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EXPERIMENTAL VALIDATION OF BEST SUITABLE MECHANISM FOR MANUALLY POWERED LILLIPUT GIN

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Abstract:-

The subject of whether to control Lilliput Ginning Machine by either hand crancking or bicycle accelerating. The principal conclusion is that leg muscles are clearly greater than arm muscles so with bicycle accelerating ready to deliver more drive/torque. This was only a general suspicion and not outline particular so a particular examination obliged that should be possible to get more particular answers.

Pedal worked and hand cracking setup was created, utilizing Anthropometric Dimensions of Madhya Pradesh ranch labourers, and point of interest trial Comparison between hand Cranking versus Bike accelerating is figured and thought about.

Key words: Hand Cracking Vs Bike Pedalling , Comparison, exploratory acceptance

INTRODUCTION:

Ginning is most important aspect of post-harvest operation. In rural areas electricity is available in interruptions or it is found expensive for a small land holding farmers. So performing many farm related activities, human muscle power can be good alternative energy source. So by keeping in mind the advantage of rural manpower the drawback of interrupted power supply can be eliminated and for this Dual system Ginning technique going to be a perfect answer for the hybrid tooling which simplifies the small land holding farmer's need there by unifying the work culture of man and machine together. Resulting in the continuous production in the rural areas, maximizing the overall economy, maximizing profit, creating employment opportunities and finally acting as a socio-economic tool in the industrial sector. The traditional method of ginning by hand operated Charkha is laborious, time consuming and low output. Whereas modern techniques are generally mass production oriented. But to serve the need of small land holding farmer in order to make him deal with every module of cotton i.e. with cotton lint and cotton seeds separately to ensure maximum profit, need of Dual System Ginning Machine was felt. Dual system implies a Machine consists of two systems and here, two way power transmission systems means Powered by Electrical as well as Manual Power transmission system. Electrically based mechanized system is already developed and tested for its efficiency but in case of human muscle power based system, it can be applied in two ways either energized by hand muscles or by leg muscles i.e. by hand cracking or by Bike pedaling. In accordance with past research evidences bicycle was found the most efficient mechanical devices developed by man and pedaling is the key to the most efficient use of leg power. But no actual experimental based comparison between Hand Cranking Versus Bike Pedaling was found to Validate superiority of leg muscles over hand muscles. This research article will set up a good reference based on Experimental Data for the validation of superiority of lower limb muscles over upper limb muscles during manual transmission based working on Dual System Lilliput Gin. The Dual System Lilliput Ginning Machine is consists of Hand Cranking Setup and Electrically based mechanized setup for the first phase of Experiment, and for the second phase of Experiment pedal powered System consists of chain drive and gear amplification mechanism along with the Electrically Mechanized system that turn the crank shaft of the Lilliput

Ginning Machine. The Ginning Machine works on McCarthy's Principle, **"**When reciprocating knife moves over the fixed knife it hit the seeds whose fibers grasped by the roller. Due to opposing forces fiber gets separated from seed."

Process Unit Description:

The unit consists of:-

1) Automated System

a) Electrically mechanized system.

2) Manual System

a) Hand cranking mechanism

b) Pedaling Mechanism

Best mechanism is to be selected out of Hand Cranking Mechanism and Pedaling Mechanism.

1) Automated System

a) Electrically Mechanized System: - An existing Electrically Mechanized System of Lilliput Gin is considered for the ongoing research and which works on the McCarthy's Principle.

2) Manual System:-

In manually energized power system workers manually pedal/ hand crank the mechanism converting the oscillatory motion of crank shaft into oscillatory motion of bitter and rotary motion of roller. This output shaft is also connected to flywheel which avoids fluctuation of speed. Transmission system consists of pair of speed gears arranged by using the concept of gear train. In this way, the human muscular energy is converted into kinetic energy of flywheel by this machine.

a) Hand Cranking Setup:-

Person performed hand turning with maybe a couple arms. Two arms hand turning is favored for the most part for such exercises where torque necessity is high. Hand crancking is performed at diverse working statures by individuals, i.e., in bowing position (beginning diesel motor and working refuse cutter), in sitting position (working sewing machine) and in standing position (working sprayer, winnower and so forth.). The torque prerequisite fluctuated from low to high contingent upon kind of horticultural exercises viz. winnowing and blending seed with seed treatment drum, TV with supporter, showering with sprayer, waste cutting with refuse cutter, and so on. Person produced a predefined level of torque with elbow flexor muscles of one arm. The torque at altered position (isometric) would be distinctive at every quadrant in clockwise heading. The most extreme drive that an individual can apply is turning can't surpass the body weight; generally wrench couldn't be moved in a descending bearing. The rate of crancking will diminish as the heap builds (Murrel, 1965). Das and Bhattarcharya (1984) reported arm going after ideal wrench length of the revolving gadget amid turning method of working with both hands was 30%. Expansion of heart rate amid hand wrenching was least when the even area of a rotating gadget was 77% of arm scope and the vertical area is 77% of shoulder tallness. Bother (1984) reported that the maximal force yield for arm work while standing spoke the truth 25% to 30% not as much as that found in a sitting stance. Raouf, A., H. Imanishi, and K. Morooka (1986) showed the predominance of a clockwise turning heading and impact of span, torque, and plane point were observed to be noteworthy. In this paper an endeavor was made to know the level of torque (isometric) created by ranch specialists in standing and sitting stances and dissected its suggestion on configuration of hardware to be worked by hand(s).

Materials and methods for Hand Cranking Setup:-

A mechanical hand crancking frictional setup has been produced in view of anthropometric information of Madhya Pradesh farm workers. A handle with variable cranck length (175 to 300 mm) was given. Length of handle for palm holding was kept at 130 mm to give free conformity of palm of lworkers amid turning. This quality was gotten subsequent to including 30% in the measurement of hand expansiveness crosswise over thumb, in light of the fact that this measurement is measured at the level of distal end of the first metacarpal of the thumb. Distance across of handle was taken at 25 mm. The body measurements considered for the configuration of seat were sitting popliteal stature, hip expansiveness sitting, butt cheek - popliteal length, interscye broadness and elbow rest tallness. Seat was comprised of seat container, seat back rest and screw jack for tallness modification. The length of seat container was chosen in light of fifth percentile butt cheek popliteal length (flat separation from the back most surface of the butt cheek to the lower's back top). Consequently, measurement was kept around 10% not exactly the worth and kept at 350 mm. Seat dish's width was 410 mm which spoke the truth 15% higher to 95th percentile hip expansiveness sitting to conform diverse sort of workers. Amid hand turning in sitting stance, arm(s) ought to move uninhibitedly in this manner, interscye expansiveness was viewed as and by including 10%, measurement was kept at 350 mm. Length of back rest was kept around 20% higher than 95th percentile elbow rest tallness for obliging the greater part of the laborers furthermore to give ease in development of their arms. In this way size of back rest seat (350 mm in width and 290 mm long) was settled. Seat stature was chosen taking into account fifth percentile sitting popliteal tallness, as this measurement was measured from over the stool surface to underside of the leg (beneath knee) and configuration prerequisite was not to touch the underside of leg. Consequently measurement for seat stature was considered around 10% not as much as this worth. To oblige the ranch's majority workers, tallness of seat was made flexible utilizing straightforward screw jack. Utilizing the measurement, PC supported outline of the setup was made and unit was created. The setup's perspective is appeared in Figure below.

No.	Dimensions	Anthropometric Dimensions Taken	Value (mm)	Finalized Value (mm)
A	**Hand Cranking Setup**			
1.	Width	Shoulder Grip Length- 5th	600	600
2.	Height	Metacarpal-III Height- 5th- 95th	603-721	(Adjustable up to) 850
3.	Palm Grip on Handle	Hand Breadth Across Thumb- 95th	99	130
4.	Diameter of handle for gripping	Middle Finger Palm grip Dia- 5th- 95th	23-33	25
B.	**Chair**			
5.	Length of Seat Pan	Buttock-Popliteal Length- 5th	404	350
6.	Width of Sseat pan	Hip breadth sitting- 95th	324	350
7.	Width of Seat Back Rest	Interscye Breadth- 95th	324	350
8.	Length of Back rest	Elbow rest height- 95th	242	290
9.	Seat Height	Sitting popliteal Heigt- 5th- 95th	350-433	(Adjustable up to) 550
Note: * Agarwal et al. (2007)				

Dimensions considered for Hand Cranking setup and Chair

Materials and methods for Pedal operated System

1. A pedaling setup along with revolutionary gear train system equip with a flywheel is developed.
2. The system is fully detachable as shown in the picture.
3. Development of the system is based on Ergonomic study made in, "Dynamic Analysis of Pedaling Leg"

Figure Showing Sitting, Standing & Pedaling Posture Along With 12 Body Regions.

a) Postural Discomfort:-

Assessment of Postural Discomfort will be carried out with the help of ''A Technique for Assessing Postural Discomfort'', by E. N. Corlett and R. P. Bishop

i) Overall Discomfort Score. (ODS)

ii) Body Parts Discomfort Score. (BPDS)

i) Overall Discomfort Score. (ODS) :-

(1) Here Subject was asked to carryout work at Extremely Comfortable state to Extremely Uncomfortable State.

(2) Time was measured between these two extreme states.

(3) And then points were located on 5 point Scale

(4) This gives us Overall Discomfort Score, as shown bellow.

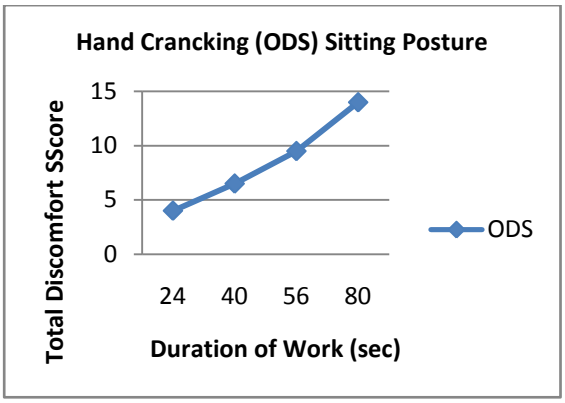
(5) After this, experiment was again carried out and this time overall time was divided in 30%, 50% and 70% of the total time period.

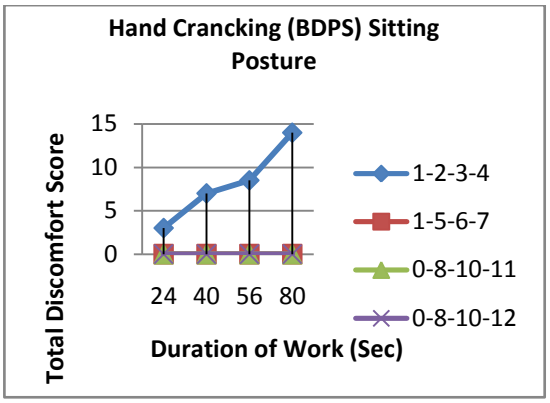
(6) And at that particular instant subjects were asked to express their pain level on a seven-point scale.

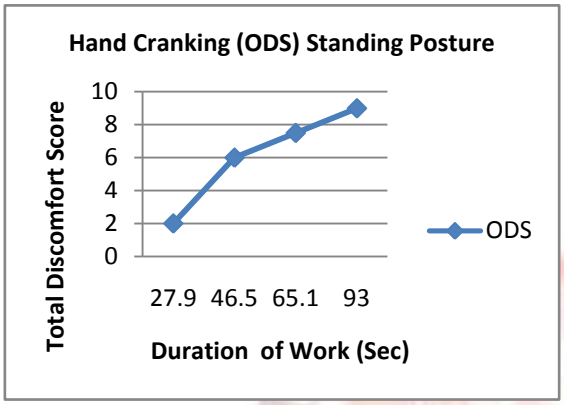
(7) This is how the Overall Discomfort Score was generated.

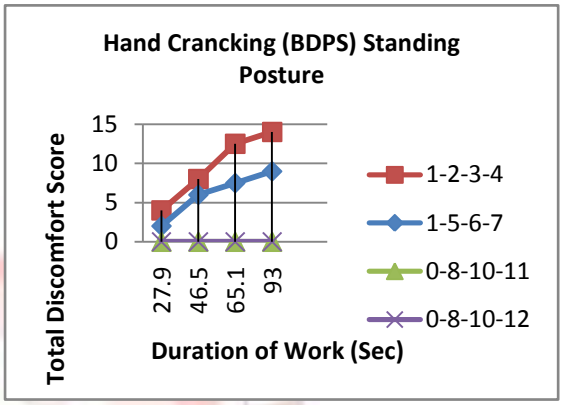
ii) Body Parts Discomfort Score. (BPDS) :-

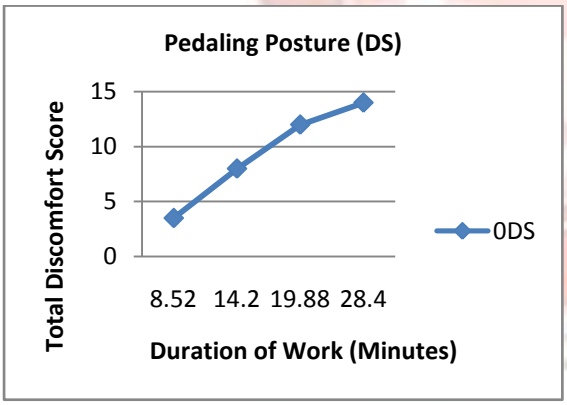
(1) Here same Experiment was carried out, but different Body Region were focused, as shown bellow

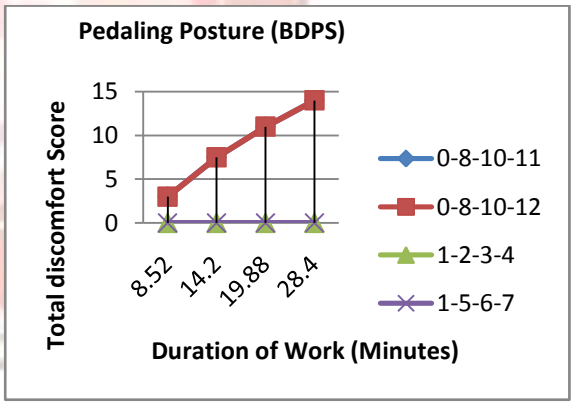












Protocols for heart rate measurement

The subjects decided for the study were homestead specialists who included in different ranch exercises. The subjects were physically fit for performing the exercises. Taking after focuses were considered for adding to the convention to lead this examination with the subjects.

1. Subject having age of 20 to 60 years was taken for the study.

2. Resting heart rate of any subject did not exceed 100 beats per min.

3. Subject was given preparing of utilizing the machine with complete operational strategies included in it.

4. The subjects chose were illustrative of User's populace (fifth to 95th percentile of stature and body weight) as reported by Agarwal et al.(2007).

5. Every one of the subjects were educated about the heart rate screen to be utilized on them for keeping away from any deceptive information. The surrounding condition (dry globule temperature and relative stickiness)

amid the trial was recorded. The heart rate was measured with the assistance of polar heart rate screen. Steps took after for heart rate estimation is given beneath:

6. An oxypulse meter is fitted on the subject's fingertip

7. Recording interim for heart rate was decided for 60s to stay away from various perusing.

8. Before recording the heart rate, subject was requested 15 minutes (min)brisk strolling took after by 30 min rest to guarantee ordinary resting heart rate, then the recording catch was exchanged ON.

9. The season of begin of rest was recorded in the information sheet. At the same minute stopwatch was likewise continued.

10. Amid this resting period, subject was not permitted to talk, eating tobacco or changing the area to maintain a strategic distance from any sporadic perusing.

11. The term of time of operation was recorded when genuine work began.

12. The stopwatch was made again ON.

13. Consideration was paid amid investigation about his inquiries/troubles if any, for example, individual need like need of drinking water and so on. The interest was corrected around then. On the off chance that it was not satisfied, the trial was ceased and rehashed.

14. After finish of tasteful work, the stopwatch was put OFF.

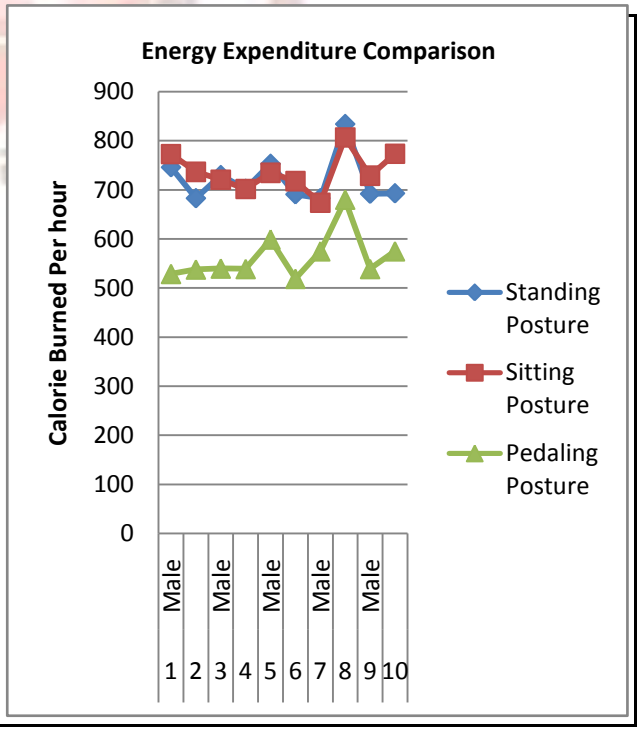
15. The subject was permitted to rest in the same spot, where she was amid rest period, until the recuperation heart rate equivalents to resting heart rate.

16. Information for resting, working and recuperation heart rate were isolated from aggregate recorded information.

Standing Posture										
Sr. No	**Sex**	**Weight of Cotton Ginned (Grams)**	**Time Required for Ginning (Sec)**	**Age of Subject (Years)**	**Height of Subject (Cm)**	**Weight of Subject (Kg)**	**Heart Rate (Resting) (bpm)**	**Heart Rate (Working) (bpm)**	**Calorie Burned During Test (cal)**	**Calorie Burned Per Hour (cal/ hr)**
1	Male	20	46	41	163	56	86	139	10	746
2	Male	20	48	44	156	50	78	133	9	683
3	Male	20	51	42	156	59	91	136	10	730
4	Male	20	43	26	165	56	74	139	8	702
5	Male	20	52	50	155	59	83	136	11	753
6	Male	20	40	32	164	49	86	138	8	691
7	Male	20	41	20	161	65	75	136	8	683
8	Male	20	42	60	166	74	76	137	10	834
9	Male	20	43	43	155	48	79	135	8	692
10	Male	20	41	46	165	64	72	129	8	693

Sitting Posture										
1	Male	20	59	41	163	56	84	142	13	773
2	Male	20	52	44	156	50	76	139	11	737
3	Male	20	49	42	156	59	89	135	10	721
4	Male	20	53	26	165	56	74	139	10	702
5	Male	20	54	50	155	59	84	134	11	735
6	Male	20	56	32	164	49	89	141	11	718
7	Male	20	48	20	161	65	74	135	9	674
8	Male	20	52	60	166	74	76	134	12	807
9	Male	20	56	43	155	48	77	139	11	729
10	Male	20	51	46	165	64	74	138	11	774
Pedaling Posture										
1	Male	20	32	41	163	56	84	115	5	529
2	Male	20	29	44	156	50	76	117	4	538
3	Male	20	26	42	156	59	89	115	4	540
4	Male	20	29	26	165	56	74	121	4	539
5	Male	20	31	50	155	59	84	119	5	599
6	Male	20	29	32	164	49	89	119	4	519
7	Male	20	28	20	161	65	74	124	4	575
8	Male	20	33	60	166	74	76	120	6	680
9	Male	20	29	43	155	48	77	118	4	539
10	Male	20	28	46	165	64	74	116	4	575

Sr. No.	Sex	Calorie Burned Per Hour		
		Standing Posture	Sitting Posture	Pedaling Posture
1	Male	746	773	529
2	Male	683	737	538
3	Male	730	721	540
4	Male	702	702	539
5	Male	753	735	599
6	Male	691	718	519
7	Male	683	674	575
8	Male	834	807	680
9	Male	692	729	539
10	Male	693	774	575



CONCLUSION:-

Be that as it may, in this examination article it is demonstrated that perseverance was higher when utilizing a pedal powered mechanism rather than a hand cranking due to the size and normal quality of abdominal area versus lower body. Accelerating was likewise be more perfect in light of the fact that it liberates your hands to stack and secure the machine furthermore accelerating point of confinement the quantity of developments that would be vital if we somehow managed to utilize a hand cranking. Subsequently pedal powered mechanism should be the best mechanism for empowering Lilliput Ginning Machine.

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