Abstract

The Dairy enterprise was selected for ergonomic intervention, as it was operative enterprise in all the selected adopted villages. Amongst all the dairy activities, milking activity was selected for technology intervention because it is strenuous activity. The Revolving stand to hold the milk pot at the time of milking was developed by AICRP VNMKV unit in order to reduce stress and strain of milk man due to fear in mind that milk will get spilt due to kick of animal. In order to improve the awkward posture of worker an experiment was conducted with a revolving stool for sitting milkman at the time of milking. When milking activity was performed by using newly developed tools such as revolving stand & stool, there was highly significant reduction in physiological cost of work (14 beats). The results of the on-job testing experiment showed that newly developed revolving stand and stool are easy to move, simple in fabrication, made out of locally available material and by local artisan. It is useful on uneven surfaces, suitable for any type of vessels, low cost, useful for resting the hands while taking break in milking and easy to handle, carry and store. It helps to avoid wastage of milk.

Key words: Drudgery, physiological cost, ergonomic evaluation, heart rate

Introduction

Rural women play a key role in the livestock management and household activities. Women are the majority of the world's agricultural producers, playing important roles in agriculture sector and in fisheries and livestock management. (Khusik and Panwar, 2006; Arshad et al., 2010.) The participation of rural women is limited in livestock activities such as barn preparation, selling of oxen and cows and deliver assistance of cows which considered as tasks that should not be performed by women. According to Mulugeta and Amsalu (2014), in Ethiopia, extent of rural women’s participation in various live stalk activities such as milking of animals regularly was 32 per cent. Livestock sector plays an important role in Indian economy. Live stock rearing is an important source of supplementary income and gainful employment for very large number of people in rural areas, particularly for those who are landless and small marginal farmers.

As far as dairy entrepreneurship is concerned, development of the dairy through the application of modern science and technology will greatly contributes to improving socio-economic conditions of rural masses by making dairy farming more productive and remunerative. So in order to minimize the work of the farmers in terms of physiological cost, improve their posture and to reduce stress and strain of milk man due to fear in mind that milk will get spilt due to kick of animal, the revolving stool and stand was developed by AICRP unit of College of Home Science, VNMKV Parbhani(MS).

Methodology

Mode of data collection
No. of male and female workers: 30
Field trials/Replications: 03
No. of methods: 02

Measurement of Parameters
Average working Heart Rates (b.min⁻¹) (AWHR): Working heart rate was recorded with the help of heart rate monitor, six times at every five minutes till the completion of activity.
Average peak heart rate (b.min⁻¹) (APHR): It was noted down while performing the activity for 30 minutes.
Average & peak energy expenditure (kJ.m⁻¹) (AEE & APEE): It was calculated by using following formulae (Mahajan et al, 2014), EE (kJ.m⁻¹) = 0.159 X Heart rate (b.min⁻¹) -8.72, Total cardiac cost of work (TCCW) (b.min⁻¹): TCCW was calculated by using the following formulae,TCCW = Cardiac cost of work + Cardiac cost of recovery ,
where, Cardiac cost of work = (Average working heart rate – Average resting heart rate) X Duration (Saha, 1976).

Cardiac cost of recovery = (Average recovery heart rate – Average resting heart rate) X Duration
Physiological cost of work (PCW) (Beats): It was calculated by following formula
PCW = TCCW / Total time of work.
RPE(Rated perceived exertion): It was measured on five point scale viz. very light (1), light(2),moderately light(3),heavy (4),very heavy(5).

Results

Selection of enterprise activity for the technology intervention and designing and developing new tool for milking activity

The dairy activity is comprised of milking, cleaning shed/collection of dung, feeding the animal, grazing the animals, care of animals and sale of milk and milk products. The gender participation in running the enterprise was studied and it revealed that men have major participation in the milking activity in Maharashtra. Major problem faced by the milkman was due to movement of animals while milking. In the beginning, when the vessel/bucket is kept under the animal, animal moves frequently. Particularly in the evening due to mosquitoes and insect’s bites animal becomes irritated and movement of tail and legs gets increased. Much time milk gets spilt due to kick of animal. On an average loss of milk due to such accidents was 1-2 Lt per month. To avoid this, in some of the dairy farms, legs of the animal are tied with rope. Milkman always experiences stress and fear that milk will get spilled off and losses will occur. It becomes difficult to move the vessel frequently. Some time milkman has to hold the vessel by one hand and carry out milking by other hand. Many times milk pot is hold between two legs and posture of milkman becomes awkward. Hence, to overcome this problem and to relieve milkman from stress and strain a revolving stand was developed for holding the milk vessel.
It was fabricated with the help of local artisan by AICRP- FRM unit. Revolving stool developed by Punjab Agricultural University, Ludhiana was selected for the improved method of milking. Revolving stool is ergonomically tested and adopted technology in Punjab. Modifications in the revolving stool were made in order to reduce the cost of stool such as shape of stool was made triangular instead of square. Newly developed revolving stand and revolving stool was selected for ergonomic evaluation as an improved method for milking activity.

Physiological workload while performing the dairy activity “Milking”

Physiological Workload while performing the dairy activity “Milking” by traditional and improved method using newly designed Revolving stand and stool is shown in table.1. There was significant reduction in the heart rate by 9 b.min⁻¹, whereas peak heart rate was reduced by 11 b.min⁻¹ than the existing method of milking. Similar trend was observed for average energy expenditure and peak energy expenditure.
Physiological parameters

Table 1 Physiological Workload While Performing The Dairy Activity –Milking

<table>
<thead>
<tr>
<th>Physiological parameters</th>
<th>Existing method (Mean±SD)</th>
<th>Improved method (Mean±SD)</th>
<th>Significant reduction in improved over existing</th>
<th>“t” values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average working Heart rate(b.m(^{-1}))</td>
<td>107±8.35</td>
<td>98±9.12</td>
<td><strong>9</strong></td>
<td>14.93**</td>
</tr>
<tr>
<td>Average peak Heart rate(b.m(^{-1}))</td>
<td>114±9.42</td>
<td>103±10.69</td>
<td><strong>11</strong></td>
<td>8.72**</td>
</tr>
<tr>
<td>Average energy expenditure(kj.m(^{-1}))</td>
<td>8.27±1.30</td>
<td>7±1.5</td>
<td><strong>1.27</strong></td>
<td>14.00**</td>
</tr>
<tr>
<td>Peak energy expenditure(kj.m(^{-1}))</td>
<td>9.25±1.43</td>
<td>8±1.69</td>
<td><strong>1.25</strong></td>
<td>8.75**</td>
</tr>
<tr>
<td>Average TCCW(Beats)</td>
<td>162±59.60</td>
<td>124±56.91</td>
<td><strong>38</strong></td>
<td>3.16**</td>
</tr>
<tr>
<td>Average PCW(beats)</td>
<td>44±18.68</td>
<td>30±13.42</td>
<td><strong>14</strong></td>
<td>2.76**</td>
</tr>
<tr>
<td>Average RPE</td>
<td>2.28±0.44</td>
<td>1.75±0.21</td>
<td><strong>0.53</strong></td>
<td>0.53**(NS)**</td>
</tr>
<tr>
<td>Total time required for the activity (min)</td>
<td>3.93±1.46</td>
<td>3.97±0.81</td>
<td><strong>0.04</strong></td>
<td>0.029**(NS)**</td>
</tr>
</tbody>
</table>

Note: (-) sign indicates reduction over existing.
TCCW - Total cardiac cost of work, PCW - Physiological cost of work
RPE - Rated perceived exertion

** Significant at 1% level, NS - Not significant

**Fig. 1** Energy Expenditure while performing Milking activity.

**Fig. 2** Physiological cost of Milking activity performed by different methods

Improved method of milking

Revolving milking stand

Revolving milking stool