

# An Ergonomic Study: Bicycle Repairer in Rural India

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# ORGANIZATION

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- ✓ **Motivation**
- ✓ **Objectives**
- ✓ **Methodology**
- ✓ **Result**
- ✓ **Recommendation**
- ✓ **Conclusion**
- ✓ **References**

# MOTIVATION

- **Despite** worldwide mechanization, **workers** still perform their daily activities **manually**.
- **Manual material handling** tasks may lead to the **musculoskeletal disorders**.
- **Workers** are often forced to work in an ergonomically **vulnerable** environment.
- **Bicycle repairer in rural India** is one such group of workers.



**Fig. 1:** Dismounting bicycle parts [1]



**Fig. 2:** Repairing of bicycle tire [2]



**Fig. 3:** Dismounting of bicycle tire



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# OBJECTIVES

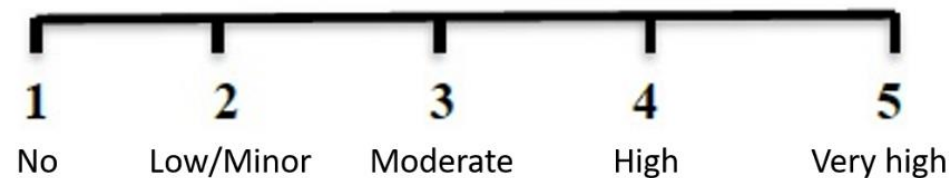
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- To **investigate** the ergonomic **risk** factors associated with **bicycle repairers** in **rural** India.
- To find a **low cost** and **effective** workplace design **solution** in order to **minimize** the postural **load** sustained due to prolonged **awkward posture**.

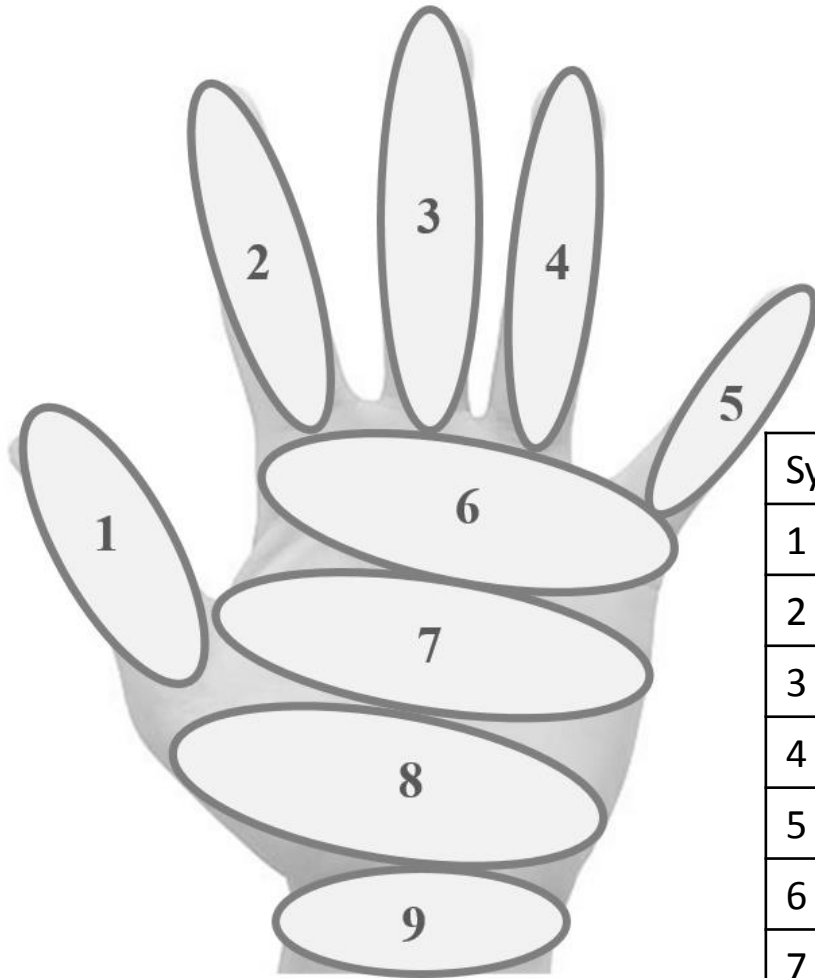


- **Twenty-one** bicycle repairers were **selected** from various bicycle **maintenance** shops.
- The **anthropometric** data were recorded using **height** and **weight** measuring scales.
- Modified **Nordic** questionnaire was utilized to **collect** participants' **information**.
- **Likert's** 5-point scale has been utilized to **measure** the **hand pain** index and **sources of injury** index.



**Fig. 4:** Adopted Likert's scale [3]

# METHODOLOGY



**Fig. 5:** Hand regions

Symbol	Hand regions
1	Thumb
2	Index
3	Middle
4	Ring
5	Small
6	Upper Metacarpal
7	Middle Metacarpal
8	Lower Metacarpal
9	Wrist

Variable	Number (N = 21)	Percentage
<b>Age group in years</b>		
18-30	4	19.05%
31-40	9	42.86%
40-50	5	23.81%
>50	2	9.52%
<b>Literacy level</b>		
Illiterate	2	9.52%
Primary School	15	71.43%
High School	3	14.29%
Degree	1	4.76%
<b>Years of experience in work</b>		
Less than 1 year	1	4.76%
1-5 years	5	23.81%
5-10 years	10	47.62%
Greater than 10 years	5	23.81%
<b>BMI range, kg/m<sup>2</sup></b>		
Underweight (<18)	1	4.76%
Normal weight(18-25)	8	38.10%
Overweight(25-30)	9	42.86%
Obesity(>30)	3	14.29%

**Table 1:** Demographic characteristics of selected workers

# METHODOLOGY

- **Four** puncture repairers were selected for objective assessment.
- **EMG** study of the **longissimus** muscle of **erector spinae** was conducted while following steps were **performed**:

S.No.	Step
1	Positioning of the bicycle
2	Dismounting of the tire tube
3	Locating puncture
4	Puncture repair
5	Mounting of the tire tube
6	Repositioning of the bicycle

**Table 2:** Steps involved in puncture repair task  
(Adopted for EMG study)



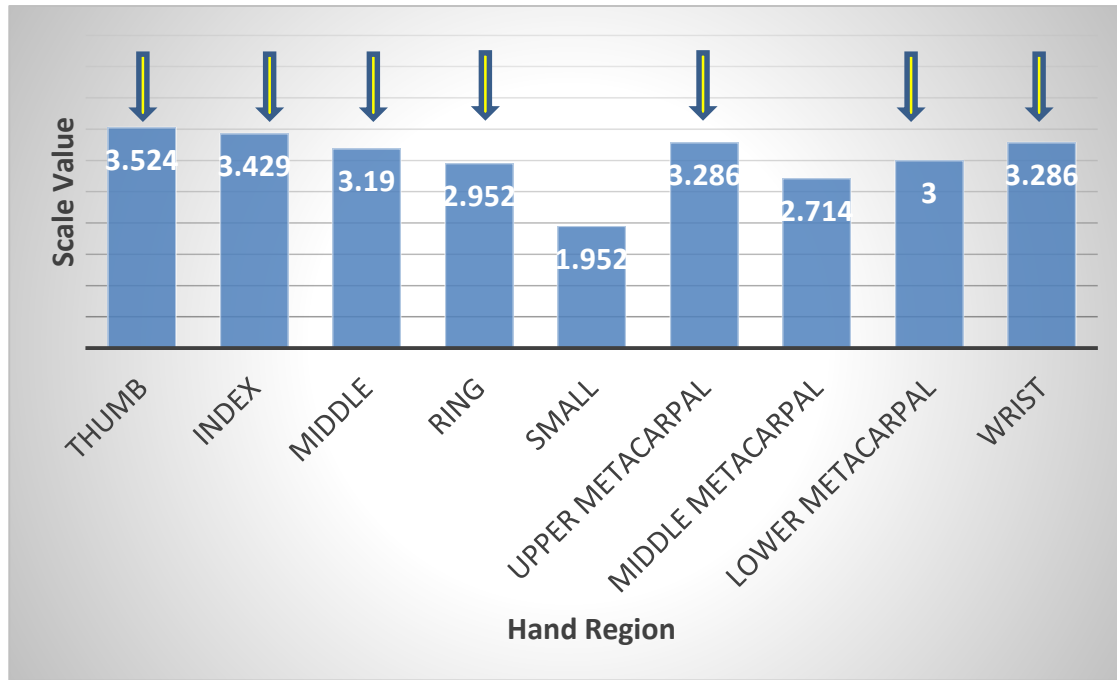
(a)



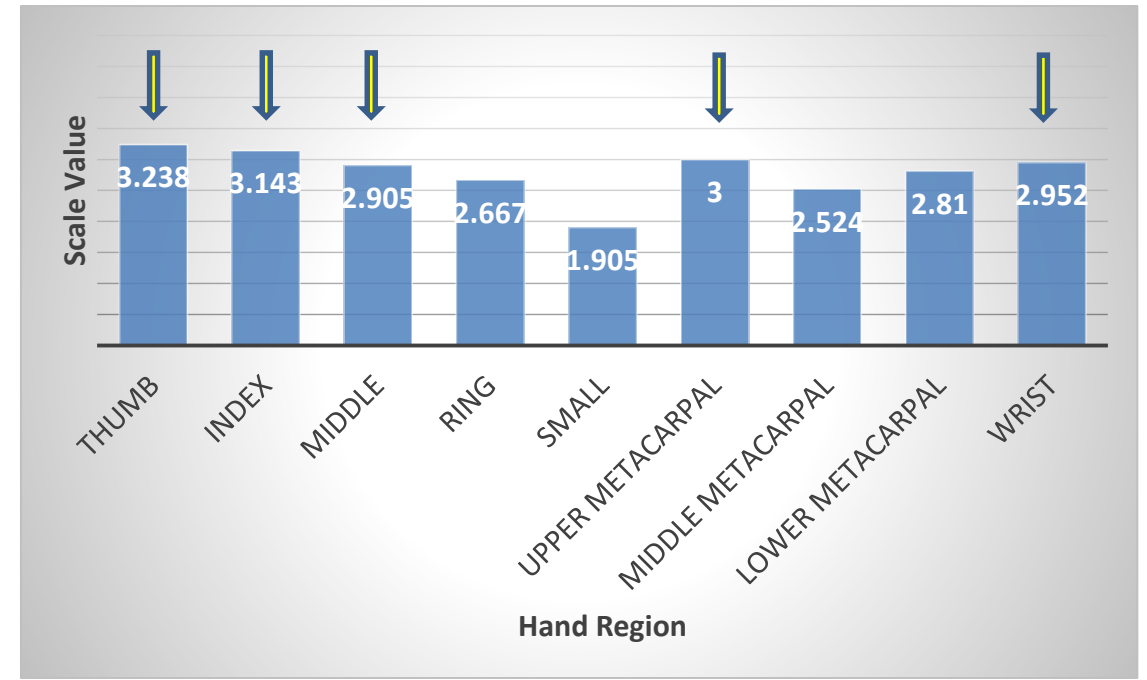
(b)

**Fig 6.** A bicycle repairer (a) locating puncture  
(b) repairing puncture

# RESULT



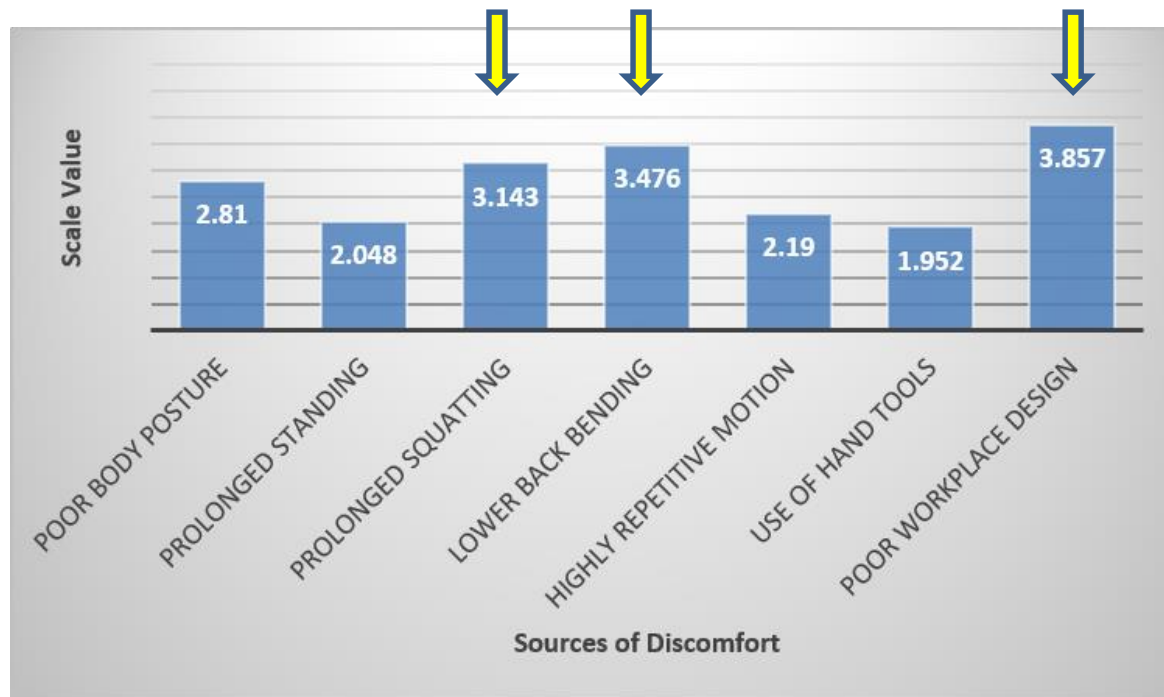
**Fig. 7:** Right hand pain index (average)



**Fig. 8:** Left hand pain index (average)



# RESULT



**Fig. 9:** Sources of discomfort score (average)

Stool Height (mm)	%MVC	Time (Sec.)
0	13.40	312
100	7.77	294
150	15.13	336
200	16.98	368

**Table 3:** Average %MVC values obtained



# RECOMMENDATION



- Any **manual material handling** work involving **squatting** posture must include a **stool** for support.
- A **stool** of height **100 mm** must be used when the job is at **ground level**.
- **Hand gloves** must be used by **bicycle repairers** in order to **reduce** hand **pain** level significantly.
- There is a **need** for organization of **ergonomic** seminars in **rural** areas in order to create **awareness** among **bicycle repairers**.



# CONCLUSION



- The study **finds** that the **bicycle repairers** are subjected to various ergonomic **risk** factors such as awkward posture, poor workplace design, etc.
- **Bicycle repairers** working in **rural** areas are in **immediate** need for proper ergonomic **interventions**.
- **Utilization** of stool is a **low cost** and **easily implementable** solution to **counter** low back **pain** and increase **efficiency** in bicycle repairers.



# REFERENCES



- 1) Mukhopadhyay, P., Jhodkar, D., Kumar, P.: Ergonomic risk factors in bicycle repairing units at Jabalpur. *Work*. 51(2), 245-254 (2015)
- 2) Cole, B.: Brett Cole Photography. Retrieved from <http://www.brettcolephotography.com/?search=India%2BBicycle>
- 3) Likert, R.: A technique for the measurement of attitudes. *Archives of psychology*. (1932)



# THANK YOU



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