Determinants of Good Work Ability among Organic and Conventional Farmers in Finland

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HIGHLIGHTS

- Demand for organic food has increased in recent years, and public policies have favored organic products, but little attention has been paid to the organic farmers' health and safety.
- We found that organic farmers have lower odds of having good work ability, indicating the need for safer working conditions, particularly for farmers considering switching to organic production.

ABSTRACT. *Based on earlier studies, farmers have poorer work ability compared to workers in most other occupations. The aim of this study was to explore if organic production has a positive effect on producers' work ability while controlling for demographic and production characteristics. This study used telephone interview data collected by the Finnish Institute of Occupational Health in 2014-2015. The material consisted of 2,164 farmers: 231 in organic production and 1,933 in conventional production. Work ability was measured with a single question regarding the farmers' current work ability compared with their lifetime best on a scale of 0 to 10, with 0 meaning unable to work. The data were analyzed using multivariable logistic regression. Organic production had a negative effect on work ability, while larger farm size, experiencing economic uncertainty rarely/never/occasionally (vs. often), age under 55 years, having occupational health coverage, and experiencing low amounts of physical strain or mental strain had positive effects in a multivariable model. While this study could not consider potential biases from the farmers' existing health status at the time of switching to organic production and other sources, it is clear that greater attention needs to be paid to improving worker health, safety, and wellness in organic farming.*

Keywords. Agricultural work, Agriculture, Farmer, Interview, Occupational health service, Occupational safety and health, Odds ratio, Risk factor, Sustainability.

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Work ability is a widely used questionnaire-based indicator for evaluating the balance between workers' resources and work demands (Gould et al., 2008). It is based on individual, environmental, organizational (including work conditions and work content), and social aspects of working life (Gould et al., 2008). A lower work ability index predicts disability pensions (Alavinia et al., 2009) and long-term sickness absences (Kujala et al., 2009). Studies of Finnish working populations indicate that entrepreneurs in general have similar or better work ability compared with salary earners. However, farmers are an exception. Farmers' work ability is clearly worse than that of other entrepreneurs or salary earners (Gould et al., 2008). Saarni et al. (2008) found that 36% of farmers, 16% of salary earners, 16% of entrepreneurs without hired workers, and 12% of entrepreneurs with hired workers had poor or moderate work ability. Karttunen and Rautiainen (2009) reported that the prevalence of declined work ability is particularly high (39%) among dairy farmers. Among dairy farmers, both genders have declining work ability with age, and the decline becomes steeper for women after 40 years of age (Karttunen and Rautiainen, 2009). Farming as the main occupation increases the risk of declining work ability; 33% of full-time and 28% of part-time farmers have reported declining work ability (Perkiö-Mäkelä et al., 2016).

Self-reported work ability is linked to worker health, motivation, and level of work engagement, as well as physical and mental strain at work (Gould et al., 2008). Perkiö-Mäkelä and Hirvonen (2018) noticed that, among farmers, good current work ability (score of 8 to 10 on a scale of 0 to 10) is associated with younger age (under 64 years), good health, normal weight, work engagement, working conditions with absence of heavy physical strain, absence of heavy lifting, and absence of musculoskeletal and mental symptoms for a prolonged period or recurrently.

According to Perkiö-Mäkelä et al. (2016), 41% of full-time farmers have a diagnosed long-term disease or injury, and 23% have a long-term disease that interferes with their work, most typically a musculoskeletal disorder. The prevalence of long-term disease increases with age (Perkiö-Mäkelä et al., 2016; Koponen et al., 2018). Based on longitudinal (1982 to 2008) insurance data, Karttunen and Rautiainen (2013a) found that 52.9% of the farm population (farmers, spouses, and salaried family members) had at least one compensated injury or occupational disease claim. The clustering of injury and disease risks is rather strong: 10% of the farm population had half of all injury cases, and 3% had half of all occupational disease cases (Karttunen and Rautiainen, 2013a). Large farm size and livestock production have been identified as farm-related risk factors for injuries and diseases in Finland (Rautiainen et al., 2009; Karttunen and Rautiainen, 2013b). The identified person-related risk factors for disease include Finnish as native language (vs. Swedish, which is also an official language in Finland) and higher income level (Karttunen and Rautiainen, 2013b). Male gender, Finnish as native language, higher income level, and older age are risk factors for injuries (Rautiainen et al., 2009; Karttunen and Rautiainen, 2013b). Furthermore, 22 significant risk factors for agricultural injuries were identified in a meta-analyses (Jadhav et al., 2015, 2016).

The disability pension incidence rate of farmers is higher than that of other "blue collar" occupations but lower than that of hired farm relief workers (Pensola et al., 2010). Karttunen et al. (2015) noticed that almost half (44.6%) of farmers' disability pensions are related to diseases of the musculoskeletal system and connective tissues. Other disabling health conditions were mental and behavioral disorders (17.5%) and injuries

(9.8%). The average annual rate of new permanent or temporary disability pension cases was 1.04 per 100 person-years during the five-year period from 2008 to 2012. On average, disability pensions started at the age of 54.5 years. They resulted in a loss of 6,800 productive person-years and €60.2 million as pension costs in the analyzed five-year period (Karttunen et al., 2015).

Organic Production in Finland

Organic farming has gained a strong foothold in Finland. In 2017, about 259,450 ha of cultivated area was under organic farming or in conversion to organic (Niemi and Väre, 2018). This is about 11% of the total cultivated area and almost twice as much as 20 years ago. During the past five years, the organic area has grown by about 5.4% per year. The Finnish Ministry of Agriculture and Forestry has set a target to increase the share of organic production to 20% of the total cultivated area by 2020. This goal is reachable if organic production continues to grow as it has previously.

One reason for farmers switching to organic production is higher subsidies and better profitability. For example, in organic milk production, the compensation for the farmers' labor and equity can be triple compared to what they would receive for conventional milk production (Luke, 2018a). This is due not only to the higher subsidies and market prices but also to the lower production costs, which compensate for the lower yields in organic production.

According to profitability bookkeeping results, organic farms have on average more arable land per farm but fewer livestock units than conventional farms (Luke, 2018a). This applies to almost all types of production. On organic sheep and goat farms, more labor input is allocated per livestock unit than on conventional farms. Organic dairy farms are slightly larger than conventional farms (measured both by land and animal units) and require less labor input per production unit than conventional farms. Organic dairy farms also use almost twice as much paid labor as conventional farms, which use more farm family labor (Luke, 2018a).

Aim of Study

Earlier studies have shown that farmers in general are at high risk of declined work ability. Organic farming is a growing and poorly understood sector of agriculture in terms of working conditions, exposures, and health outcomes. The aim of this study was to explore if organic production has a positive effect on producers' work ability while controlling for demographic and production characteristics.

Materials and Methods

This study was based on telephone interview data collected by the Finnish Institute of Occupational Health between October 2014 and January 2015. The study sample consisted of 5,774 Finnish-speaking active farmers who submitted a subsidy application in 2014 and were between 18 and 68 years of age. The randomized sample was stratified by the production sector to represent 12 major sectors in Finnish agriculture. The response rate was 54% (3,117 responding farmers). The data were originally collected for the "Occupational health and agriculture in Finland" study and contained about 200 variables concerning agricultural production, work exposure, and health outcome information for full-time and part-time farmers (Perkiö-Mäkelä et al., 2016). A subset of the original data was selected for our study that comprised only full-time farmers who answered the question

concerning their work ability (n = 2,164). Health- and work-related dimensions of current work ability in the dataset were analyzed earlier, but the farming method (organic vs. conventional) was not included in that analysis (Perkiö-Mäkelä and Hirvonen, 2018).

We selected demographic and farm-production variables that could potentially have an effect on work ability, with our primary interest on the effect of organic versus conventional farming. A farm was classified as an organic farm if it had organic plant production, organic animal production, or both.

Outcome Variable

The work ability score (WAS), which was used as the outcome variable, is the farmers' own assessment of their current work ability compared with their lifelong best on a scale of 0 to 10, with 0 meaning unable to work. In the analysis, the WAS values were categorized as declined (scores of 0 to 7) or good (scores of 8 to 10) work ability, similar to previous studies (Gould et al., 2008; Perkiö-Mäkelä and Hirvonen, 2018). The WAS is part of the work ability index (WAI) questionnaire, which assesses an individual's work ability with a series of questions (Tuomi et al., 1997). The single-question WAS has been demonstrated to have a strong correlation with the results of the full WAI questionnaire (Ahlström et al., 2010).

Potential Determinants for Good Work Ability

Farm-related potential determinants that were tested in the analysis were:

- Farming method (organic vs. conventional).
- Main production sector (livestock, potato and horticulture, cereal and other plant production, or forestry and other).
- Farm size (<50 ha or ≥50 ha).
- Hired labor (yes or no; yes if the farm hired any short-term or long-term labor).
- Income from animal production (yes or no).
- Economic uncertainty of the farm (rarely or never strains the farmer, occasionally strains, or often strains).
- Use of contractor work or other services (yes or no).
- Selling contractor work or other services (yes or no).
- Co-operation with other farms (yes or no).

Person-related potential determinants were:

- Age (<45 years, 45 to 54 years, or >55 years).
- Gender (male or female).
- Marital status (married or living together, or single).
- Agricultural education (yes or no; yes if the farmer had any level of agricultural education).
- Occupational health service (OHS) coverage (yes or no; yes if the farmer used the voluntary agricultural OHS).
- Share of agriculture and forestry in taxable income (<25%, 25% to 49%, 50% to 74%, or 75% to 100%).
- Main use of annual working hours (animal care, plant production, forestry, working as a contractor, or other than farm work).
- Share of management working hours (<18% or 18% to 100%).
- Physical strain at work (little or some strain, or much or very much strain).

- Mental strain at work (little or some strain, or much or very much strain).

Statistical Analysis

Statistical analyses used existing data from the "Occupational health and agriculture in Finland" study (Perkiö-Mäkelä et al., 2016). Datasets were prepared for previous analyses (Perkiö-Mäkelä et al., 2016; Perkiö-Mäkelä and Hirvonen, 2018), which included categorizing continuous variables. Some variables were reclassified by combining categories that had small numbers of observations. The outcome variable (WAS) was dichotomized into good and declined work ability. The chi square test was used for testing the association between the WAS and the potential determinants. Variables that showed no association with the WAS in the chi square test were excluded from the regression analysis; the only exception was the gender variable, which was included as a common characterizer even if it did not show any association with the WAS ($p = 0.88$). Logistic regression analysis was applied, first using univariable analysis for exploring associations of the WAS with each of the selected potential determinant variables. Variables that were significant at $p < 0.1$ were selected for multivariable analysis, which was conducted using a stepwise (forward) method to include factors that were significant at $p < 0.05$. All analyses were conducted using SAS version 9.4.

Results

Data analyses included responses from 2,164 farmers who answered the question concerning their work ability (WAS); 231 of them were organic farmers, and 1,933 were conventional farmers. Contrary to the hypothesis, the WAS was significantly lower for organic farmers: 39% of organic farmers showed declined work ability compared with 32% of conventional farmers ($p = 0.02$, chi square test) (table 1).

Unadjusted logistic regression analyses (table 2) showed that organic farmers had lower odds (odds ratio, OR = 0.73) of having good work ability, or conversely they had 1.38 greater odds (95% CI: 1.06 to 1.83) of having declined self-reported work ability.

Larger farm size had a favorable effect on work ability in both the crude and adjusted models. Having hired labor had a positive effect, but only in the crude analysis. Indicating economic uncertainly on the farm less often was associated with better work ability in both the crude and adjusted analyses. Selling services to outside entities and co-operating with other farms in farm production had positive effects, but only in the crude analyses. Younger age was a strong determinant of better work ability in both models, while gender had no significant effect. Agricultural education was a significant predictor, but only in the crude analysis. Having coverage from the voluntary agricultural OHS had beneficial effects on work ability in both models. Having less physical and mental strain were also significant predictors in both the crude and adjusted models. The odds ratios along with their confidence intervals are presented in table 2.

Table 1. Prevalence of good and declined work ability scores among organic and conventional farmers.

	Good (WAS of 8 to 10)		Declined (WAS of 0 to 7)	
Farm Type	*n*	%	*n*	%
Organic	140	61	91	39
Conventional	1,314	68	619	32
Total	1,454	67	710	33

Table 2. Determinants for good work ability (WAS of 8 to 10) among full-time farmers.[a]

		Unadjusted		Adjusted[c]	
	Frequency[b]	OR	CI	OR	CI
Farming method					
Conventional	1933	1		1	
Organic	231	0.73*	0.55 to 0.96	0.70*	0.52 to 0.95
Farm size (ha)					
<50	1133	1		1	
≥50	1031	1.56*	1.30 to 1.87	1.24*	1.01 to 1.52
Hired labor force					
No	1615	1			
Yes	549	1.50*	1.21 to 1.86		
Economic strain					
Often	449	1		1	
Occasionally	896	2.03*	1.61 to 2.57	1.85*	1.43 to 2.39
Rarely or never	813	2.04*	1.60 to 2.59	2.08*	1.59 to 2.73
Selling services					
No	1054	1			
Yes	1105	1.28*	1.07 to 1.53		
Co-operation					
No	1006	1			
Yes	1154	1.24*	1.03 to 1.48		
Age (years)					
≥55	764	1		1	
45 to 54	786	1.98*	1.61 to 2.43	2.06*	1.65 to 2.57
<45	614	4.65*	3.60 to 6.02	4.82*	3.67 to 6.35
Gender					
Female	241	1			
Male	1923	0.98	0.73 to 1.30		
Agricultural education					
No	836	1			
Yes	1323	1.34*	1.12 to 1.61		
Agricultural OHS coverage					
No	724	1		1	
Yes	1440	1.40*	1.16 to 1.69	1.29*	1.05 to 1.58
Physical strain at work					
Much or very much strain	1069	1		1	
Little or some strain	1095	2.06*	1.72 to 2.48	1.55*	1.27 to 1.90
Mental strain at work					
Much or very much strain	928	1		1	
Little or some strain	1236	1.70*	1.42 to 2.04	1.43*	1.16 to 1.77

[a] Asterisks (*) indicate significance at $p < 0.05$.
[b] Low numbers ($n = 4$ to 6) of missing information.
[c] $n = 2144$.

Other Models

During the study process, we also tested several other models, e.g., a model with variables for organic farming method (vs. conventional), farm size, having hired labor, economic uncertainty of the farm, age, agricultural education, OHS coverage, physical strain at work, mental strain at work, long-term disease (with categories for no diagnosed long-term disease, diagnosed long-term disease, and diagnosed long-term disease that impedes work), and body mass index (<25 and ≥25). In that model, both the absence of a diagnosed long-term disease (OR 3.6, 95% CI: 2.8 to 4.5) and having a diagnosed long-term disease that does not impede work (OR 3.0, 95% CI: 2.2 to 4.0) had clear positive effects on work ability compared with a diagnosed long-term disease that impedes work. A nor-

mal body mass index (<25) also had a favorable effect on work ability (OR 1.49, CI 1.20 to 1.85). These variables were not included in the model reported in table 2 because diagnosed diseases are known to have a dominant effect on work ability. Including them could hide other determinants that are not as strong yet have a significant effect on work ability. In the data, organic farmers had slightly more diagnosed chronic diseases that interfere with farm work than conventional farmers, but this association was not significant ($p = 0.13$, chi square test).

Discussion

The results indicate that 33% of all farmers had declined work ability, which is in accordance with earlier findings in Finland (Gould et al., 2008; Saarni et al., 2008; Karttunen and Rautiainen, 2009). In the final adjusted multivariable model, conventional farming method, larger farm size, limited amount of strain because of economic uncertainty, younger age, OHS coverage, and absence of heavy physical and mental strain predicted good work ability.

Organic farmers had greater odds of having declined self-reported work ability. This finding was not completely unexpected, as there are some indications that producers who have healthier cattle are less healthy themselves (Kolstrup, 2008). Animal welfare is one of the key targets in organic production, and organic farmers may be willing to compromise their own health to some extent in favor of their production animals.

Based on agricultural statistics, organic farms have larger field areas, fewer livestock units, more hired labor, and better profitability (Luke, 2018a). All of these factors support good work ability; therefore, our findings indicate the need for better understanding of the specific disabling conditions and their etiology, as well as improving working conditions on organic farms. The findings may also be affected by detection bias; organic producers may be more health-conscious, pay more attention to their own health, and report health concerns they have more readily. Furthermore, it has been found that safety and health concerns motivate farmers to change to organic production (Cranfield et al., 2010). The association of work ability and farmers' interest in switching to organic production was outside the scope of this study, but this result could indicate that declined work ability is among the reasons for switching to organic production.

When comparing migrant farm workers' self-reported health in conventional and organic horticultural systems in the U.K. using four standard health instruments, three of the instruments found no difference between workers on organic and conventional farms, but the fourth instrument (the short depression happiness scale) indicated better health and happiness for workers on organic farms (Cross et al., 2008). A positive relationship between self-reported life satisfaction and being an organic producer was also found in France (Mzoughi, 2014).

Larger farm size had a favorable effect on work ability. This finding is consistent with a finding among dairy farmers that small herd size, among other factors, is associated with declined work ability (Karttunen and Rautiainen, 2009). In contrast, large farm size has been reported to be a risk factor for both occupational injury and disease (Rautiainen et al., 2009; Karttunen and Rautiainen, 2013b; Jadhav et al., 2016). Larger farm size means more working hours, and it is expected that greater exposure time increases the risk of occupational injury and disease in an occupation, such as farming, that is known to be hazardous (e.g., Rautiainen et al., 2009; Karttunen and Rautiainen, 2013b). Our

finding suggests that lack of balance between work demands and personal resources is more frequent on smaller (<50 ha) farms. In Finland, the average agricultural area per farm was 47 ha in 2017 (Luke, 2018b).

A farmer's younger age was a strong determinant of better work ability. This finding is similar to practically all studies using the WAS or WAI methods (e.g., Gould et al., 2008; Ilmarinen et al., 1997; van den Berg et al., 2009). Interestingly, age is not as clear a predictor of agricultural injury. A meta-analysis found that numerous studies have explored age as a determinant of the risk of injury in agriculture, but the results were inconsistent (Jadhav et al., 2016).

Having coverage from the voluntary agricultural OHS had beneficial effects on work ability in both models. Measurement of work ability was developed for the use of the OHS in Finland in the early 1980s after realizing that the curtailing of work careers was due to several reasons, in additional to medical reasons (Ilmarinen, 2009). The main aim of the OHS is to support work ability in workplaces. It has been available, on a voluntary basis, for self-employed farmers in Finland since 1984, and it has achieved a good participation rate. However, the effectiveness of the OHS is insufficient for preventing occupational injuries and diseases. OHS coverage even seems to increase the risk of compensated claims for injuries and diseases (Karttunen and Rautiainen, 2013b). On the other hand, chronic illnesses may encourage farmers to have OHS coverage (Kinnunen et al., 2009), and those having the coverage may also be more actively diagnosed and better informed about insurance benefits (Karttunen and Rautiainen, 2013b), which may have biased the research results. The farmers who use OHS are a very heterogeneous group and also include fishers and reindeer herders from multiple farm-specific working conditions and traditions. Understanding the specific working conditions of each group is challenging for the OHS personnel and may partly result in ineffective implementation of the service (Kaustell et al., 2017).

High physical and mental workloads were associated with declined work ability, as has been stated earlier in the systematic review (van den Berg et al., 2009). An excessive amount of economic worry was also associated with declined work ability.

Strengths and Limitations

The strengths of this study are the relatively large representative sample of Finnish farmers, the well-established research methods using phone interviews and validated questions, the well-established WAS as the outcome measure, and the availability of relevant farm production and personal variables.

The limitations of this study include the relatively small number of organic farms in the sample. Furthermore, there is a lack of information on the reasons (e.g., health and other concerns) why the farmers in the sample switched to organic farming. We also had difficulties assessing the detection bias from the differences between organic and conventional farmers in terms of their concern with and reporting of health issues. While there is an association with declined work ability among organic producers, it remains unclear if this difference was pre-existing or exacerbated due to work in organic farming.

Conclusion

While this study could not consider the potential selection bias from existing health status at the time of switching to organic production, it is clear that greater attention needs to be paid to improving worker health, safety, and wellness in organic farming.

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