THE EFFICACY OF FORK TYPE HOE AND SINGLE BLADE HOE FOR HOEING WET RICE FIELD LAND IN POH MANIS VILLAGE, DENPASAR MUNICIPALITY

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Abstract

Balinese farmer in doing their daily activities in agricultural work still relay on their hand tools. One of the hand tools used is the hoe. In fact there are two type of hoe, fork type and single blade hoe. The single blade hoe is very rare used for hoeing in wet rice field. Farmer chose the fork type one. Therefore, a study was conducted to compare the efficacy of those two hoes. Twenty farmers were participated voluntarily. They were divided into two groups evenly. The first group hoeing using the fork type hoe, and the second group using the single blade one. They hoeing in the same area of rice field (wet rice field) from 07.00 until 12.00. The parameter measured were resting and working heart rate, product and productivity, musculoskeletal disorders, and the deep of soil hoed. The student-t test was applied to analyses the results. The results found are: a) the working heart rate, the product and productivities were 111.1 ± 14.66 bpm; 127.74 ± 9.15 m2; 0.54 ± 0.00 and 110.2 ± 13.88 bpm; 126.88 ± 8.79 m2; 0.54 ± 0.00 for first group and second group, respectively. The MSD and the deep of soil hoed were 4.50 ± 1.97; 30.0 ± 2.54 cm and 4.45 ± 2.03; 29.64 ± 1.75 cm for both groups. There are no significant different found statistically. Therefore, it is concluded that the efficacy of single blade hoe is similar to the fork type hoe for hoeing the wet rice field in the tropic. For further study it is recommended to use these two hoes for hoeing in the dry soil.[**MEDICINA 2009;40:43-6**].

Keywords: fork type, single blade hoe, product, productivity, Balinese farmer.

INTRODUCTION

Due to geographical condition of Bali, agricultural lands are in a conical type. Balinese farmers make us of that in a such way to be fitted with the condition in forms of terraced rice fields. Therefore, it is impossible to mechanize all the agricultural tools. The limited farmer's land ownership also another factor why buying a hand tractor is still a luxury one for Balinese farmers. Therefore, agricultural hand tools still used by the farmers in doing their agricultural tasks. The hand tools used for agricultural tasks are hoe, ploughs, dyke cleaner knife, herb cutting knife, harvesting knife, rice cutter, and sack or basket[1]. Amongst the hand tools used the hoe still playing the significant role for land preparation.
There are more than 600,000 farmers in Bali[2]. Almost every farmer in Bali has a hoe. There are two type of hoe e.g. fork type hoe and single blade hoe.[1,3,4,5] The single blade hoe is fabricated one, and the fork type hoe is made manually by the local blacksmith. In the market it is not available to buy all agricultural hand tools. It is available for buying hoe (fork type

and single blade), sickle, and long knife. Another hand tools like rice cutter, herb cleaner, plough, and harvesting knife is made locally.

Up to now, very few of research had been conducted on the efficacy of Balinese farmers hand tools. Manuaba and Nala[3] had been pointed out that the single blade hoe of slifer brand is the best one[3]. Adiputra pointed out that the Balinese farmers were lean, nor of them suffering of overweight.[6] There was due to their physical activities. The agricultural works considered as highly demanding task.

In doing any study on Balinese farmer, the approach must be done through the farmer traditional organization which called *subak*. As it had already reported by Adiputra et al.[7] that an intervention to farmer through *subak* organization, could meet the goals efficiently. The same case was also reported by Adiputra et al. in Batunya Village of Tabanan regency.[4,5] The communication between *subak* members are very intensive, therefore, it is very good media for every body in regards doing any intervention study to farmers. The workload of traditional harvesting rice was also assessed by Adiputra et al[5]. It is belong to the light workload task.

Sutjana had reported that by applying participatory approach a sickle had been successfully changed from non-serrated into serrated, and increased the farmer' productivity in harvesting rice.[8] Artayasa had also modified the seat aspect of plough to be more comfortably used.[9]

The roles of hoe in land preparation for Balinese farmer are very dominant. That is way every farmer in Bali has at least two hoes, fork type and single blade hoe. Up to now there is no study has conducted yet, in assessing the hoe's efficacy. This study was conducted with the goal to compare the efficacy of single blade hoe and the fork type hoe in hoeing rice field. The working hypothesis was: that the single blade hoe has a similar efficacy with the fork type hoe in hoeing the wet rice field.

MATERIAL AND METHOD

Subject. Twenty male Balinese farmers from Poh Manis Village, Denpasar County were selected as subjects for this study. They joined the study voluntarily. Informed consent was signed by them. They were divided into two groups, randomly; every group consisted of 10 persons.

Method. The first group was designed hoeing rice field using the fork type hoe, and the second group using the single blade hoe. They worked from 07.00 until 12.00 am. The parameter measured were resting heart rate, working heart rate, by applying ten pulses method. Production was measured by measuring the wide of land have been hoed in a certain given time; productivity was counted using the formula. The musculoskeletal complaint was assessed by using the questionnaire of Nordic Body Map, before starting to work and after working. The deep of hoeing was also measured in cm using part of the anthropometric instruments.

Analysis. Data was processed in SPSS and for the difference found was tested by student-t test.

RESULTS

For the physical characteristics of subjects is presented in **Table 1**. Both groups there is no significant difference found on their physical characteristics in term of age, weight, height, blood pressure and working experiences.

Table 1. The physical characteristics of subject, male Balinese farmer of Poh Manis Village, Denpasar County. Results are in mean ± SD

No	Parameter	The first group (n = 10)	The second group (n = 10)
1.	Age (year)	49.27 ± 10.46	50.20 ± 9.25
2.	Height (cm)	56.72 ± 7.87	155.50 ± 5.78
3.	Weight (kg)	51.73 ± 6.64	52.58 ± 5.45
4.	Blood pressure systolic	119.89 ± 6.89	120.00 ± 5.68
	Diastolic	79.59 ± 4.59	80.00 ± 5.25
5.	Working experience (Yr)	15.5 ± 2.50	16.50 ± 2.50

For the resting heart rate, working heart rate, product, productivity, musculoskeletal complaint, and the deep of hoeing is presented in **Table 2**.

Table 2. Resting, working heart rate, product, productivity, MSD and depth of soil hoed using two different hoes in Poh Manis Village, Denpasar County

No	Parameter	Fork type hoe	Single blade hoe
1.	Resting heart rate	77.3 ± 7.4	77.1 ± 7.7

	(bpm)		
2.	Working heart rate (bpm)	111.1 ± 14.7	110.2 ± 13.9
3.	Product (m2)	127.7 ± 9.2	126.9 ± 8.8
4.	Productivity	0.54 ± 0.00	0.54 ± 0.00
5.	MSD	4.50 ± 1.97	4.45 ± 2.03
6.	Depth of soil hoed (cm)	30.0 ± 2.54	29.6 ± 1.8

The average of resting heart rate is no significant difference ($p>0.05$) means that the starting point was in the similar condition. The mean of resting heart rate were 77.3 and 77.1 bpm for the subject hoeing used fork type and single blade hoe, respectively. The same was happened for the working heart rate 111.1 and 110.2 bpm for both groups. Statistically there is no significance ($p>0.05$).

The deep of soil hoed is no significantly difference ($p>0.05$), means that in hoeing used fork type hoe or the single blade hoe produce the same depth of hoeing. These data give an evident that the similar working results for the fork type hoe and the single blade hoes, used for hoeing in the wet rice field. Up to now, there was no study conducted in regards to this matter.

Table 3. The environmental aspect where the experiment were conducted at Subak Poh Manis, Denpasar Municipality

No	Parameter	Mean ± SD
1.	Dry temperature (°C)	29.3 ± 0.43
2.	Wet temperature (°C)	27.4 ± 0.50
3.	Relative humidity (%)	85.03 ± 0.45

DISCUSSION

The physical working capacity in this case was not able to do. From physical characteristics point of view, it is found that they belong to the ideal body weight group. None of them is in the overweight or obese. This study result confirms the study conducted previously[7]. In another study one of the authors had reported that Balinese had a lower physical working capacity.[10]

Looking at the working heart rate means, it is obviously that the hoeing on the wet rice field is categorized into a hard workload.[11,12] It is comparable to some works, which were evaluated in Bali before.[5,13] The product in terms of wide of soil being hoed was not also significantly differed ($p>0.05$). Productivity showing the similar thing, statistically there is no significance ($p>0.05$).

The MSD which were measured before and after working using the Nordic Body Map[14] showing the similar results. There is no significant difference ($p>0.05$) among the both groups. This data also supports that the amount of work done may in similar quantity; by doing so, produced the muscle disturbances in a similar quantity. The use of NBM event it is considered is less accurate, but it is still valid and it is used by many researchers for assessing the muscle disturbances, as it had been reported.[14,15]

Looking at the environmental aspect, it is fair to say that it is not significantly differ from the environmental of Bali in general. Means that farmer in Poh Manis as subject of this study are well adapted to environment. They are exposed to this environment every day, make them are so familiar. By then it is wise to say that during the study was not differed from their daily working environments. And also in doing the experiment for both hoes was conducted in the same area of rice field and at the same day. Therefore, the effect of environmental aspect could be similar for both hoes.

The results found in this research, was due to the application of participatory approach to the subject since in the beginning, as it is suggested by many other researchers.[16-19]

CONCLUSION

Therefore it is conclude that: 1) looking at the quality of working products, productivity, and MSD that for hoeing the wet rice field in the tropical environment, the fork type hoe and the single blade hoe as one of the Balinese' hand tools have a similar efficacy.

For further study it is recommended to conduct the same study using the same hoes for the dry soil.

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DAFTAR PUSTAKA

1. Anonymous. Small Farm Ergonomics – handtools for crop production in South Asia. Silsoe Research institute. An Institute of the Agricultural and Food Research Council. 1993.
2. Anonymous. Bali in Figure and Data. The Development Planning Board of Bali. 2003.
3. Manuaba IBA and Nala IGN. Survey on Pacool in Bali. Majalah Hiperkes. 1967.
4. Adiputra N, Sutjana DP, Widana K, Manuaba A, O'Neill DH. Participatory Ergonomics in Agriculture. A case Study in Batunya village, Bali Indonesia. In: Khalid HM. Ed. Proceedings ASEAN Ergonomics-97. 5th ASEAN Conference. IEA Press. 1997a: 463-7.
5. Adiputra N, Suyasning HI, Sutjana DP, Manuaba A, Vanwonterghem K. The workload of traditional harvesting's task. In: Khalid HM. Ed. Proceeding ASEAN Ergonomics-97. 5th Asean Conference. IEA Press. 1997b: 474-8.
6. Andersen KL,Masironi R, Rutenfranz J, Seliger V, Degree D, Habitual Activity and Health. WHO Regional Publications.European Series 6. Copenhagen:1978.
7. Adiputra N. Body Composition of Balinese farmers. Research Report. The Medical School Udayana University. 1985.
8. Sutjana DP. The increasing of farmers productivity using serrated sickles. Elsevier. 1998: 405-412. In: Scott PA, Bridger RS, Charteris J. Eds. Global Ergonomics.
9. Adiputra N, Sutjana DP, Widana K, Kerana T, Suyasning, Manuaba A. Introducing ergonomics through "Subak" Organization among the farmers in Bali. In: Intaranont K. Ed .Ergonomics for Productivity and safet Work. Proceedings of 4th SEAES'94 . An International Conference. Bangkok, November 21-23.1994.
10. Adiputra N. Physical Capacity of Balinese. The Udayana Medical Journal. 2003; 34(120):108-10.
11. Grandjean E. Fitting the Task to the Man. A Textbook of Occupational ergonomics. 4th edition. London:Taylor & Francis;1993.
12. Astrand PO, Rodahl K. Textbook of Work Physiology. 2nd edition. WB Saunders Comp. Philadelphia. 1986.
13. Manuaba IBA, van Wonterghem K. Improvement of quality of life: determination of exposure limits for physical strenuous tasks under tropical conditions. Final Report. Dept of Physiology, School of Medicine Udayana University Denpasar, Bali, Indonesia – CERGO International Brussels, Belgium – The Commission of the European Communities Brussels. Belgium. 1996.
14. Dickinson CE, Campion K, Foster AF, Newman SL, O'Rourke AMT, Thomas PG. Questionnaire development: an examination of the Nordic Musculoskeletal questionnaire. Appl Ergonomics. 1992; 23(3): 197-201.
15. Kourinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sorensen F. Standardised Nordic Questionnaires for the Analyses of Musculoskeletal Symptoms. Appl.Ergonomics. 1987; 18(3): 233-7.
16. Loewenson R, Lourell C, Hogstedt C. Participatory approach in occupational health research. National Institute of Occupational Health. Solna, Sweden. 1994: 38. Asian Perspective. Asian-Pacific Newsletter on Occup Health and Safety. 2001(8): 62-64.
17. Kogi K. Participatory Ergonomics that Builds on Local Solutions. J Hum Ergol. 1995; 24(1): 37-45.
18. Manuaba A. Impacts of Globalization on Working Conditions and the Environment – An
19. Manuaba IBA. Holistic design is a must to attain sustainable product. The Indonesian Journal of Ergonomics. 2003; 4: 45-9.