

## Assessment of ergonomic risk among healthcare laboratory technician using rapid upper limb assessment (RULA)

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**Abstract:** Healthcare laboratory technicians encompass individuals employed in the departments of pathology, microbiology, and biochemistry. Their work includes maintaining same position or posture while performing tasks, sitting for a long time, using hands or body as a clamp to hold object while performing tasks. All these factors lead to the ergonomic risk leading to work related musculoskeletal disorders. **Objective:** The study aims to assess Ergonomic risk amongst healthcare laboratory technicians using Rapid Upper Limb Assessment (RULA). **Materials and Methods:** Cross Sectional Study was done on 100 Healthcare Laboratory Technicians using RULA tool to assess the ergonomic risk factors. **Result:** The participant were marked according to the RULA scoring from 1-7, where majority of participant had action score of 4,3 & 2. 18 participants scored level 4. 45 people scored Level 3. Level 2 was scored by 37 participants. No participant scored level 1. **Conclusion:** The study concluded that healthcare laboratory workers are vulnerable to ergonomic dangers, which calls for further investigation change soon.

**Key Words:** RULA- Rapid Upper Limb Assessment, Work Related Musculoskeletal Disorder, Laboratory Healthcare professionals.

### 1. INTRODUCTION:

The word ergonomics today is used to describe the science of “designing the job to fit worker, not forcing the job to fit the worker”. The physical strain a job puts on joints, muscles, nerves, tendons, bones, and other anatomical structures is just one component of ergonomics; other parts include environmental influences that may have an impact hearing, vision, and general comfort and health. The purpose of ergonomics is the improvement of health, safety and performance through the application of sound people and workplace principle. <sup>(1)</sup>

Healthcare Laboratory Technicians includes individuals working in Pathology, Microbiology and Biochemistry Departments. Their primary goals is to determine the causing microorganism and provide a likely diagnosis. <sup>(2)</sup>

The process of testing specimens requires accuracy and sustained concentration, by its very nature. Due to the repetitive nature of their work, which includes pipetting, utilizing microscopes, managing microtomes, using cell counters, etc., they are constantly in awkward and immobile working positions. <sup>(3)</sup> Such kind of occupations which require maintaining static postures for long hours put increase load or forces on the muscles and tendons which lead to fatigue and pain. When any or all of these risk factors are present at work, especially in jobs that involve repeated motion or strong exertion, the force already needed to do tasks increases. This lengthens the time muscles take to recover from the exertions the task requires. These risk factors accelerate the onset of fatigue and the consequences of overusing muscles, joints, and tendons if the recovery period is insufficient. <sup>(4)</sup>

A work setting causes workplace risk factors for Musculoskeletal disorders such as shoulder pain, lowback ache, joint pain and muscle fatigue, this suffering mainly lies on health care professionals. <sup>(5)</sup> Uncomfortable postures among employees might also result from work surfaces that are excessively high or low. Employees who work on these surfaces for extended periods of time have a higher risk of developing tissue damage and other issues related to musculoskeletal illnesses. <sup>(4)</sup> The elbow, hand, shoulder, and neck were the main regions impacted by WMSDs, which are particularly common in medical laboratory technicians. <sup>(5)</sup> Hence it is important to identify the ergonomic risk factors to improve the quality of life among the healthcare laboratory technician. Several studies labelled work related risk factors for musculoskeletal disorders, such as long work-shifts, lack of work-rest schedule during work, repetitive

movements, the combination of strain and repetitiveness, poor postures, strained hand and arm movements, vibrations, movements requiring extreme hand and arm postures, static muscular constraints, sudden muscular effort, task invariability, short work cycles, short deadlines, high cognitive demand, low temperatures in the work environment, mechanical compression on tissues.<sup>(6)</sup>

Moreover, laboratory professionals are susceptible to injury because of their awkward posture at their workstations. Therefore there's a need to identify the ergonomic risk among healthcare laboratory technicians, to prevent further physical or environmental stress due to their working environment. This study will also help in implementing intervention and strategies to limit future musculoskeletal problems.

The Rapid Upper Limb Assessment (RULA) is an ergonomic assessment tool, considers biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities.<sup>(2)</sup> RULA (Rapid Upper Limb Assessment) is a subjective observation method of posture analysis that focuses on the upper body and work-related upper limb disorders.<sup>(7)</sup>

This tool requires no special equipment in providing a quick assessment of the postures of the neck, trunk and upper limbs along with muscle function and the external loads experienced by the body. It was designed to be carried out quickly and with minimal equipment or change to the working environment, and with minimal disruption to those under observation. It requires no previous skills in observation techniques and is easy to learn. Intra-and inter-rater reliability of RULA is found to be excellent with ICC=0.92 (0.90-0.94) and 0.91 (0.89-0.93) respectively.<sup>(7)</sup>

## 2. MATERIALS & METHOD:

A cross sectional study was conducted among 100 Healthcare Laboratory Technicians belonging to Microbiology, Pathology & Biochemistry department in Sir. Jamshedjee Jeejeebhoy (J.J) Group of Hospitals, Mumbai. Convenience Sampling method was used. Laboratory Technician working for 1 or >1 year, working for 8 or >8 hours, both males and females were included in the study. Participants with disability, any diagnosed musculoskeletal deformities & any recent trauma to neck, hand and trunk were excluded. Materials used during the study were Rapid Upper Limb Assessment (RULA) Scale, Consent form, Information sheet, Pen & paper.

## 3. PROCEDURE:

An approval was taken from the institutional ethics committee of TMV's Lokmanya Tilak College of Physiotherapy. The purpose of the study was explained to the participants and their informed consent was taken. Demographic details like Name, age, sex, address, of all the participants were collected. Data collection sheet was filled in which any diagnosed Musculoskeletal Deformities and any recent trauma to neck, hand and trunk was asked. Participants of all the departments were assessed in their specimen testing positions using RULA Scale. The individual scorings were scored into a single combined risk score using a table provided to give an overall score. The scale consists a scoring of 1-7 which provides a risk assessment for posture that represents the level of Ergonomic risk. After the data for each region was collected observations and readings were noted and correlated accordingly.

## 4. ANALYSIS:

Demographics and criterion for assessing ergonomic risk –

The present study was conducted on 100 healthcare laboratory technicians. The criteria put forth for assessing healthcare laboratory technicians included the working experience of 1 or >1 year, working for 8 or >8 hours, both males and females. Following graphs represent the inclusion criteria and the necessary details taken into consideration for the study.

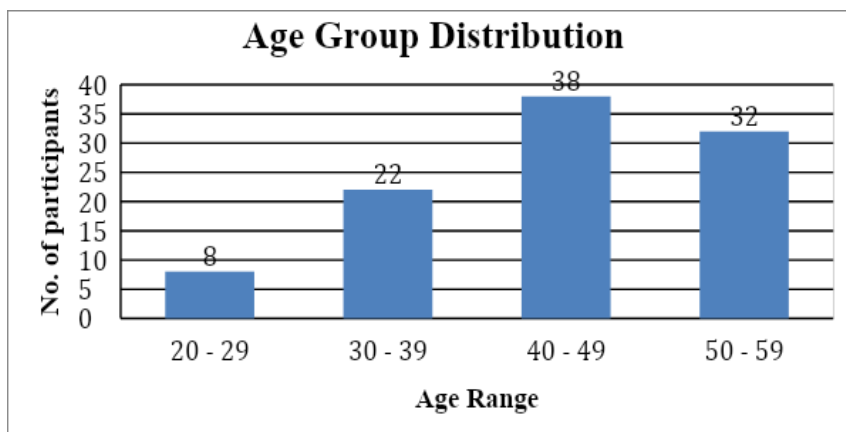


Fig 1. The figure illustrates the age group.

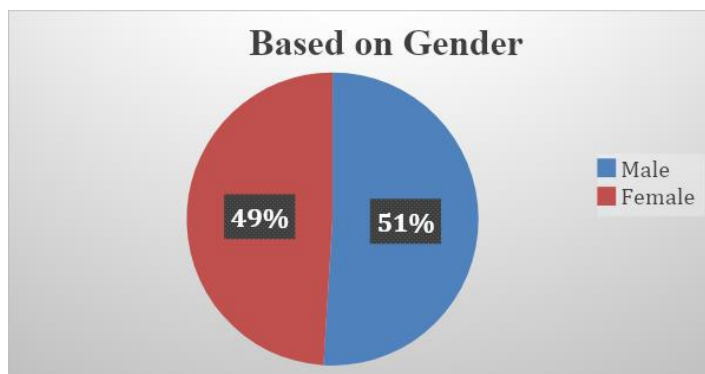


Fig 2. The figure illustrates the distribution of Gender.

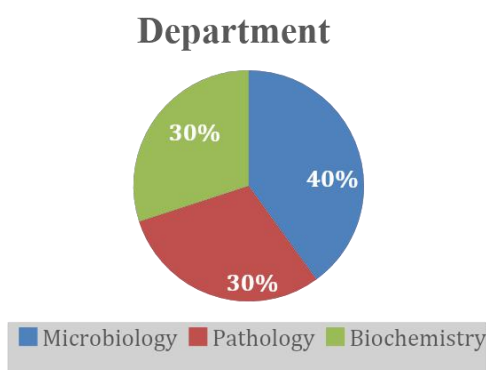


Fig 3. The figure illustrates the distribution among the departments.

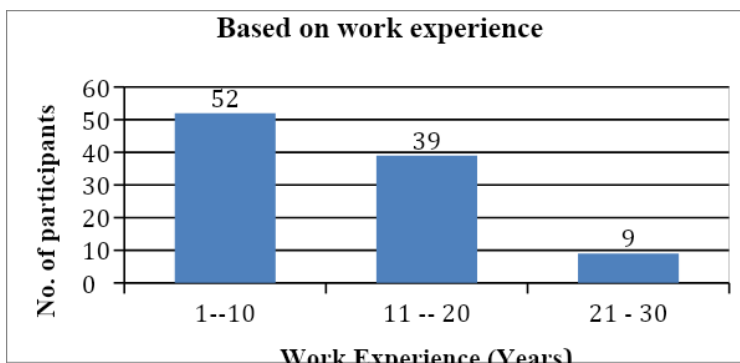


FIG 4. The figure illustrates work experience of the study population (years)

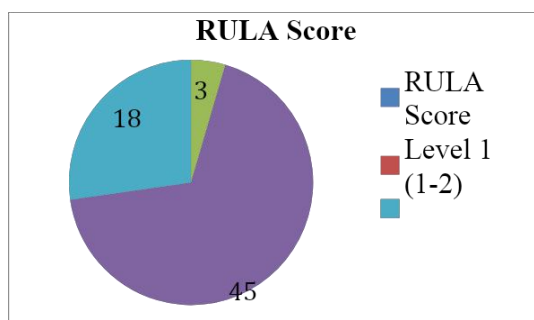


Fig 5. The figure illustrates the level of action required among the participants.

**RULA Scoring based on Age**

AGE	Level 1 (1-2)	level 2 (3-4)	level 3 (5-6)	level 4 (7)
20-29	-	3	4	1
30-39	-	11	10	1
40-49	-	15	19	4
50-59	-	8	12	12

**Fig 6. The table illustrates the RULA scoring with relation to Age.**

RULA level of action 2 and 3 was found in most of the total participants. Level of action 4 and 3 was found in the oldest age group whereas level 2 and 3 were common in the remaining groups.

**RULA Score according to the Departments**

DEPARTMENT	Level 1 (1-2)	Level 2 (3-4)	Level 3 (5-6)	Level 4 (7)
Microbiology	-	20	14	6
Pathology	-	8	13	9
Biochemistry	-	9	18	3

**Fig 7. The table illustrates the RULA scoring with relation to department.**

20 participants in Microbiology department fall in level of action 2. A total of 13 and 18 from the Pathology and Biochemistry department respectively fall in level of action 3.

**RULA score based on work experience of the study population**

WORK EXPERIENCE	level 1 (1-2)	level 2 (3-4)	level 3 (5-6)	level 4 (7)
1-10 yrs	-	17	25	10
11-20 yrs	-	16	17	6
21-30 yrs	-	4	3	2

**Fig 8. The table illustrates the RULA scoring with relation to the Work experience (years).**

91 participants had work experience between 1 to 20 years where Level of action 3 was seen in majority. 4 participants from 21 to 30 years of work experience require level of action 2.

**5. DISCUSSION:**

Technicians in healthcare laboratories are more likely to get injuries due to their awkward workstation posture. These professionals operate in repetitive, difficult postures for extended periods of time, which increases their risk of ergonomic injury. Hence the present study was conducted on 100 healthcare laboratory technicians at Sir J.J Hospital in their specimen testing position.

Both males and females respectively were included. Amongst all the participants, 51% are males and 49% are females. Employees with minimum of 1 years of experience and 8 hours of work were included in the study and those with less than 1 years of experience, any disability, diagnosed musculoskeletal conditions and recent trauma to neck, hand, upper extremity and trunk were excluded from the study.

The age range varies from 20-59. Where 20-29 age group had 8 participants. 30 to 39 had 22 number of participants. 40 to 49 age group had 38 participants and 50 to 59 had 32 participants. RULA level of action 2 and 3 was found in most

of the participants. Working in poor posture and performing repetitive motions for a prolonged amount of time can increase force and exertion, strain joints, and reduce blood flow.<sup>(3)</sup> Level of action 4 and 3 was found in the oldest age group whereas level 2 and 3 were common in the remaining groups.

The work of specimen testing requires accuracy and sustained focus over a prolonged period of time. There is a clear correlation between the prevalence of MSDs and occupations that require repetitive motion, as evidenced by the findings in the Health Effects section. The joints are most susceptible to repetitive motion injuries, especially the wrists, fingers, shoulders, and elbows.<sup>(4)</sup> Out of total 100, 40 participants from the Microbiology, 30 from Pathology and 30 from Biochemistry department were included. 20 participants in Microbiology fall in level 2. 13 and 18 from the Pathology and Biochemistry department respectively fall in level 3. The pipetting work requires the use of the thumb to press tools, as well as frequent hand, thumb, finger, and forearm motions, wrist twisting, neck bending, and prolonged standing. Additionally, while working at a workstation, technicians must repeat thousands of wrist and hand motions throughout the day. These motions typically call for extended neck and back flexion, elevated shoulders, elbow abduction, and uncomfortable wrist and hand postures. The majority of these risk factors increase the strain on the body's lumbar spine.<sup>(1)</sup> Hence the subjects in action level 2 require change in posture and further investigations should be done. Subjects in action level 3 require changes in posture and further investigations soon.

These employees had an average work experience of 12.46 years. 91 participants had work experience between 1 to 20 years where level of action 3 was seen in majority. The work environment or work setting causes workplace risk factors for MSDs such as shoulder and backache, joint pain and muscle fatigue, this experiences mainly lies on healthcare professionals comprising musculoskeletal problems.<sup>(8)</sup> Medical laboratory technicians in particular have a significant incidence of WMSDs, with the neck, shoulder, elbow, and hand being the main affected regions.<sup>(9)</sup> 4 participants belonging to 21 to 30 years of work experience require action level 2.

The final RULA scoring in all the participants was noted. All the participants had a common RULA action level of 4, 3 and 2. 18 participants need level of action 4. 45 participants need level of action 3. 37 participants need level of action 2. None of the participants had a RULA scoring of 1 and 2 that is level of action 1. This study also shows that with age, ergonomic risk increases due to repetitive activities in the same position for prolonged time as it puts stresses and leads to work related musculoskeletal disorders. Based on the obtained result in the study it can be concluded that the clinical laboratory technicians are prone to ergonomic risk due to their poor working environment.

## 6. CONCLUSION:

It can be concluded from the study that, healthcare laboratory technicians are prone to ergonomic risks, demanding further investigation. Certain modification of bench surfaces to increase knee & foot clearance, use of foot rest and adjusting arm rest to support shoulders in a neutral position should be made to correct the posture. Application of proper ergonomic modification will bring motivation and decrease work related musculoskeletal problems in healthcare laboratory technicians.

## 7. CLINICAL IMPORTANCE:

Healthcare laboratory technicians demands work that includes maintaining same position or posture while performing tasks, sitting for a long time, using hands or body as a clamp to hold object while performing tasks. Working surfaces are too high or too low whereas horizontal reach is long, vertical reach is below knees or above the shoulders. All these factors lead to the ergonomic risk leading to work related musculoskeletal disorders. Hence it is necessary for the application of proper ergonomic modification that will bring motivation and decrease work related musculoskeletal problems in healthcare laboratory technicians.

## 8. LIMITATIONS:

This study considers of relatively small sample size with samples collected from only one study setup. The RULA scale was taken while doing only one certain activity and is used to assess only upper extremity. RULA is an observational study and it can vary from therapist to therapist.

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