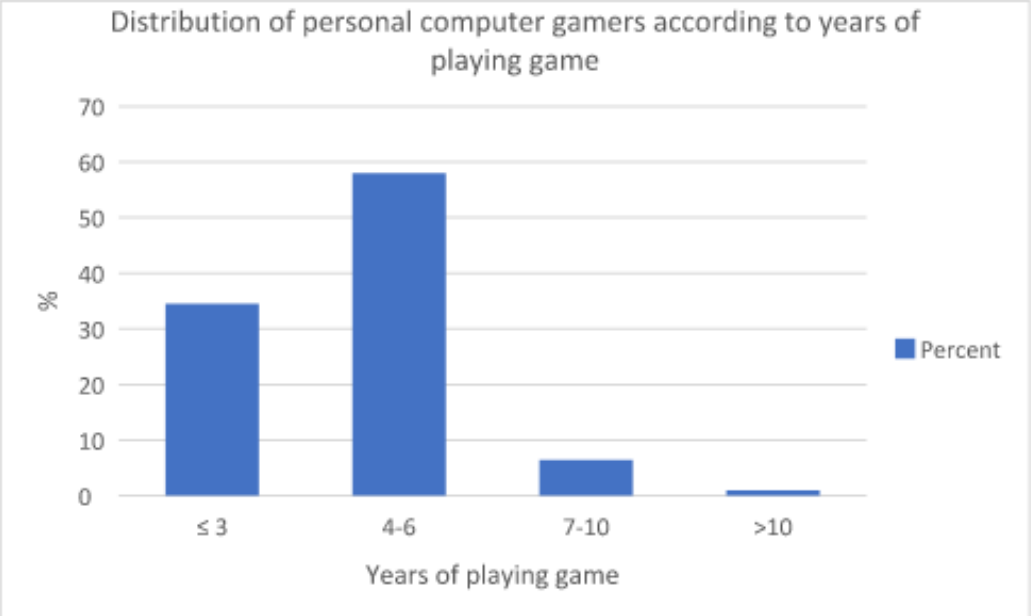


**Fig 4: Bar diagram representing distribution of personal computer gamers according to years of playing game**

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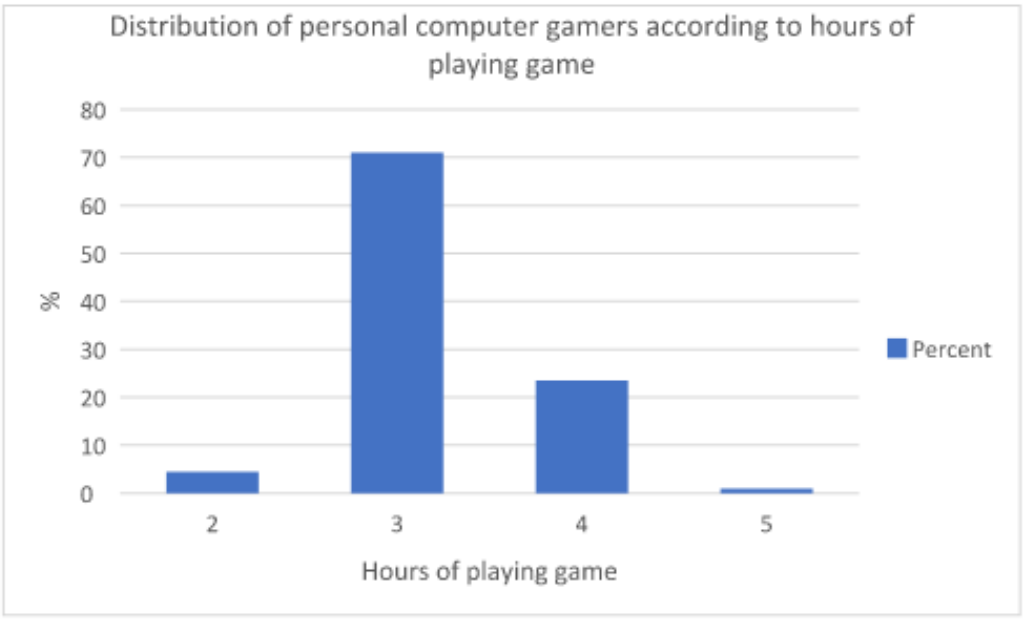


**Fig 5: Bar diagram representing distribution of personal computer gamers according to hours of playing game**

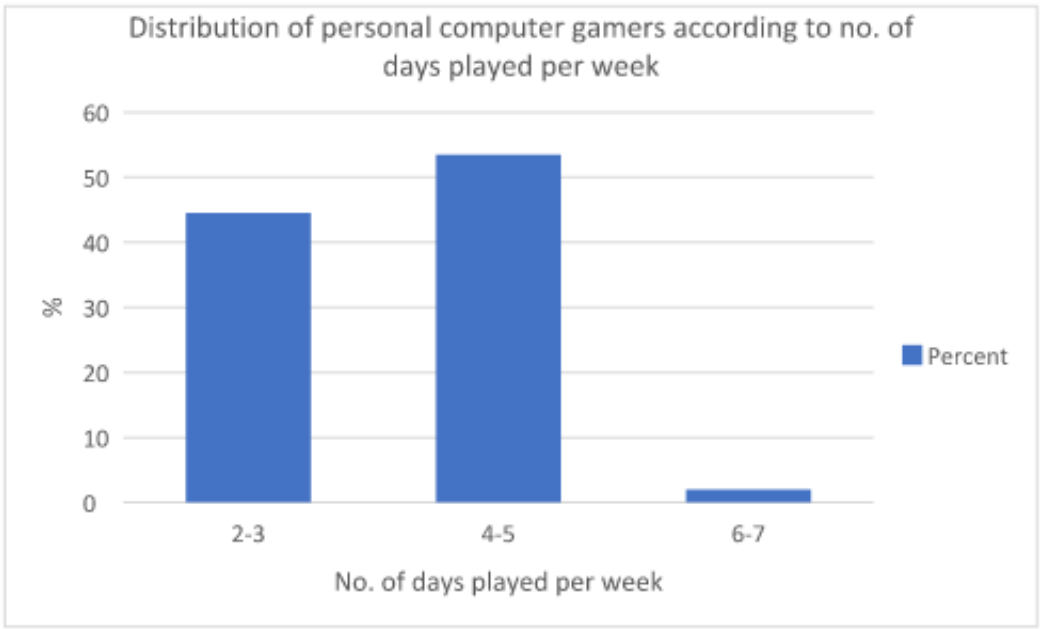


**Fig 6: Bar diagram representing distribution of personal computer gamers according to no. of days played per week**

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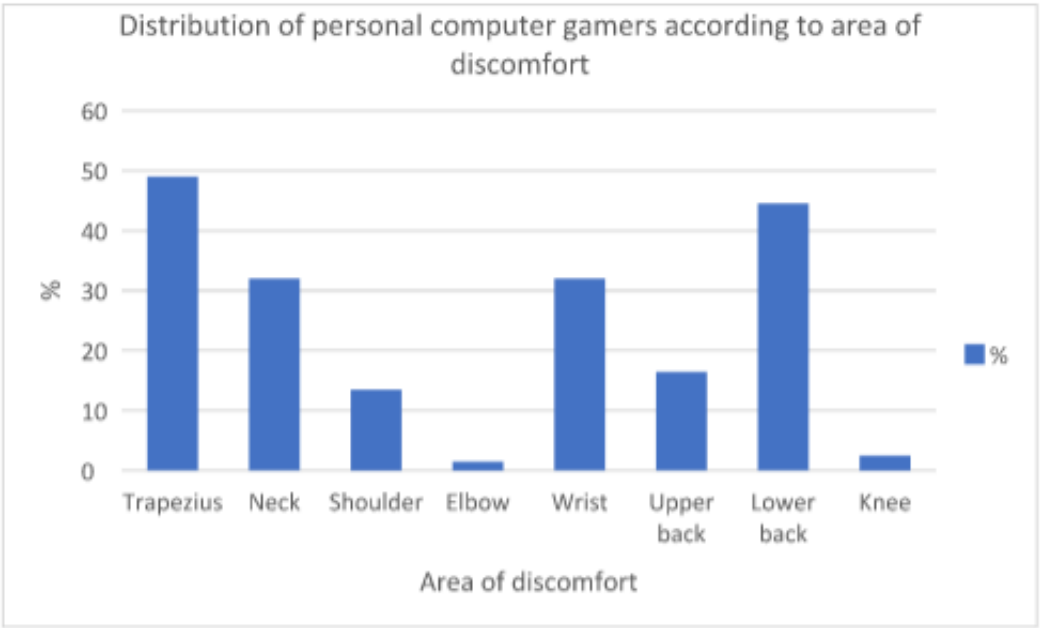


**Fig 7: Bar diagram representing distribution of personal computer gamers according to area of discomfort**

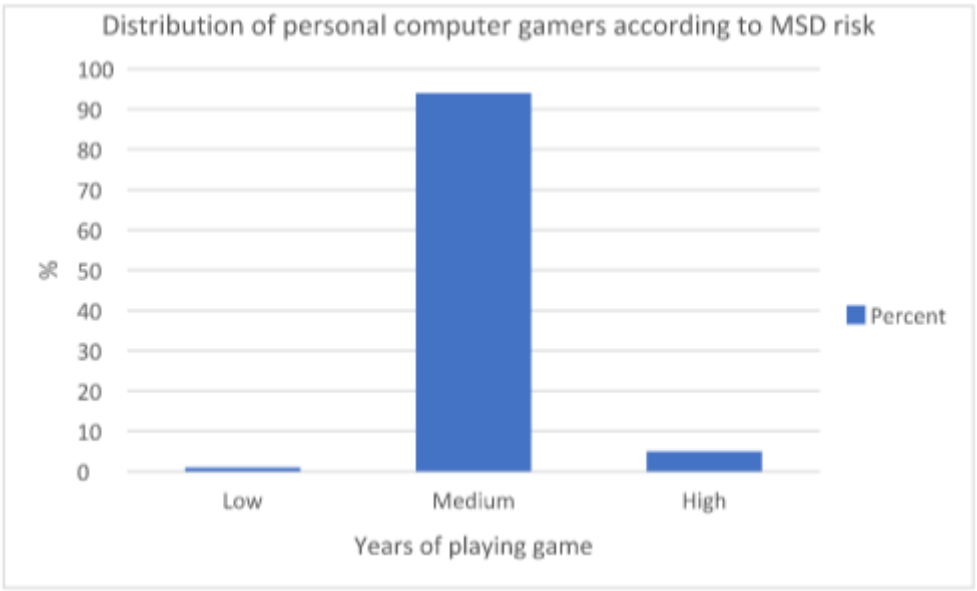


**Fig 8: Bar diagram representing distribution of personal computer gamers according to MSD risk**

## IV. DISCUSSION

The study involved 149 males and 51 female participants between the age 17- 25 years of which all the participants were normal healthy adults with no prior history any injuries.

Our study is different in this regard from others that other studies did research on musculoskeletal problems in personal computer gamers and did a survey to check the presence of any discomfort they might be experiencing during playing gamers can risk them for any future musculoskeletal problems using REBA scale.

Very few studies are done to check the musculoskeletal problems in computer users or bank workers who use computer.

This study aimed to assess the musculoskeletal problems in personal computer gamers who are playing games for hours in various positions which might not be ergonomic correct.

During this study, it was found that the mean of REBA score for computer gamers was

6.48 ± 0.93. Studies have shown people who use computer on daily basis and bankers are at high risk for developing musculoskeletal problems as they are exposed to a considerable amount of time using the computer or laptop with no proper sitting posture. Studies have shown people who are prone to play games for hours are at high risk for developing psychological problems as well as eyes problems later in life. The gender wise distribution of the personal computer gamers highlighted that 74% males and only 26% were female gamers.

Angela Mae B et al. found in their study that the desk, chair, keyboard and mouse have a significant association with body discomfort, which means that these workstation designs affect the body discomfort of online gamers and that gamers' poor posture during online gaming significantly contributed to their neck, mid-back, and lower back discomfort. Our study revealed that most the computer gamers wereinvolved in playing gamers from almost 4-5 hours each day for at least 6 days a week. this lead to prolong discomfort due to constant incorrect posture.[7]

Etana G et al. found in their study that prevalence of work-related musculoskeletal disorders among bank staff was high (73.1%). Work experience, awkward posture, working in the same position for two or more hours, and job stress were significant predictors and contribute to the high prevalence of work-related musculoskeletal disorders among bank staff. [8]

Georgia Silva CA et al. found in their study that high prevalence of musculoskeletal pain in adolescents, as well as an increased amount of time using digital devices was observed. The presence of musculoskeletal pain symptoms was reported by 65.1% of the adolescents, being more prevalent in the thoracolumbar spine (46.9%), followed by pain in the upper limbs, representing 20% of complaints. The mean time of use for computers and electronic games was 1.720 and 583 minutes per week, respectively. The excessive use of electronic devices was demonstrated to be a risk factor for cervical and lumbar pain. Female gender was associated with the presence of pain in different body parts.[9]

Fathuldeen A et al. found in their study that involved a competitive video gaming participants between ages 18 to 48 years, with a mean age of 22.5. the most reported sites injured included the lower back (63.8%), neck (50%), hand/wrist (44.8%), and shoulder (35.3%).and had an idea that competing in electronic gaming tournaments is linked to conditions such as tendinopathy, carpal tunnel syndrome, and repetitive stress injuries. This study showed that the majority of competitive video gamers had musculoskeletal injuries mainly at the lower back, neck, hand/ wrist, and shoulder. A higher pain rate was reported among females and new gamers.[10]
Awareness should be spread among the personal computer gamers about the importance of use of proper computer set up and proper equipment to be used while playing gamers and the possible adverse effect of prolonged sitting posture with no correct back and arm support while using the personal computer.

## V. CONCLUSION

The first objective of the study is to evaluate the effect of prolonged duration of gaming on the posture by using REBA. It was found that, in overall, the average of the REBA score is 6.48 ± 0.93

The second objective is to evaluate the discomfort level among the gamers during pre- and post- experimental session by using the Corlett & Bishop's Scale it was found that 98(49%) computer gamers having discomfort of trapezius, 64(32%) having discomfort of neck, 27(13.5%) having discomfort of shoulder, 3(1.5%) having discomfort of elbow, 64(32%) having discomfort of wrist, 33(16.5%) having discomfort of upper back, 89(44.5%) having discomfort of lower back and 5(2.5%) having discomfort of knee.

Limitations and suggestions

The study was performed over small sample size and samples were only collected from Mumbai regions, the duration of the study was only 6 months, there was no fixed hours or days nor fixed set up for the computer were decided

**Suggestions for further study**

There should fixed computer sets, and hours and number of days a participant plays in a week should be fixed and with fixed hours and fixed the type of game played by the gamer to understand the specific effect that type of game will have on the individual.

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