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# Efficiency Assessment of Maize Sheller in Context of Drudgery of Farm Women

**Nimisha Awasthi[1], Anjali Sahu[2], Poonam Singh[3]**

[1]Programme Assistant, KVK Kanpur

[2]Subject Matter Specialist, KVK Kushinagar

[3]Subject Matter Specialist, KVK Kannauj

**Abstract:** ***Present study entitled "Efficiency Assessment of Maize Sheller" was conducted on 90 randomly selected physically fit farm women of district Kanpur and Kushinagar. Data was gathered with prestructured interview cum observation schedule. Descriptive cum experimental research design was adopted to collect information regarding socio-economic profile, physiological cost of work, percent change in grip strength, musculoskeletal pain, and time taken to remove grain from corn. Findings reveled that majority of respondents were between age group of 25-35 years, illiterate belonging to nuclear family and having monthly income up to Rs.10000. Maize shelling is moderately heavy work when done manually but light work if done through Maize Sheller. AWHR was 121 beats/ min for manual shelling and 103 beats/ min in case of Maize Sheller. Physiological cost of work for manual maize shelling was 23 beats/ min and 13.33 beats/ min for Maize Sheller along with 10.7 KJ/ min and 7.66 KJ/ min of energy expenditure respectively. Percent Change in grip strength was observed in both the cases but in manual shelling it was quiet higher. Moderate to severe pain is reported in wrist and fingers in manual shelling while very light to light pain was reported in wrist and no pain in fingers. In one hour 13 kg grain was removed by Maize Sheller whereas only 7.5 kg grain was removed in one hour by manual shelling. Average time taken for removing grain from one corn was 93 seconds in case of manual shelling and by use of Maize Sheller it was only 40 seconds.***

**Keywords:** Maize Sheller, Physiological cost of work, Grip Strength, Musculoskeletal Pain, manual shelling

## 1. Introduction

India is mainly an agricultural country, having farming as one of the largest occupations and agriculture in India is a labour intensive industry, rural women in India are the major labour force in agriculture. They perform almost all agricultural activities, from sowing up to harvesting and post-harvest activities. Most of the drudgery prone tasks for women in agriculture are cutting, uprooting, transplanting, weeding, sowing and post harvest tasks like manual threshing of maize millet and pulses, sieving and cleaning. Traditionally shelling of maize are done either by threshing cobs or removal of seeds by hand. Studies have pointed out that farm activities that are time and labour intensive, monotonous, repetitive and more drudgery prone are generally performed by women. Since all the operations are done manually they cause considerable physical and mental fatigue and other health problems. The root cause of their sufferings is unawareness or ignorance about improved technologies, age-old methods of doing the work, inappropriateness of the technology and attitudinal constraints such as innate conservation and resistance to change. Study was planned with objective to compare physiological work load and Muscular pain and assess efficacy of Maize Sheller as compared to manual maize shelling.

## 2. Material and Methods

The study was conducted on 90 randomly selected physically fit farm women of Rania and Karsa Village of sarwankheda block and Lodhar village of Kalyanpur block of Kanpur district, Laxmipur and Malludeeh village of Kasya and Gahzipur village of Tamkuhi block of Kushinagar District i.e. Ten farm women from each village were selected. Data was collected with the help of pre-structured interview schedule and measurement was done for Height, Weight, BMI, and Physiological parameters like physiological cost of work, percent change in grip strength, muscular pain and performance parameters of Maize Sheller were assessed by the equipments designed for the purpose. Polar Heart rate monitor and Grip Dynamometer were used to measure heartbeat/min and grip strength respectively. Following formula was used to calculate PCW, energy expenditure and Percent Change in Grip Strength while removing grain from the cob manually and through maize sheller as well.

## 3. Physiological Cost of work

**TCCW** = Cardiac cost of work (CCW) + cardiac cost of recovery (CCR)
**AHR** = Average working heart rate (AWHR) – Average resting heart rate
**CCW** = Average hear rate (AHR) x Duration of activity
**CCR** = Average recovery heart rate – Average resting heart rate x duration of activity
**PCW=** Physiological cost of work / Total time of activity
**Energy expenditure (Kj/min)** = 0.159 ´ AHR – 8.72

**Change in Grip Strength =** : Sr –Sw / Sr X 100
Where
Sr= Strength at rest
Sw= Strength at work


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## 4. Result and Discussion

**Socio- Economic Profile of Respondents:** All community based studies focus on socio-economic stratification as this is the key to understanding affordability of health services, amenities and purchasability. When it is taken as a summation of education, occupation and income it reflects the value system expected for that level of education and occupation. Income is parallel to standard of living. Socio Economic Status (SES) is established determinant of health.

**Table 1:** Distribution of Respondents on the basis of Socio-Economic Profile N=90

| *S.No.* | *Particulars* | *Frequency* | *Percentage* |
|---|---|---|---|
| **a. Age** | | | |
| 1 | 25-35 | 54. | 60.00 |
| 2 | 36-45 | 20 | 22.22 |
| 3 | 46-55 | 9 | 10.00 |
| 4 | <55 | 7 | 7.78 |
| **b. Education** | | | |
| 1. | Illiterate | 57 | 63.33 |
| 2. | Up to primary | 19 | 21.11 |
| 3 | Up to Middle school | 10 | 11.11 |
| 4 | Up to High School | 4 | 4.44 |
| **c. Caste** | | | |
| 1. | General | 13 | 14.44 |
| 2. | Backward Caste | 23 | 25.56 |
| 3 | Schedule Caste/Schedule Tribes | 54 | 60.00 |
| **d. Occupation** | | | |
| 1. | Unemployed | 27 | 30.00 |
| 2 | Farm labour | 63 | 70.00 |
| 3 | Business | - | - |
| 4 | Service | - | - |
| **e. Monthly Income of Family from all sources (Rs.)** | | | |
| 1. | **Up to 10000** | 48 | 53.33 |
| 2. | 10000- 15000 | 26 | 28.89 |
| 3. | 15000-20000 | 12 | 13.33 |
| 4. | <20000 | 4 | 4.44 |
| **f. Type of Family** | | | |
| 1. | Nuclear | 71 | 78.89 |
| 2. | Joint | 19 | 17.78 |
| **g. Size of Family** | | | |
| 1. | Up to 4 members | 34 | 36.78 |
| 2. | 5-7 members | 55 | 61.11 |
| 3 | 8 and above | 1 | 1.11 |
| **h. Type of Body** | | | |
| 1. | Ectomorph | 34 | 37.78 |
| 2. | Mesomorph | 49 | 54.44 |
| 3. | Endomorph | 7 | 7.78 |

Data Scrutinized for socio-economic profile shows that majority of respondents were from the 25-35 years of age group (60.00%), illiterate (63.33%), schedule caste(60.00%), Farm labour (70.00%), having monthly income up to Rs.10,000 from all the sources, belonging to nuclear family (78.89%) having 5-7 members in family(61.11%), and have mesomorph body type (54.44).

**Table 2:** Physical Parameters of Respondents N= 90

| *S.No.* | *Particulars* | *Mean Value* |
|---|---|---|
| 1 | Height (c.m..) | 153 |
| 2 | Weight (Kg) | 47.11 |
| 3 | BMI | 20,45 |

Physical parameters of selected respondents in table 2 revels that mean height of respondents was 153 cm, mean weight 47.11 Kg and mean BMI 20.45 which shows that respondents were physically fit.

**Table 3:** Mean Values of Physiological Parameters of manual maize shelling and shelling through Maize Sheller, N=90

| S.No. | Physiological Parameters | Manual Shelling | Maize Sheller |
|---|---|---|---|
| 1. | Average working Heart Rate (AWHR) | 120 beats/min | 103 beats/ min |
| 2. | Total Cardiac Cost of Work (TCCW) | 304 beats / min | 219 beats /min |
| 3. | Physiological Cost of Work (PCW) | 23 beats/ min | 13.33 beats /min |
| 4. | Energy Expenditure (E.E.) | 10.7 KJ/min | 7.66 KJ/min |
| 5. | Type of Activity | Moderately heavy | Light |

Heart rate is one of the accurate means to evaluate the physiological or functional demands of work on the worker. Table-3 is depicted physical work load of respondents mean values for average working heart rate of respondents performing maize shelling manually was 120 beats/min ranging from 113 beats /min to 134 beats per min which is quiet higher from the resting i.e.72-75 beats/ min clearly stating the strenuousness of the activity. From the physiological point of view, the job demand or workload refers to the demands placed on the cardio-respiratory system and is determined by the energy cost and cardiac cost of work. TCCW for manual maize shelling was 304 beats/ min whereas 219 beats/ min for Maize Sheller. Physiological Cost of work for manual maize shelling was 23 beats/ min while in case of Maize Sheller it was 13.33 beats / min. Demand of energy for manual maize shelling was 10.7 KJ/min but it is very low in case of Maize Sheller i.e. 7.66 KJ/ min. As per the classification given by Verghese (1999) on the basis of heart rate and energy expenditure manual maize shelling is considered to be Moderately Heavy activity while if done through Maize Sheller it is Light.

**Percent Change in Grip Strength:** Grip strength is the force applied by the hand to pull on or suspend from objects and is a specific part of hand strength optimum-sized objects permit the hand to wrap around a cylindrical shape. The main reasons for this decrease in grip strength are relative lengthening of the musculo-tendinous units

**Table 4:** Mean Distribution of Respondents on the basis of Percent Change in Grip Strength, N=90

| S. No. | Hand | Manual Shelling | Maize Sheller |
|---|---|---|---|
| 1. | Left | 13.67 | 8.66 |
| 2. | Right | 17.33 | 11.30 |
| 3. | Both | 15.86 | 9.33 |

Analysis of data in table 4 shows the reduced grip strength of left, right and both hands. Maximum force exerted from the grip was reduced significantly in manual maize shelling leading to fatigue and under productivity and ultimately leads to Musculoskeletal Disorder in Wrist, upper arm, Shoulder and elbow.


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**Table 5:** Rank wise distribution of Musculoskeletal Pain reported

| S. No. | Body Part | Manual Maize Shelling | | Maize Sheller | |
|---|---|---|---|---|---|
| | | Mean Score | Rank Order | Mean Score | Rank Order |
| 1 | Neck | 2.26 | IV | 1.2 | IV |
| 2 | Shoulder | 2.11 | V | 1.22 | III |
| 3 | Upper back | 0.95 | VIII | 0.93 | VI |
| 4 | Upper Arm | 1.79 | VI | 1.07 | V |
| 5 | Lower Back | 2.37 | III | 2.23 | II |
| 6 | Fore Arm | 1.57 | VII | 0.82 | VII |
| 7 | wrist | 3.35 | I | 1.27 | I |
| 8 | Finger | 3.25 | II | 0.43 | VIII |

Musculoskeletal Disorders are defined as a group of disorders that affect the musculoskeletal system including the nerves, tendons, muscles, and joints and supporting structures such as inter-vertebral discs etc. Musculoskeletal Disorders could result in pain, injury, illness, poor quality of life and reduced productivity. They are the most common cause of sever long term pain and disability

Table 5 Exhibiting data related to musculoskeletal pain reported by the respondents while performing maize shelling activity. Majority of respondents complaint Pain in Wrist (Mean.Score.3.35) and therefore ranked I followed by fingers (Mean.Score.3.25) Ranked II. In case of Maize Sheller wrist here is also ranked Ist with Mean Score 1.27.but in finger it is negligible (Mean.Score.0.43) Rank VIII. Since activity is used to done in sitting posture pressure on back was more so the results are. In both the cases i.e. in Manual Shelling (Mean.Score.2.37) and in Maize Sheller (Mean.Score.2.23) too severe pain in lower back was reported by the respondents and got III and II rank respectively. Pain in neck (Mean.Score.2.26) and (Mean. Score. 1.2) identified as rank IV in both the cases.

**Table 6:** Performance Efficacy of Maize Sheller

| S.No. | Parameter | Manual Shelling | Maize Sheller |
|---|---|---|---|
| 1 | Average Time taken to remove grain from 1 cob | 93 seconds | 40 seconds |
| 2 | Average Grain Removed in one hour | 7.5 Kg | 13.0 Kg |
| 3 | Average Grain removed in one man day | 60 Kg | 104 Kg |
| 4 | Difference in terms of labour cost | 120/60Kg | 120/104 Kg |

Data in table 6 shows comparative performance of manual maize shelling and with Maize Sheller. Average time taken to remove grain from one cob is 93 seconds i.e. only 7.5 kg grain is removed in one hour but in case of Maize Sheller it is 40 seconds and 13.0Kg respectively. In a single man day i.e. In 8 working hours average grain removed manually was 60 Kg but by use of Maize Sheller it was 104 Kg. Net 44kg less was removed in a single day which may take about 6 more hours if done manually and thus enhanced labour cost by Rs 90.

## 5. Conclusion

It is concluded from the study that Manual Maize shelling is a strenuous activity leading to pain in Neck, back, Shoulder, Wrist and Finger. Time taken in shelling grain from one cob is quiet higher from the Maize Sheller. Manual Maize Shelling is Moderately Heavy work but it can be lightened by the use of Maize Sheller. Musculoskeletal pain is considerably reduced with Maize Sheller. If talking in monetary terms, Maize Sheller saves Rs.90/day. Hence Maize Sheller is good option for removing maize from the cobs, it saves not only the time but also increases the efficiency of farm women almost by twice and save cardiac cost of worker per unit of output in comparison to the hand shelling. It eliminated the chances of injury to finger and is very comfortable hand-operated tool.

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