

## Role of Rice Farming in Development Risk of Musculoskeletal Disorders Among Rice Farmers: a Prospective Study in 2013

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### ABSTRACT

Farming as job, had some activities or work task such as strenuous physical tasks and high levels of manual labor in farming job, which can increase risk of MSDs among farmers. Present study with prospective design designed for assessment role of rice farming in developmental risk of MSDs among Iranian rice farmers.

Present prospective study was performed on 75 rice farmers of Babol city in Iran and 75 participants without history of rice farming, during March 2013 until September 2013. At the beginning of the study, participants did not have any musculoskeletal complaints in each of their body parts. Study exposure in the present study was working in the rice farming workplace for one rice farming period which at least lasted for four months. Frequency of MSDs had been assessed by Nordic questionnaire at three follow-up points.

We followed 75 rice farmers of Babol city as expose and compare them with 75 participants without history of rice farming. Within the six months follow-up, MSDs complaints in 38 (50.66%), 61 (81.33%) and 47 (63.51%) rice farmers had been reported respectively in upper limbs, spinal and lower limbs regions.

In the present study, rice farming was reported as a risk factor for MSDs in the spinal region and lower limbs.

**Keywords:** Musculoskeletal; Rice forming; Risk, Occupational Medicine

### INTRODUCTION

MSDs as common occupational disorder had severe pain and discomfort and might lead to physical disabilities [1]. Farming as job, had some activities or work task such as strenuous physical tasks and high levels of manual labor in farming job, which can increase risk of MSDs among farmers [2, 3]. Even in some studies, noted work tasks reported as the most common causes of occupational and non-fatal injuries among farmers [4, 5]. Although most of health related problems among farmers can be prevented and reduced by existing health and safety procedures and instruments, in some situation, farmers experienced some health problems such as discomfort, minor aches and this situation can exacerbate by serious medical conditions and require removal from work, medical treatment and hospitalization and even lead to dissatisfactory in chronic cases.

A wide range of MSDs problems such as osteoarthritis of the hip and knee, low back pain (LBP), upper limb disorders, and hand/arm vibration syndrome with different prevalence had been reported among farmers as in some sever conditions

MSDs were occurred in the consequences of trauma such as sprains, fractures, and dislocations [6].

For instance, in Southeast Kansas, more than 60% of farmers had to work related MSDs experienced during the previous year [3]. In other surveys, in Britain during 1995, investigators found that near to 43000 farmers reported work related MSDs in their occupations [6]. In other studies in Ireland among farmers 31.4% had arthritis and 17% had back pain and were reported as harmful consequence of MSDs [5]. In survey at Netherland, MSDs had been reported as the main factor for sick leave among farmers [4]. In most studies work related MSDs reported in the farmers and few studies had been assessed rice farmers.

The questionnaire included questions about musculoskeletal complaints in each of the following body regions: neck, shoulder, elbow, wrist/hand, upper back, lumbar, one or both hips/thighs, one or both knees and one or both ankle/feet. The aim was to develop and test a standardized questionnaire methodology allowing comparison of low back, neck, shoulder and general complaints for use in epidemiological studies.

NMQ as research tool, did not develop for clinical diagnosis and can be used as a questionnaire or interview device [7]. However, medical examination is essential to establish a clinical diagnosis [8, 9]. Study investigator for covering noted problem, prepared checklist same with NMQ tools but in the recent shorter months and fill that at follow-up points for aware from MSDs complaints among cohort participants from study beginning. The NMQ has been used in several studies for evaluating musculoskeletal problems, including computer and call center workers [10], car drivers [11], Aluminum and steel workers [12, 13], and forestry workers [14]. Previous studies reported that the NMQ is repeatable, sensitive and useful as a screening and surveillance tool. The validity and reliability of the questionnaire were calculated and approved in different studies and several languages, including the Persian language [15, 16]. In the present study, we summarized NMQ body regions into the three categories Spine (Neck, Back, and Lumbar), Upper limbs (Shoulder, Elbow, Wrist/hand) and lower limbs (hips/thighs, knees, ankle/feet).

It seems that rice farming had most of risky activities and risk of rice farming on the prevalence of MSDs had been reported in few studies with cross sectional or retrospective design. Present study with prospective design designed for assessment role of rice farming in developmental risk of MSDs among Iranian rice farmers.

## MATERIALS AND METHODS

### *Study participants*

Present prospective study was performed on rice farmers of Babol city in Iran during March 2013 until September 2013. Study protocol was approved in ethical research committee of Iran University of medical sciences. Study participants are randomly selected from people who lived in Babol city in the north of Iran that distributed in all of its villages. According sampling formula ( $P=0.4$ ,  $\alpha=0.05$ ,  $d=0.08$ ) near to 150 peoples were needed to participate as exposure and non-exposure groups. Rice farmers in exposure group must have been study inclusion criteria including: 20-50 years old age and at least one-year history of rice farming without extra job. Included rice farmers who had a history of renal or liver failure, bone fracture, neurodegenerative disease, major surgery, rheumatic or musculoskeletal disorders were excluded from the study. At the beginning of the study, participants did not have any musculoskeletal complaints in each of their body parts and were examined clinically by a study physician. Participants of un-exposed group randomly selected from age and sex matched nearby people in the Babol city who did not have a history of

rice farming and work in other jobs. In the same with the exposed group, they did not have any musculoskeletal complaint in each of body parts and study physician either clinically examined them.

### *Study exposure*

Study exposure in the present study was working in the rice farming workplace for one rice farming period which at least lasted for four months (March until June every year). Their work tasks in this environment were preparation and husband of camlet and making the planting location at the first month, buds transformation and into the camlet and its irrigate were second step (lasted 15 days). In the third month, weeding of camlet and in lastly in the fourth month rice was removed from camlet workplace. In all of noted steps, MSDs risk factors (hazards) such as lifting, bending, twisting, pulling, pushing, and whole body vibration were happened and might lead to MSDs complaints among rice farmers in the expose group.

### *Study follow-up*

Study participants totally followed six months with three follow-up points: the second and fourth month and totally at the last of the sixth months. Within the follow-up time, we want from study participants to report any musculoskeletal complaints in their body parts immediately to study investigators. After farmers report, study physician examined them and confirmed their advocating and in some of the case that clinically examination did not have any evidence for musculoskeletal disorders imagining study performed. Investigators in noted three follow-up points, contact with rice farmers and un-expose group via telephone number and ask them about musculoskeletal complaints, final decision for accepting or denying of rice farmers advocating performed by using clinical examination by study physician and imagining studies in some of complex cases.

### *Study instruments*

Musculoskeletal complaint was defined as pain or discomfort experienced in soft tissue of the different body regions, which had occurred at least 2-3 work days during the study follow-up. Noted pain has improved on the weekends, vacations and holidays. MSDs symptoms in exposure and non-exposure study participants assessed with The Nordic Musculoskeletal Questionnaire (NMQ) which was developed from a project funded by the Nordic Council of Ministers [17].

### *Statistical analysis*

Study data were entered into the SPSS ver. 16.0 (SPSS Inc. Chicago Ill) and analyzed with statistical tests. For presenting study groups, data showed as mean  $\pm$  standard deviation for continues variables

and frequency (percentage) for discreet variables. We used chi-square statistical test (for sex and smoking) and independent sample t-test (age and BMI) for comparing demographic variables between exposure and un-exposure groups. We set 95% at level of confidence and all of P-value less than 0.05 assumed as significant results.

We considered participants who had positive MSD complaints in each of three study body parts as MSD positive cases and in the last of follow-up, we calculated and compared six-month prevalence of MSD complaints among participants of both groups with chi-squared statistical test. We had three points in during six months follow-up time. Number of study participants with positive MSD complaints (new cases) and negative MSD complaints were assessed in both of exposed and un-exposed groups. We cross tabulated findings of each follow-up point and finally reported a number of positive cases in both groups and risk of getting MSD disorders in exposed and un-exposed group and finally risk ratio were calculated.

## RESULTS

### *Demographic items in studied subjects*

Present study had been performed on 150 participants (exposed and unexposed groups) to determine differences between the incidence rate of musculoskeletal rice farmers as exposed and non-rice farmers as unexposed groups. Mean of age and BMI in study participants were  $37.19 \pm 5.83$  years and  $26.67 \pm 3.68$  kg/m<sup>2</sup>. Among study participants, 87 (58.0%) farmers were male. Mean of age in exposing farmer was not significantly higher than unexposed participants ( $37.68 \pm 6.03$  vs.  $36.69 \pm 5.62$ ;  $P \geq 0.31$ ). Same no significant difference was seen in BMI between exposed and non-exposed ( $27.26 \pm 3.84$  vs.  $26.09 \pm 3.43$ ;  $P \leq 0.053$ ). Most of participants in expose (41, 54.7%) and unexposed group (46, 61.3%) were male and smoking was more common in unexposed group (16, 21.3%) in compare with exposed group (10, 13.3%) ( $P \geq 0.19$ ). Details of demographic variables between expose and unexposed groups were presented in Table 1.

**Table 1.** distribution of demographic variables between study groups

Variables Study groups	Age	BMI*	Sex (N, %)		Smoking (N, %)	
			Male	Female	Smoker	Non smoker
Exposed	$37.68 \pm 6.03$	$27.26 \pm 3.84$	41(54.7%)	34(45.3%)	10(13.3%)	65(86.7%)
Un exposed	$36.69 \pm 5.62$	$26.09 \pm 3.43$	46(61.3%)	29(38.7%)	16(21.3%)	59(18.7%)
P-value	0.31	0.053	0.41		0.19	

\*BMI: Body Mass Index

### *MSD prevalence among rice farmers within the follow-up pints*

In the present study we followed study participants in three follow-up points. (1) two months later (2) four months later and (3) six months later. At the start of the study, we had not any case of musculoskeletal disorders among expose and unexposed groups. Second months after study beginning, we reported all of new cases within two months period. Four months after study beginning we reported all of new case within third and fourth months of the study. And finally, six months after study beginning, we reported all of new case within fifth and sixth months of the study.

#### *First follow-up time*

In the present study, we followed study participants in three follow-up points. (1) two months later (2) four months later and (3) six months later. At the start of the study, we had not any cause of musculoskeletal disorders among expose and unexposed groups. Second months after study beginning, we reported all of new cases within two months period. Four months after study beginning we reported all of the new case within third and fourth months of the study. And

finally, six months after study beginning, we reported all of the new case within fifth and sixth months of the study.

#### *Second follow-up time*

Four months after study beginning, at the second follow-up point, 15 (20%) in exposing and 11 (14.66%) new cases in unexposed group reported MSDs in their upper limbs. Among expose group 20 (26.66%) and un-expose group 10 (13.33%) had been reported as a new case of MSDs in the spinal region respectively. Finally in lower limbs, 15 (20%) and 6 (8%) new cases of MSDs were seen an expose and unexposed groups respectively. There was no significant association between expose and unexposed group for frequency of a new case of MSDs in upper limbs region ( $P \geq 0.39$ ). Frequency of new case of MSDs in spinal ( $P \leq 0.04$ ) and lower limbs ( $P \leq 0.04$ ) regions were significantly higher in exposing group in comparison with unexposed group.

#### *Third follow-up time*

Six months after study beginning, at the third follow-up point, 10 (13.33%) in exposure and 9 (12.0%) new cases in unexposed group reported MSDs in their upper limbs. Among expose group 19 (25.33%) and

in un-expose group 8 (10.66%) had been reported as a new case of MSDs in the spinal region respectively. Finally in lower limbs, 13 (17/33%) and 11 (14.66%) new cases of MSDs were seen an expose and unexposed groups respectively. There was no significant association between expose and unexposed group for frequency of a new case of MSDs in upper limbs ( $P \geq 0.81$ ) and lower limbs ( $P \geq 0.64$ ) regions. Frequency of new case of MSDs in

spinal regions was significantly higher in exposing group in comparison with unexposed group ( $P \leq 0.03$ ). In the present study, rice farming was reported as a risk factor for MSDs in spinal region (RR=2.10 CI95%:1.56-2.85) and lower limbs (RR=1.74 CI95%:1.23-2.47). Details of MSD frequencies among expose and unexposed groups were reported in Table 2.

**Table2.** Frequency of MSDs positive cases among exposed and unexposed participants in three study follow-up points

Follow-up points	Upper limbs		P-value	RR (CI95%)	Spin		P-value	RR (CI95%)	Lower limbs		P-value	RR (CI95%)
	Exposed	Unexposed			Exposed	Unexposed			Exposed	Unexposed		
Second month	13 (17.33%)	12 (16%)	0.83	1.08 (0.53-2.22)	22 (29.33%)	11 (14.66%)	0.04	1.95 (1.02-3.73)	19 (25.33%)	9 (12%)	0.04	2.11 (1.02-4.36)
Fourth month	15(20%)	11(14.66%)	0.39	1.37 (0.67-2.77)	20(26.66%)	10(13.33%)	0.04	2 (1.02-3.73)	15(20%)	6(8%)	0.04	2.50 (1.26-6.09)
Sixth month	10 (13.33%)	9 (12%)	0.81	1.11 (0.48-2.58)	19 (25.33%)	8 (10.66%)	0.03	2.28 (1.07-4.90)	13 (17.33%)	11 (14.66%)	0.66	1.18 (0.57-2.47)
Total (n=75)	38 (50.66%)	32 (42.66%)	0.33	1.19 (0.84-1.68)	61 (81.33%)	29 (38.66%)	0.001	2.10 (1.56-2.85)	47 (62.66%)	26 (34.66%)	0.001	1.80 (1.27-2.58)

## DISCUSSION

This study is the first study with a prospective design that assesses role rice farming in development of musculoskeletal disorders among Iranian rice farmers. In the present study, we followed 75 rice farmers of Babol city as expose and compare them with 75 participants without history of rice farming. Within the six months follow-up, MSDs complaints in 38 (50.66%), 61 (81.33%) and 47 (63.51%) rice farmers had been reported respectively in upper limbs, spinal and lower limbs regions. According to findings of our study, rice farming was a risk factor for developing of MSDs complaints in spinal and lower limbs of rice farmers. Study findings showed that MSDs prevalence among Iranian farmers was high and our findings were similar with other studies such as Kansas study, where 60% of farmers reported MSD symptoms during the preceding 12 months [3], and 69% reported by multiple male occupational groups in Ireland [6].

Higher MSDs prevalence among Iranian farmers might be due to higher rate of their expose with ergonomic hazards such as awkward postures, heavy lifting, prolonged standing and walking over rough ground and vibration from tractor driving, bending, unsafe twisting, squatting, force full exertion and muscular tension [2, 3]. Although we did not plan for assessment of risk factors among study participants, similar studies reported further exploration of other risk factors including heavy work, lifting, bending, twisting, pulling, pushing [1], whole body vibration [18] as well as some personal factors [19] as MSDs complaints risk factors.

In Iran, most of rice farming job task were performed manually with physical force without automatic devices. This fact can increase the risk of MSDs

development among Iranian farmers especially rice farmer due to more hazardous workplaces. Rice farming in Iran had been performed in smaller paddy fields and therefore role of rice farmers and their physical force and stability was presented more than large and homogenous paddy fields. For instance in 2008, 42% of all farmers in Ireland were reported to undertake off-farm work due to limited economic returns from smaller farms [20]. Many of these works as manual laborers in the construction sector [21] with its attendant risk of MSDs [22]. It also suggests that a study focusing on specific rice farm worker exposures as a cause of MSDs complaints among rice farmers would be worthwhile.

In our study, 81.33% of rice farmers experienced MSDs complaints in spinal regions in the previous six months compared with 38.66% in unexposed groups. Our results are consistent with a study of Iowa farmers [20] where 31% experienced back pain in the previous 12 months compared with 18.5% of the general working population. Unfortunately, no comparison could be made with the general Iranian population for MSDs complaints. It is suggested that for better assessment and comparing MSDs complaints in spinal regions between rice farmers, we need to clear definition of Back or lumbar pain and clearly focusing on their farming characters such as their farming period and their workplaces.

In our study 50.66% of rice farmers experienced MSDs complaints in their upper limbs and in comparison with non-farmers. Our findings were similar to one study that reported than twenty per cent of farmers experienced neck and shoulder problems in the previous year. Similar studies have found that farmers have a higher prevalence of neck

and shoulder problems compared with non-farmers [23, 24].

We found that rice farmers had been reported significantly higher MSDs complaints in their lower limbs in comparison with non-farmers. While our study indicates that farmers may have higher rates of osteoarthritis of the hip compared with other occupational groups [2, 23] especially if they have farmed for over 10 years [25]. It has been estimated that as many as one in five farmers may eventually require hip replacement [25]. Walker-Bone *et al.* [2] states that 'the precise cause of hip osteoarthritis in farmers has not been defined, but potential risk factors include regular heavy lifting, prolonged standing and walking over rough ground and vibration from tractor driving'.

Our study had some limitations; firstly we had not performed risk factor analysis both in exposed and unexposed groups and only considered rice farming as total risk factor. Next studies with careful control of risk factors might archive accurate findings. Secondary, we selected six months as a follow-up period and considered only new or acute MSDs cases. Therefore next longitudinal studies with longer follow-up time were needed for the assessment of chronic MSDs cases.

### ETHICAL ISSUES

Study protocol was approved in ethical research committee of Iran University of medical sciences.

### CONFLICT OF INTEREST

Author of the manuscript did not have any conflict of interest.

### AUTHORS' CONTRIBUTIONS

Elaheh Kabir-Mokamelkhah and Mohammad Hassan Nassiri-Kashanias designed the Study and supervise that. Mashallah Aghilinejad and Narges shahnaghi drafting the manuscript. Amir Bahrami-Ahmadi performed statistical analysis of study data and finally Soheila Abbaszadeh and Sharbanou Moslemi collected the study data.

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