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## Grip Fatigue analysis in women making wood bead strings

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### Abstract

Around 70 percent of households in Mangali, a village of Hisar Haryana are run by the activities related to wooden beads. Men are mostly involved in bigger machines constructing beads whereas women's major work is to compile those beads in strings and make them ready to be sold. The long hours' strenuous work and continuous stringing and finishing give so much strain to fingers of women. The grip strength of women was found to be severely reduced for other households' works too. Other body and joint pains add to the drudgery of the women. The prolonged exposure to uncomfortable sitting and drooping neck without any front support was found to be one of the reasons for grip fatigue. Fifteen women involved in only string making and string finishing, working for an average of 6 to 8 hours per day were selected and had been given a platform of 10 inches to put their hands over it and working while wrists were in a supported position. After observations of each women working for 2 hours with and without increased platform workstation, the grip fatigue was significantly found to be reduced by 10.45 for left hand while 18.75 for the right hand. Women themselves felt a difference of ease while doing other works immediately and moving hands freely. The body posture was lifted to straight back and front seeing eyes and neck. An overall visual occupational improvement was observed among the women. The working platform was made as a raised prototype platform for the women inspired through bed table while a virtual modified and more sophisticated workstation idea was built to prevent overall body discomfort of the workers.

**Keywords:** Bead strings, grip fatigue, workstation, etc

### Introduction

Grip strength is the force applied by the hand to pull on or suspend from objects and is a specific part of hand strength. Grip strength is a generally also used to refer the physical strength and the muscular power and force that can be generated with the hands. Since the grips involve the action of a large number of different joints and muscle groups, grip strength is not always very sensitive to measure individual muscle groups in medicine. For this purpose, dynamometers have been developed that provide more specific information on individual muscles in the hand such as the Rotterdam Intrinsic Hand Myometer (RIHM) [3]. Sometimes Doctors also use grip strength to test a patient's mentality, as grip strength directly correlates to mental state. Different occupation need certain amount of grip strength and consecutively cause a certain amount of grip fatigue which can be identified through reduction in grip fatigue.

Bead making is one of the small-scale enterprises practiced in Northern western part of Haryana. Mangali, a little known village 12 km from Hisar in Haryana, where work goes on at a feverish pace from dawn to dusk in more than 100 units, producing wooden beads for rosaries for the domestic as well as the export markets. Today the village is one of the biggest producers of beads made of sandalwood, red wood, *ber* wood, *shisham* and Ebonite. These beads are exported to countries like Saudi Arabia, Iraq, Iran, Abu Dhabi, France, the UK, and the USA. Mostly, these beads are used for making rosaries for members of different religious communities. Bead-making is a laborious task. It keeps the entire family busy throughout the day. Bead making comprises sub activities starting from procurement of wood, chopping of wood, seasoning of wood, bit designing, sharpening blade/Bit, designing Bead, drilling of beads, sieving & sorting beads, coloring/ waxing/Buffering, stringing and mala making, 3-Eyed, Bead/ *guru* Bead fixing, tassel fixing, bundle making/*kaudi* forming. The present study was undertaken to assess grip fatigue in different activities of bead making enterprises and studying workstation requirement and health hazards. Men are mostly involved in bigger machines constructing beads whereas women's major work is to compile those beads in strings

and make them ready to be sold. The long hours' strenuous work and continuous stringing for 6-8 hours with finishing give so much strain to fingers of women. The grip strength of women was found to be severely reduced for other households' works after the occupational tasks. The study aimed to show the requirement and effectiveness of a workstation to reduce the grip fatigue among women due to bead stringing activities.

### Methodology

The present study was conducted in Mangali village (biggest producers of beads) of Hisar district, Haryana. Fifteen bead making and stringing households were selected and out of these selected places, 30 women respondents were selected for studying the grip strength due to bead stringing and other product finishing tasks in bead making. A well structured method to calculate grip strength was used to collect the data from women using Grip Strength Dynamometer as the measuring equipment. The purpose of using a grip strength dynamometer is to measure the maximum isometric strength of the hand and forearm muscles which, naturally keeps

decreasing after heavy works as the strength of hands reduces. Readings at rest were observed for all the respondents in a healthy normal condition. Again, three set of reading were taken for respondents while at work before and after the workstation improvement. The readings at rest, pre-exposure work and post-exposure work were recorded and compared. A raised wooden platform was provided to support hands of women on the basis of which a future workstation can be built accordingly. Data collection was done in 3 sittings for each woman at an interval of one hour duration of work with and without the provided raised platform to work upon.

### Results and discussions

The given table represents the percentage of change brought to grip fatigue after the provision of the raised platform. The grip fatigue in relation to the initial original grip strengths of women was calculated before and after workstation improvement. An overall change of 10.45 % was brought to grip fatigue of left hand and of 18.75% to that of right hand. Hence a subsequent positive change is observed due to the use of new hands' support the form of raised wooden platform.

**Grip strength of respondents after workstation improvement**

Mean values after 3 sittings	At rest (Kg)	Before platform		After platform		Change (%)
		After activity (Kg)	Grip Fatigue (%)	After activity (Kg)	Grip Fatigue (%)	
Left hand	22.30	18.98	14.89	21.31	4.44	10.45
Right hand	23.00	17.26	24.96	21.57	6.21	18.75

The grip strength of right hands had been shown greater than left hands by Parvatikar and Mukkanavar, (2009) [7] and various joint positions affected grip strength, especially elbow and shoulder joints with respect to wrist positions. This supports the data that due to the improved posture of wrists through developed workstation among women, subsequent decrease in the grip fatigue of respondents for left hand (10.45%) and right hand (18.75%) was brought. The importance of the workstation is supported by Ashish, (2018) who suggested a decrement of hand grip and pinch strength in handicraft occupation in an ergonomic assessment proposed the need for ergonomically designed hand tool interventions to reduce the loss in static muscle strength.

### Conclusion

The grip strength was certainly reduced among the women after the bead stringing, tassel making and other bead products making from the initial position of rest or from a fresh start in the morning. Hand dominance is reliably correlated with hand strength, so the data provides support for hypotheses about differences in strength levels between left- and right-handers. Further research is required to assess whether handedness associated with hand grip strength can differentiate by using protective equipments in bead making and product making enterprise or other works related to wooden beads. The shown differences in grip strength can be worked upon using various exercises of hands in between the tasks and the better developed workstations with other features using the height of this intervened platform can help to reduce the grip strength among women up to a certain level.

### Recommendations

- Working upon a new modified workstation to provide a hand and tools support for the tasks.

- Protective equipments and cushioning provisions so that the strain on hands is reduced to a certain limit like use of thimbles or gloves.
- As finger flexor/extensors serve a function as wrist flexor/extensors, doing wrist extension exercises (sometimes called "reverse wrist curls") would also stimulate the finger extensor fibers.
- Doing fist pushups on the backside of the first finger-bone would increasingly put pressure on the extensor muscles as weight was shifted from knuckle-end to the further joint.

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