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Original Research Article

Physical condition and maintenance of agricultural workers: a survey in a depopulated municipality in Japan

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Abstract

In most of the countries, agriculture is until now, one of the most important sectors. In general, farmers usually carry out heavy physical activities for the long duration. We aim to explain the conditions for examining health guidance and maintaining physical fitness of older farmers. Questionnaire survey and measurement of body function were carried out in this study. Multiple linear regression analysis was carried out using the data from 43 males of the same corporation. They took part in all the physical condition measurements and responded to the entire questionnaire. The concept of after harvest physical condition of those who think 'maintaining a good physical condition' and 'exercise after work is easy' was significantly higher compared to those who did not share this view (p value = 0.021 and 0.044, respectively). Strong positive feelings still remain in the corporation and agricultural continuation among the older farmers. As this number increases so does the action intention related to health. The attitude, the subjective norm, and a feeling of control to action are related to an action intention which is a proactive stage to maintain good physical condition.

Keywords: Agriculture, Older Farmer, Physical Condition, Safety, Japan

Introduction

Agriculture is until now one of the most important sectors in many countries. Globalization and climate change are impacting the agricultural farming as a vulnerable occupation (Alston, 2004; Berry *et al*., 2011). Farmers usually perform heavy physical and long hours work, mostly isolated from other communities and social services, almost without a routine vacation and retirement (Thelin and Holmberg, 2010). It's consequences are causing ultimately mental and physical health issues. The previous studies reported that there is a high rate of suicide among the farmers in comparison to other occupations (Kelly and Bunting, 1998; Page and Fragar, 1998; Miller and Burns, 2008). The farmers commonly experiencing worse physical health due to less access to medical care, and therefore, they have higher chances to suffer from chronic diseases without well management (Brew *et al*., 2016). The agricultural workers frequently notice the symptoms of cardiovascular diseases (Moyce *et al*., 2017). Aging is becoming a big issue among the farmers (Abdullah and Samah, 2013). In Asia, it has a main geographical feature of steep slopes than other land areas in West (MLIT, 2017). Land used for rice crops in Asia, called a gathering in small farmland. Until now, they don't use heavy types of machinery; farmers do their work by manually. Ultimately, labor productivity becomes low and the farmer's health is sacrificed for agricultural income.

Many Japanese farmers are advanced in age. A farmer's average age is about 60 years and over. One

characteristic of Japanese farming culture is that young successor would be the responsible for farming since the land belongs to families, they do not accept farmers from other areas to continue as a successor. The successor, who mainly performs agricultural work, is the child who works independently or, in many cases retires at around 60 years old. The farmer's age ratio is increasing in every year.

There is a previous report that 80% of agricultural workers had some form of musculoskeletal injury in Great Britain, and agriculture has one of the worst fatal accident records of any industry (Cowie *et al*., 2005). Agricultural work is thought to deteriorate elderly people's physical condition and for that reason, they decided to stop the agricultural work. The reduction in the farming population ruins farmland and decays municipalities. It is necessary to address the situation of a decline in the farming population due to poor physical condition, particularly in rice cultivation.

The physical condition of farmers belonging to a corporation based in a small residential area was investigated. Researchers found that there were no people who suffered from a deteriorating physical condition, even after harvest time. The reason for this consequence was unclear. It was decided to clarify the reasons with a view to adopting the same methods for other farmers across Japan thus directly addressing the problem for decreasing farming population and offer recommendations on how to solve the problem. The purpose of this study is to clarify the conditions for maintaining physical fitness of older farmers and to examine health guidance.

Materials and Methods

Initially, 186 people agreed to participate in a physical state measurement in June 2012. All were from the constituent of a corporation based in a residential area of Sera-cho, registered in Hiroshima Prefecture in 2012. A mail survey was conducted among them. Consent was shown by returning the completed survey. Finally, 106 people were registered for their participation in this research, of which 84 were male. Subsequently, three physical condition measurements were performed on 43 participants, who completed a questionnaire in November 2012, March 2013 and November 2013.

The study town is located in the Middle East part of Hiroshima Prefecture in Japan. One geographical feature is a plateau with an altitude of 350-400m and 70% of the area is occupied by mountains. These are the common features across Japan. The management area of a farmhouse is small, there are also many places where the farmland is located in the steep sloping ground, called 'Tanada', and large-scale machinery cannot easily access to these areas. Since the productivity is low, the farmhouse is suffering to bear the remaining cost. The average old farmer age is 68.8 years and the shortage of successors to the business poses is a serious problem and as a result, abandoned cultivated land areas are increasing (MAFF, 2015). The research period was November 2012 to November 2013.

Questionnaire items

After receiving recognition at the meeting in which the representatives of a company gathering, sending of a survey form was in July 2012 when rice planting finished. A mail survey was conducted on a lifestyle including the relationship with neighbors and attitudes towards agriculture.

Measurement items

The measurement items were included as height, weight, usual walking speed, best walking speed, power of grip, knee expansion, muscular power and agility (Time to stand up & move) and flexibility. The measurements were taken three times in November 2012, March 2013 and November 2013.

Statistical analysis

To investigate the relationship between the results of the questionnaire and the physical condition at the time of after harvest and after adjustment of past physical condition, we carried out a multiple linear regression analysis. Prior to the analysis, we performed a principal component analysis to quantify the comprehensive index using logarithmic transformed values of the above-mentioned measurement items. In the regression analysis, the response variable is the score of the first principal component that was based on the 3rd measurements, which were taken in November 2013. The scores of the first principal components that were based on the 1st and 2nd measurements were taken in November 2012 and March 2013. These measurements were used for adjustment variables of inter-individual variation. Timetable of the planning of survey and flow of the analysis were shown in Fig. 1. We analyzed the data from 43 males who were belonging to the same corporation and took part in all the physical condition measurements and were responded to the entire questionnaire.

Ethical consideration

This research protocol was approved by the ethics committee of Hiroshima University, Japan (Approval No. 24-2). Informed consent was received from each of the participants.

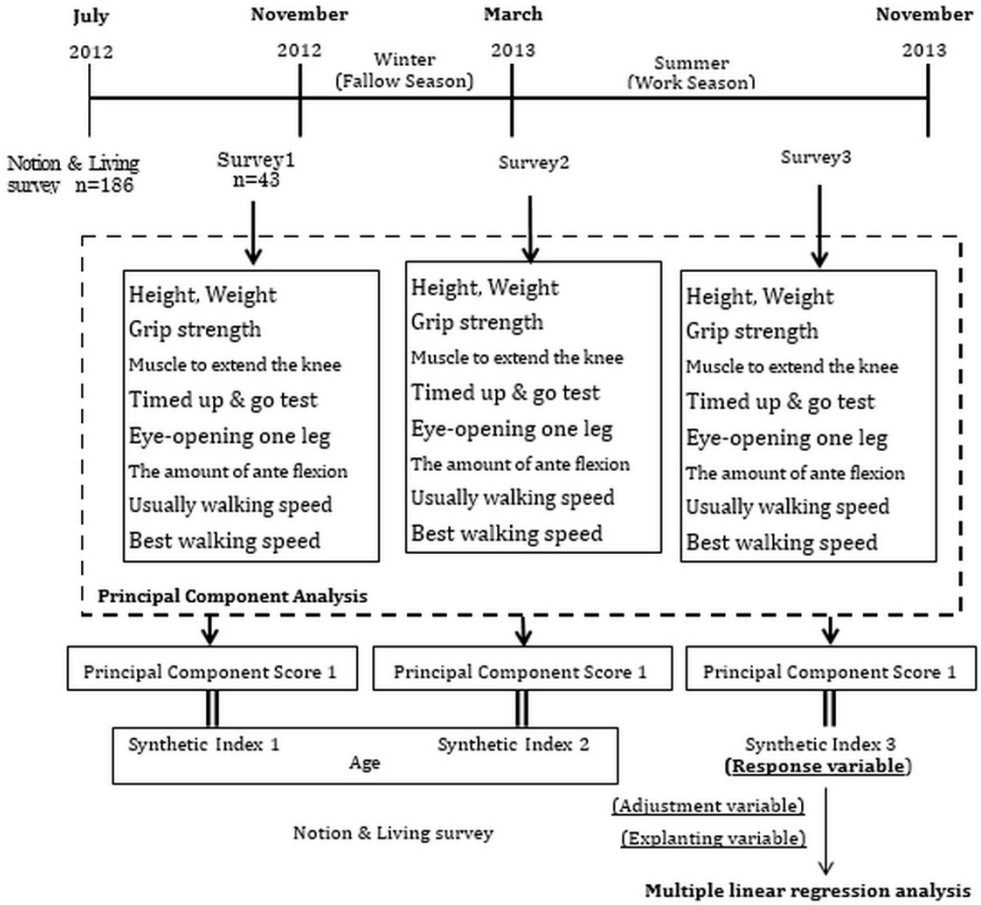

Fig. – 1: Timetable of planning of the survey and flow of the analysis

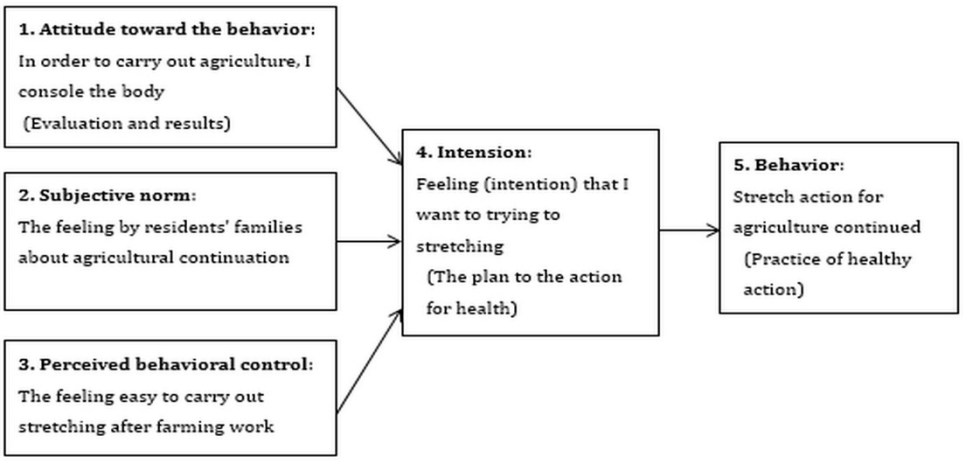

Fig. – 2: The concept for the practice of healthy action in Sera-cho based Theory of Planned Behavior

Results

The average age of the participants was 63.4 (SD 8.63) years. Participants lived in the same house with their wives or wives and children. In this study, 74.4% did not have any successor. The people of 81.4% worked solely for the rice crop corporation. Many of them also worked independently besides their cooperative work. There were 74.4% people working independently for the land of the corporation, and 67.5% people had an average income of less than 500,000 yen monthly from the corporation. The 16.3% of participants felt that there was a value in agriculture, and 76.7% felt they would like to help the corporation. The percentage of the person who responded as they had no relaxation was 88.4%. The people with feelings of trouble or stress were 69.8%. The people of 83.7% believed that they had a duty to the family to continue working in agriculture. The first, second, and third measurements are shown in Table 2. Conversion for a comprehensive index was carried out by utilizing the principal component analysis which used all measured value 3 times. The results of the analysis are shown in Table 3.

The five principal components were extracted and the percentage of variance of the first main component was 32.9%. As for multiple linear regression analysis, the first main component score was used as a comprehensive evaluation index of the physical condition. All principal component loadings had positive values. The result of the multiple linear regression analysis is shown in Table 4.

The concept of physical condition after harvest of those who think 'maintaining a good physical condition and exercise after easy work' was significantly higher compared to those who did not share this view (p value = 0.021 and 0.044, respectively).

Table - 1: Socio-demographic profile of the participants

Characteristic	Frequency (n = 43)	Percentage
Family structure		
Single	2	4.7
Married	13	30.2
Family (two-generation)	18	41.9
Family (three-generation)	7	16.3
Other	3	6.9
Successors of farmers		
Not have	32	74.4
Have	11	25.6
Income from corporation		
Less than ¥ 100,000	11	25.6
¥ 100,000 to less than 500,000	18	41.9
¥ 500,000 or more	11	25.6
Unknown	3	6.9
Time to rest		
Not have	38	88.4
Have	5	11.6
Trouble/Stress		
Not have	13	30.2
Have	30	69.8
Willing to help corporation		
Do not	6	14.0
Do	33	76.7
Unknown	4	9.3
Caring body for farming		
Do not	19	44.2
Do	24	55.8
Respond to a family expecting		
Not have	6	14.0
Have	36	83.7
Unknown	1	2.3

Knowledge of exercise and stretch		
Not have	29	67.4
Have	14	32.6
Stretch in farm work		
Do not	19	44.2
Do	24	55.8
Feeling of stretch after work		
Difficult	13	30.2
Easy	30	69.8

Table - 2: Summarized statistics of three measurements

Item	Nov. 2012 (1st)			Mar. 2013 (2nd)			Nov. 2013 (3rd)		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Height (cm)	43	164.20	6.03	39	164.20	5.97	37	163.80	5.69
Weight (Kg)	43	62.80	9.58	39	64.61	9.45	37	64.27	9.71
Usual walking speed (sec)	43	7.31	1.15	39	8.47	9.34	37	7.25	0.90
Best walking speed (sec)	43	5.26	0.79	39	5.19	0.62	37	5.12	0.75
Grip strength (Kg)	43	38.75	7.16	39	38.79	5.99	37	38.18	6.11
Muscle to extend the knee (L) (Kg)	42	36.80	10.67	37	40.64	11.35	37	40.73	12.31
Muscle to extend the knee (R) (Kg)	41	38.60	11.06	37	42.10	11.36	37	41.21	11.18
Timed up & go test (sec)	43	5.80	0.98	38	6.10	0.94	37	5.90	0.95
Time of standing eye-opening one leg (L) (sec)	42	48.74	17.40	38	49.40	16.41	37	48.00	18.42
Time of standing eye-opening one leg (R) (sec)	43	47.78	18.31	38	47.93	18.79	37	47.88	20.15
The amount of anti flexion (Flexibility) (cm)	42	34.53	9.20	37	33.19	9.81	36	32.02	8.78

Table - 3: Results of Principal Components Analysis

Parameter	Component loading matrix				
	Component				
	1	2	3	4	5
Height	0.688	-0.182	0.074	0.363	0.417
Weight	0.605	-0.570	-0.169	-0.206	0.309
Grip strength	0.809	-0.127	0.099	0.098	0.224
Muscle to extend the knee (L)	0.782	-0.262	-0.021	-0.137	-0.417
Muscle to extend the knee (R)	0.748	-0.306	-0.187	-0.071	-0.441
Timed up & go testing	0.532	0.477	0.406	-0.073	0.007
Time of standing eye-opening one leg (L)	0.489	0.607	-0.495	-0.065	0.02
Time of standing eye-opening one leg (R)	0.437	0.589	-0.503	0.216	0.157
The amount of anti flexion (Flexibility)	0.171	0.047	0.386	0.801	-0.332
Usually walking speed	0.189	0.103	0.614	-0.162	0.373
Best walking speed	0.415	0.409	0.461	-0.416	-0.231
Factor extraction method: principal component analysis					
Total	3.616	1.66	1.481	1.105	1.016
Contribution rate	32.872	15.095	13.464	10.048	9.233
Cumulative contribution rate	32.872	47.967	61.431	71.479	80.712

Table - 4: Related factors for maintenance of a physical condition

Variable	Standardized coefficient	t	p
Age	-0.046	-0.559	0.582
The 1st major component score of the 1st measurement	0.332	1.867	0.075
The 1st major component score of the 2st measurement	0.622	3.523	0.002
Satisfied with what the corporation decided	-0.144	-1.710	0.101
For carrying out agriculture, I console the body	0.192	2.481	0.021
It is easy to carry out stretching after work	0.169	2.134	0.044
		R^2=0.885	

Discussion

In this study, older farmers had a strong subjective norm for agriculture. An average age of the members of agricultural corporation was 65.8 years that was reported by The Ministry of Agriculture, Forestry, and Fisheries, Japan in 2012 (MAFF, 2015). So, the average age of the target corporation found younger in this study as 63.4 years. The members usually live with their wife and grown-up child similar to the present condition of other areas in Japan. They did not have a successor. They had a feeling of 'value in agriculture'. They want to meet their relative's expectations, which are 'maintain the farmland from the ancestors', and 'to be helpful to their corporation'. Member had a particular sense of belonging to the land from their ancestors, and a strong concern about farmland and agriculture (Gaboriaud, 2000). The corporation in this area was established with a policy of agricultural maintenance rather than simply for the purpose of profit (Kakubo, 2006). Therefore, it is thought that the members' attachment to this corporation is strong. The member's rice field was managed by the corporation. The member's role was managing the main work involved in rice crop farming, mowing, watering, etc. Since there is no successor, when a member grows older, the pursuer of the main work decreases. Although the members' role involves only activities that they are capable of doing, they will retire soon. Some of the work is done by younger members, but this number is very small. If retirees increase in the number, it will not be possible to maintain farmland and ultimately the municipality will collapse from the productivity of agricultural industry.

The physical strength and athletic ability test measurement results were conducted and announced by The Ministry of Education, Culture, Sports, Science & Technology in Japan (MEXT, 2017) were higher than those found in the results of this research. Agricultural work is not in general and expected to improve an individuals' athletic ability. Agricultural work may practically cause overwork for the body as the previous researches showed (Xiang *et al*., 1999; Solecki, 2011).

Government statistics show a 'common value', related to health condition for Japanese people in general from all walks of life. This common numerical value is comfortable for Japanese people and helps to maintain a positive attitude. However, there was no common value for specifying the agricultural workers and that agricultural work has the impact on the body. This research clearly establishes a common, numerical value, which is specific to active farm workers. This is very important in maintaining a positive state of mind and healthy attitude as shown by the previous study (Markus and Kitayama, 1991). The data from this research can be used as a comparison with more general values for future studies.

The physical condition was significantly higher after harvest among those who conceive 'maintaining a good physical condition' and 'exercise after work is easy' in comparison to those who did not share this view. Theory of planned behavior has described the attitude toward the behavior, the subjective norm, and perceived behavioral control those are related to action intention (Ajzen, 1991). The attitude, the subjective norm, and a feeling of control to action are related to an action intention which is a proactive stage of taking action to maintain good physical condition.

An idea is seen as an attitude toward preparing and maintaining the body for agricultural work. Stretching is an effective method for fatigue and posture improvement. The activity has to be seen as one that is easily achieved, a perceived behavior. Strong, positive feelings still remain in the corporation and agricultural continuation among the members of this corporation

and their families. This subjective norm is in 80% of the members. As this number increases, therefore, the action intention might impact to health.

Limitation

The findings in this study were obtained from limited areas of Japan. In the future, a large scale of study may carry out for the situation analysis and verification in other areas of Japan and as well as Asia.

Conclusion

The physical condition among the members of the farm management corporation is poorer than the national average of Japanese people. It is suggested that agricultural work is a burden for the body development. The thoughts about maintaining the body condition and the comfort with which this can be done (perceived behaviors) were directly related to actual physical maintenance. There is a recommendation for farmers, after retirement age, to maintain a good physical condition, it is important to strengthen their attitudes towards health and agriculture, not simply guide them through various methods of exercise such as gymnastics. The public health nurse appealed to representatives of the corporation to participate in a measurement activity and discussion event. Orientation and measurement were carried out by the university team members and personnel from the municipality, and measured values were given to each participant following each activity. Participants showed great interest in the measurement results and were quick to encourage each other in the activities. This type of 'event' is effective for helping male agriculture workers with health promotion as they were all acquainted with each other, competed for the best measurement values and sought further participation for suggesting a positive behavioral shift in attitudes towards health promotion.

Declaration of Conflicting Interests

This research was conducted as a joint research with Hiroshima University and Sera-cho, Hiroshima in Japan. There is no conflict of interest.

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