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# Back Pain Among Farmers in a Northern Area of China

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**Study Design.** This was a population-based survey conducted in 2008 in a northern area of China.

**Objective.** To investigate back pain prevalence and to examine the associations between potential risk factors and back pain among Chinese farmers.

**Summary of Background Data.** Few studies have investigated back pain and its associated risk factors among farmers in low-income and developing nations.

**Methods.** Farmers ages 15 years and older were chosen from 800 families in Heilongjiang province of the People's Republic of China using cluster sampling methods. Complete survey data were obtained from 2045 farmers. The prevalence of self-reported back pain during the previous 3 months was reported. Associations between back pain and potential risk factors, which included age, gender, education levels, perceived stress, main farm activities, smoking, and drinking status, were examined in logistic regression models.

**Results.** A total of 786 (38.4%) farmers reported back pain. Two-thirds of those with back pain (66.0%) reported that back pain affected work quantity and quality. The adjusted odds ratios of reporting back pain increased with advancing age. Females and farmers who experienced stress regularly were also more likely to report back pain.

**Conclusion.** Back pain is a common problem among Chinese farmers and is reported more frequently by females. Significant positive associations of gender, age, and perceived stress with back pain warrant additional study.

**Key words:** agricultural work, back pain, China, epidemiology, farmers, stress. **Spine 2012;37:508–514**

Among working adults, low back pain (LBP) is one of the principal causes of disability in industrialized nations.[1] Occupational risk factors contribute to 37% of LBP worldwide.[2] Moreover, back pain leads to substantial losses in financial revenue and to reductions in quality of life. Farming has become increasingly recognized as an occupation that poses a high risk for back pain. The risk of back and joint pain has been found to be higher among farmers when compared with workers from other occupational sectors, including manual workers.[3]

A number of contributing factors have been associated with back pain among farmers. Potential risk factors include physical occupational demands such as manual handling, repetitive motion, and whole body vibration and mechanical shock from farming equipment.[4–6] In addition, several studies in industrialized nations have shown that people with mental distress and people who smoke are more likely to suffer from back pain.[7–9]

Although there has been research in the United States[4,10] and other developed countries,[5,11] less is known about the factors associated with back pain among farmers in low-income and developing nations. In the past 3 decades, the still-developing People's Republic of China (PRC) has emerged as a prevailing force on the world market. Producing 30% of the world's rice, 20% of the world's corn, 25% of the world's cotton, an estimated 37% of the world's fruit and vegetables, and half of the world's pork, China has become the largest agricultural producer and consumer.[12] Not only does China export to the rest of the world, it must also sustain its own population of 1.3 billion. It is thus imperative to investigate and to address the issue of back pain among China's vast agricultural workforce.

The objectives of this study were to (1) describe the prevalence of back pain among Chinese farmers by selected demographic characteristics and (2) examine the associations between potential risk factors (perceived stress, smoking, and alcohol drinking) and back pain among Chinese farmers.

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## MATERIALS AND METHODS

### Data Source

We analyzed data from a population-based survey conducted in 2008 that was a collaborative effort between the Center for Injury Research and Policy (CIRP) of the Research Institute at Nationwide Children's Hospital, the Colorado Injury Control Research Center (CICRC) of the Psychology Department at Colorado State University, and a research team from the School of Public Health of Qiqihar Medical University. These data were previously used by Wang *et al.*[13] in a study investigating the association between alcohol consumption and work-related injuries among Chinese farmers. The survey procedures and study methods were described in detail in their study.

### Study Design and Sampling

Qiqihar is a population center located in China's northernmost province, Heilongjiang. Approximately 59% of Qiqihar's population lives in surrounding agricultural areas. Information about residents was obtained from Qiqihar's mandatory registration of residents. The following procedures were utilized to select the sample for this study. First, 800 families were selected through systematic sampling from 9 villages with similar soil and farming techniques. Using cluster survey sampling methods, rural residents aged 15 years and older were surveyed.

With help from CIRP and CICRC, the research team at the School of Public Health of Qiqihar Medical University developed the survey questionnaire. After obtaining approval from the Colorado State University Institutional Review Board and the Scientific Research Committee of the Qiqihar Medical University, the study was officially launched.

Trained in May 2008 by the principal investigator, 25 students from the School of Public Health of Qiqihar Medical University served as interviewers. Student interviewers filled in all questionnaires by conducting face-to-face interviews. Data collection began on May 7 and was completed by May 25 in 2008. The principal investigator at the university randomly chose 25 questionnaires following completion of the initial survey and met with the respondents to verify the consistency of the data collected. Data agreement was greater than 90%, and so the previously collected data were considered reliable.

### Definition of Back Pain

A specific question about back pain was asked in the survey: "During the past 3 months, that is, February to April, 2008, did you have back pain that lasted for a full day or more?" In this study, a positive response (yes) to this question was defined as back pain. To those who self-reported back pain, another question was asked: "Did any of the back pain you had during the past 3 months affect your work quality or quantity?" Respondents who answered "yes" were defined as having back pain that affected work.

### Potential Risk Factors

The potential risk factors examined in this study were gender, age, education, main agricultural activities, perceived life stress, cigarette use, and alcohol consumption. Subjects were asked to evaluate the overall level of stress they felt in relation to external factors, as well as whether they perceived stress in their family and neighbor relationships. Subjects were asked whether they smoked or drank, as well as a detailed history of their use.

### Statistical Analysis

EpiData 3.02 (EpiData Association, Odense Denmark) was used to collect and store the data.[13] SAS 9.1 (SAS Institute, Cary, NC) was used in the data analysis. Our analysis was completed in phases. First, the prevalence of self-reported back pain was compared across gender, age, education, and main agricultural activities using Pearson $\chi^2$ tests. Similarly, comparisons in back pain prevalence were considered across stress, smoking, and alcohol consumption variables. Finally, logistic regression models were fitted with back pain and back pain that affected work as the outcome variables and gender, age, education, main farm activities, perceived stress, smoking, and alcohol-use status as independent variables. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported. We also evaluated the use of the generalized estimating equation (GEE) to account for nonindependence because more than 1 adult could participate from each family (using the SAS GENMOD procedure). The original survey did not include a cluster variable, but we could identify clusters using phone numbers for just over 43% of our sample. On average, 2 individuals from each family (*i.e.*, with the same phone number) participated in our survey. Our statistical results from the standard logistic regression analysis and the GEE that accounted for clustering effects were similar, and the conclusions were the same. Therefore, we choose to present the results of logistic regression models, so we could utilize the full dataset.

## RESULTS

Of the 2264 respondents initially selected, only 15 (0.7%) declined to participate in the survey, and another 51 (2.3%) provided incomplete information. After data collection, we found that 148 persons actually spent little time performing farm work, so they were excluded from the study. Therefore, 2045 farmers were included in the final analyses. There were 786 (38.4%) farmers who reported having experienced general back pain and 518 (25.4%) who reported having experienced back pain that affected work within the 3 months preceding the survey. Two-thirds of those with back pain (66.0%) reported that back pain affected work quantity and quality. Because patterns and potential risk factors were similar for back pain and back pain that affected work, the results and discussion in this article focus primarily on general back pain.

### Demographic Variables

As shown in Table 1, 40.7% of females reported back pain compared with 36.3% of males ($P = 0.041$). In addition, farmers aged 25 years and older reported significantly higher rates of back pain relative to younger farmers (15- to 24-year-olds),

**TABLE 1. Demographics and Perceived Stress of Chinese Farmers With Self-Reported Back Pain and Back Pain That Affected Work**

| | | Back Pain | | | Back Pain That Affected Work | | |
|---|---|---|---|---|---|---|---|
| | Total | n | %* | *P* | n | %* | *P* |
| Total | 2045 | 786 | 38.4 | | 519 | 25.4 | |
| Sex | | | | | | | |
| Male | 1073 | 390 | 36.3 | Ref. | 252 | 23.5 | Ref. |
| Female | 972 | 396 | 40.7 | 0.041 | 267 | 27.5 | 0.042 |
| Age (yrs) | | | | | | | |
| 15–24 | 195 | 31 | 15.9 | Ref. | 17 | 8.7 | Ref. |
| 25–34 | 438 | 130 | 29.7 | <0.001 | 63 | 14.4 | 0.048 |
| 35–44 | 515 | 213 | 41.4 | <0.001 | 135 | 26.2 | <0.001 |
| 45–54 | 426 | 203 | 47.7 | <0.001 | 154 | 36.2 | <0.001 |
| 55–64 | 326 | 145 | 44.5 | <0.001 | 102 | 31.3 | <0.001 |
| 65–74 | 105 | 49 | 46.7 | <0.001 | 37 | 35.2 | <0.001 |
| 75–84 | 29 | 14 | 48.3 | <0.001 | 11 | 37.9 | <0.001 |
| Education | | | | | | | |
| Elementary or below | 828 | 348 | 42.0 | Ref. | 248 | 30.0 | Ref. |
| Middle school | 1049 | 374 | 35.7 | 0.005 | 220 | 21.0 | <0.001 |
| High school and above | 168 | 64 | 38.1 | 0.345 | 51 | 30.4 | 0.807 |
| Main farm activities | | | | | | | |
| Livestock breeding | 1271 | 482 | 37.9 | Ref. | 311 | 24.5 | Ref. |
| Crop cultivation | 573 | 241 | 42.1 | 0.092 | 167 | 29.1 | 0.034 |
| Other | 201 | 63 | 31.3 | 0.073 | 41 | 20.4 | <0.001 |

*Ref. indicates reference group.*

**Row percentages.*

with those older than 35 years reporting back pain 40% more often than the younger farmers. Farmers whose main farm activity was crop cultivation were more likely to report back pain than farmers whose main activity was breeding livestock, although this difference was not statistically significant (42.1% *vs.* 37.9%, $P = 0.092$).

### Perceived Stress, Smoking, and Alcohol Consumption

Of the 584 farmers who reported experiencing stress "regularly," 53.9% reported back pain compared with 31.3% of farmers who reported back pain among those that said they never experienced stress ($P < 0.001$) (Table 2). Overall, less than 2% of respondents reported stress in their familial and neighbor relationships, but those with familial stress reported back pain more often than those without that stress ($P = 0.003$). Back pain was self-reported more often among smokers than among nonsmokers ($P = 0.008$). Current and former drinkers reported back pain more often than those abstaining from alcohol.

### Multivariate Analyses

Gender, age, and stress were statistically significant in the multivariate model (Table 3). The associations of smoking and drinking with back pain were not statistically significant after controlling for other variables in the multivariate model. Females were more likely to experience back pain than males (OR 1.22; 95% CI: 1.09–1.36). The odds ratios of back pain increased with increasing age among farmers. Farmers with regularly perceived stress had an increased odds ratio of reported back pain (OR 2.51; 95% CI: 2.00–3.16) compared with farmers who "never or rarely" experienced stress.

## DISCUSSION

The overall prevalence of self-reported back pain in the preceding 3 months among Chinese farmers in Qiqihar was 38.4%; back pain affected the quantity and quality of work of more than a quarter of the farmers. Although comparisons with other studies face limitations because of differences in reference periods, study population, and back pain

**TABLE 2. Perceived Stress, Cigarette, and Alcohol Use in Chinese Farmers Self-Reporting Back Pain and Back Pain That Affected Work**

| | | Back Pain | | | Back Pain That Affected Work | | |
|---|---|---|---|---|---|---|---|
| | Total | n | %* | *P* | n | %* | *P* |
| Perceived stress | | | | | | | |
| Never or rarely | 785 | 246 | 31.3% | Ref. | 152 | 19.4% | Ref. |
| Sometimes | 667 | 223 | 33.4% | 0.395 | 144 | 21.6% | 0.294 |
| Regularly | 584 | 315 | 53.9% | <0.001 | 222 | 38.0% | <0.001 |
| Familial stress | | | | | | | |
| No | 2003 | 763 | 38.1% | Ref. | 501 | 25.0% | Ref. |
| Yes | 33 | 21 | 63.6% | 0.003 | 17 | 51.5% | <0.001 |
| Neighbor stress | | | | | | | |
| No | 2005 | 769 | 38.4% | Ref. | 506 | 25.2% | Ref. |
| Yes | 31 | 15 | 48.4% | 0.255 | 12 | 38.7% | 0.115 |
| Smoker | | | | | | | |
| No | 1214 | 438 | 36.1% | Ref. | 297 | 24.5% | Ref. |
| Yes | 831 | 348 | 41.9% | 0.008 | 222 | 26.7% | 0.251 |
| Years smoking† | | | | | | | |
| Less than 10 | 152 | 50 | 32.9% | Ref. | 31 | 20.4% | Ref. |
| 10–19 | 201 | 77 | 38.3% | 0.294 | 40 | 19.9% | 0.909 |
| 20 or more | 478 | 221 | 46.2% | 0.004 | 151 | 31.6% | 0.764 |
| Drinker | | | | | | | |
| Never (abstainer) | 1358 | 495 | 36.5% | Ref. | 333 | 24.5% | Ref. |
| Former (quit) | 76 | 39 | 51.3% | 0.005 | 27 | 35.5% | 0.031 |
| Current | 611 | 252 | 41.2% | 0.015 | 159 | 26.0% | 0.477 |
| Years drinking† | | | | | | | |
| Less than 5 | 56 | 21 | 37.5% | Ref. | 7 | 12.5% | Ref. |
| 5–9 | 89 | 31 | 34.8% | 0.744 | 16 | 18.0% | 0.379 |
| 10–14 | 149 | 55 | 36.9% | 0.938 | 36 | 24.2% | 0.068 |
| 15 or more | 391 | 182 | 46.6% | 0.204 | 126 | 32.2% | 0.003 |

*Ref. indicates reference group.*
**Row percentages.*
*†Approximate figures from self-reports.*

definitions, the results of a US study and several other Chinese studies provide context for our results. In the United States, a study using a large, nationally representative dataset reported a previous 3-month prevalence of LBP (with and without neck pain) of 26.3%.[14] Studies of LBP among farmers, mostly males in the United States, have sometimes reported higher levels of prevalence.[4,15] Several studies have described self-reported LBP prevalence rates in Chinese populations. Nearly 67% of farmers in eastern China self-reported back pain in the previous 12 months, and the prevalence rate among women was consistently higher than that among men until age 60.[16] Jin *et al.*[17] reported an annual LBP prevalence rate of 50% for 3 types of workers in Shanghai: teachers, battery/kiln factory workers, and garment workers. A cross-sectional study of villages in Tibet found a point prevalence rate of LBP of 34.1% and a 12-month prevalence of 41.9%.[18] In our multivariate modeling, sex, age, and perceived stress were statistically associated with back pain while controlling for education, farm activity, smoking, and alcohol use, but gender had only a weak association in the multivariate

**TABLE 3. Logistic Regression Model of Self-Reported Back Pain and Back Pain That Affected Work Among Chinese Farmers**

| | Back Pain | | Back Pain That Affected Work | |
|---|---|---|---|---|
| | OR | 95% CI* | OR | 95% CI* |
| Sex | | | | |
| Male | 1.00 | | 1.00 | |
| Female | 1.22 | 1.09–1.36 | 1.16 | 1.03–1.32 |
| Education | | | | |
| Elementary or below | 1.00 | 0.69–1.43 | 0.82 | 0.56–1.21 |
| Middle school | 1.07 | 0.75–1.53 | 0.77 | 0.52–1.12 |
| High school and above | 1.00 | | 1.00 | |
| Age (yrs) | | | | |
| 15–24 | 1.00 | | 1.00 | |
| 25–34 | 2.12 | 1.36–3.30 | 1.72 | 0.97–3.04 |
| 35–44 | 3.29 | 2.14–5.07 | 3.31 | 1.92–5.70 |
| 45–54 | 4.16 | 2.67–6.48 | 5.01 | 2.89–8.69 |
| 55–64 | 4.00 | 2.52–6.35 | 4.46 | 2.53–7.87 |
| 65–74 | 4.97 | 2.82–8.75 | 5.96 | 3.08–11.55 |
| 75–84 | 5.43 | 2.32–12.73 | 6.73 | 2.66–16.99 |
| Perceived stress | | | | |
| Never or rarely | 1.00 | | 1.00 | |
| Sometimes | 1.16 | 0.92–1.46 | 1.22 | 0.94–1.59 |
| Regularly | 2.51 | 2.00–3.16 | 2.52 | 1.96–3.25 |
| Main farm activities | | | | |
| Livestock breeding | 1.00 | | 1.00 | |
| Crop cultivation | 1.11 | 0.90–1.37 | 1.18 | 0.93–1.49 |
| Other | 0.78 | 0.56–1.09 | 0.82 | 0.56–1.20 |
| Smoker | | | | |
| No | 1.00 | | 1.00 | |
| Yes | 1.19 | 0.97–1.47 | 1.04 | 0.83–1.31 |
| Drinker | | | | |
| Never (abstainer) | 1.00 | | 1.00 | |
| Current | 1.26 | 0.99–1.61 | 1.11 | 0.85–1.46 |
| Former (quit) | 1.64 | 1.00–2.68 | 1.49 | 0.88–2.51 |

*CI indicates confidence interval; OR indicates odds ratio.*

logistic model. Greater back pain reported among women has been seen in other large population-based studies.[14,19] Of the 4 identified studies about back pain among Chinese general populations or workers, [16 18,20] only 1 study of a rural population in Tibet reported no gender-related difference in prevalence of back pain.[18] The 3 other previous studies and our study suggest that females have slightly higher prevalence of back pain.[16–18,20] This higher prevalence of back pain among Chinese females may be due to reporting bias (*i.e.*, females may be more likely to report back pain than males) or pain among females due to menstruation.[16,17]

In the multivariate modeling, advancing age and perceived stress were more strongly associated with back pain than gender. Close to half of Chinese farmers older than 45 years of age reported back pain, and those farmers with regular stress reported back pain more often than those who never or rarely

perceived stress. There are a number of literature reviews regarding back pain and psychosocial factors at work[21,22] and in private life.[23,24] More recently, a review of review studies has been published.[25] Although there appears to be value in including psychosocial factors in studies of back pain,[25,26] associations should be viewed cautiously.[22] It is not possible to determine the direction of causality between pain and stress in this cross-sectional survey.

In the univariate analysis, we observed that smokers were significantly more likely to have self-reported general back pain, and individuals with 20 or more years of smoking cigarettes had a significantly higher prevalence of general back pain. In addition, former drinkers were significantly more likely to report general back pain and back pain that affected work quality and quantity. The prevalence of self-reported back pain that affected work also increased with years of alcohol drinking. Our results further suggested that one's number of years of alcohol drinking had a larger impact on back pain that affected work than on general back pain. These results could be caused by the confounding effects of age. We found a strong association between age and both general back pain and back pain that affected work in this study. Older individuals are more likely to be former alcohol drinkers and smokers than young individuals in China. Cigarette smoking and alcohol drinking were not associated with back pain in the multivariate model controlling for confounding effects of age. These results suggest that association between years of cigarette smoking/alcohol drinking and self-reported back pain could be explained by the confounding effects of age. According to a systematic literature review of original research reports published between 1987 and 1995, there is no positive association between alcohol consumption and low back pain.[27] However, 1 recent prospective study suggests that moderate alcohol consumption had a protective effect on back pain.[28] A meta-analysis of 40 studies published before February 2009 indicates that the association between smoking and low back pain was fairly modest.[29]

This study has several limitations. First, because of the variability of estimates and their high sensitivity to various factors, such as inquiry phrasing, setting, and cultural differences, comparison of prevalence rates of back pain among various populations and countries can be problematic.[3,30] In future studies, standard definitions of back pain for use in epidemiological studies developed and agreed upon by a group of international experts should be used.[31] Their use will facilitate comparisons among back pain studies internationally.[32] Second, results were based on self-reports of back pain and the potential risk factors, and both may have been affected by recall bias. Also, because of cultural stigmatization regarding alcohol consumption and cigarette use, it is possible that participants underreported actual use. Third, although the study questionnaire asked a general question about whether subjects "perceived life stresses," the more detailed questions focused only on familial and neighbor relationships, not allowing assessment of other sources of stress, such as job, economic condition, and other life pressures. In addition, the psychometric properties of the stress questions used in the study have not been validated. Finally, because our study was cross-sectional, causality cannot be evaluated.

## CONCLUSIONS

This study found a high prevalence of self-reported back pain among farmers in this northern area of China. Because two-thirds of those with back pain (66.0%) reported that back pain affected work quantity and quality, back pain is an important public health issue among agricultural workers in China. Future research should address remaining important questions regarding prevalence of back pain, risk factors, and effective interventions.

### ➢ Key Points

- ❑ The overall prevalence of self-reported back pain in the preceding 3 months among Chinese farmers in Qiqihar was 38.4%.
- ❑ Back pain affected the quantity and quality of work for over a quarter of the farmers.
- ❑ In multivariate logistic models, gender, age, and perceived stress were associated with back pain while controlling for education, farm activities, and cigarette and alcohol use.
- ❑ Females and older farmers were more likely to report back pain.
- ❑ Farmers under regular stress reported back pain significantly more often than those without perceived stress.

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