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Fatigue and the Need for Recovery among Latino/a Immigrant Cattle Feedyard Workers

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ABSTRACT

Cattle feedyards are animal feeding operations where beef cattle are finished to market weight on grain. Cattle feeding can be dirty, demanding, and dangerous work. This study sought to assess the predictors of fatigue and the need for recovery among Latino/a immigrant cattle feedyard workers in the United States. A path model was examined to explore direct and indirect relations among physical fatigue, mental fatigue, need for recovery, job characteristics, and health and sociodemographic covariates. Lower self-reported health, experiencing physical pain, not handling animals, and decreased decision latitude were directly related to increased physical fatigue. Shorter tenure working on cattle feedyards, lower educational level, experiencing physical pain, and increased job demands were directly related to heightened mental fatigue. Being female, experiencing physical pain, an elevated average of hours worked per day, increased job demands, and less decision latitude were directly related to an increased need for recovery and indirectly related to both physical and mental fatigue. Physical and mental fatigue have specific correlates, but job characteristics, including job demands and decision latitude, can directly and indirectly impact workers' levels of physical and mental fatigue and their need for recovery. Both preventive measures and restructuring work operations may reduce the risk for fatigue and the need for recovery. Implications for cattle feedyard workers, supervisors, and employers are discussed. Finding ways to balance productivity and the well-being of workers should be a high priority for cattle feedyards across the country.

KEYWORDS

Fatigue; need for recovery; cattle feedlot; hispanic/Latino; agricultural workers

Introduction

A cattle feedyard is an animal feeding operation where beef cattle are finished to market weight on grain. Cattle feedyards are a significant economic driver for high plains states such as Nebraska and Kansas. In fact, Nebraska has the second highest number of cattle in feedyards in the entire country, followed by Kansas with the third highest.[1] The average number of head of cattle on a feedyard in Nebraska is 12,971, and the worker-to-animal ratio is approximately one worker for every 1,095 heads of cattle.[2]

Cattle feeding can be dirty, demanding, and dangerous work. The cattle must be cared for every day. Cattle spend approximately three to six months on a feedyard, but they may be processed in and out of the feedyard at various times throughout the year. Standard departments on a feedyard include the cowboy/pen riders who check animal welfare on a daily basis, feed truck drivers who deliver feed to the bunks multiple times per day, feed mill operators, hospital pen staff who care for sick animals, the processing team who manages the entrance and exit process for groups of cattle, yard maintenance staff who ensure facilities are in working order, security who track individuals on the property, and administration. Cattle feedyard workers often work long hours in relentless weather conditions. They may have contact with large animals including cattle and/or horses and be exposed to dust, loud machinery, heavy equipment, and hazardous chemicals.[3]

Because of the size and scope of the feedyard industry, there is a significant need for hired labor. In fact, the livestock sector has had the fastest

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growth in the number of hired farmworkers, with a 17% increase from 2010 to 2018.[4] Many livestock production jobs in the United States are now being filled by immigrant workers.[5] Indeed, approximately 36% of the livestock production workforce is comprised of immigrants.[4] Immigrants and foreign-born farmworkers (regardless of immigration legal status) are considered vulnerable by the National Institute for Occupational Safety and Health.[6] These workers often work more hours per week than native-born workers and have less access to health, employment, and social benefits. Immigrant farmworkers may be given more difficult tasks, have less control over how to complete their tasks, and be less likely to refuse dangerous work or formally report safety violations.[7] They may also face additional burdens related to cultural and linguistic differences and precarious immigration legal status.[7,8] For all of these reasons, immigrant farmworkers may be at risk for physical and mental fatigue and have fewer resources for recovery from work.

Fatigue

The Effort-Recovery Model implies that high job demands and high strain jobs create workload effects that result in a variety of emotional, cognitive, and behavioral consequences, including fatigue and a need for recovery.[9] Fatigue refers to feelings of extreme tiredness, reduced functional capacity, and increased effort needed to perform tasks at a desired level.[10–12] It is both a process and a state of excessive psychophysiological exertion associated with continued intensity and duration of activity resulting from internal and external demands. It affects a person's ability to engage in current and future efforts and is subjectively evaluated by the individual experiencing the phenomena.[13]

Fatigue affects millions of workers in the United States.[14] It is costly to employers and is associated with both absenteeism (missing work) and presenteeism (being less productive while at work).[14,15] Fatigue is also associated with an increased risk of error and is a known risk factor for occupational injury, especially those related to vehicles and large machinery.[11,16–18] Moreover, fatigue has been associated with chronic health conditions, pain, and poor self-rated health.[19–21] In a recent study of people with chronic conditions including depression and anxiety, both common among farmworkers, fatigue was a significant predictor of work and activity impairment.[19] Although fatigue and depression share some common symptoms, depression has specific cognitive and emotional symptoms above and beyond those of fatigue;[22] however, fatigue may be a precursor to depression.[23]

Fatigue has been associated with a number of job-related factors including physically or mentally demanding work, shift work, high-risk hours (e.g., early mornings or late nights), working long shifts or more than 50 hours per week, lack of rest breaks or time off between shifts, lack of adequate sleep, and long commutes.[24–26] Farmworkers are at risk for fatigue due to physically and mentally demanding work, long hours, unpredictable schedules, lack of recovery time between shifts, and extreme weather conditions. Recently, Ramos et al.[27] found that hours of sleep, job demands, poor self-rated health, and reporting pain were significant predictors of fatigue among migrant farmworkers. However, livestock production is quite different from crop work. Livestock workers have the added risk and stress of working with or near large animals and have less leeway in operations as animals must be cared for daily. Livestock production does not have the same type of seasonality. The work is year-round, and workers tend to be mainly settled in communities such that they are not migrating regularly for work. No studies to the authors' knowledge have explored physical and mental fatigue among livestock workers in the United States.

Need for recovery

Fatigue and need for recovery are related but distinct concepts. Need for recovery is a short-term emotional state considered to be an early-stage work-domain specific indicator of excessive effort. Fatigue differs from need for recovery in that fatigue may have a number of antecedents including some from outside of the work environment, may be short- or long-term, and by nature is psychophysiological.[28,29] The need for recovery is characterized by "temporary feelings of overload,

irritability, social withdrawal, lack of energy for new effort, and reduced performance".[30, p. i3] Because the need for recovery accumulates if a worker is unable to recuperate, then "the worker starts the next working day with a residual level of need for recovery",[31, p. 3] which over time may result in either physical or mental fatigue. It is possible, however, to have a need for recovery without being fatigued (Figure 1).

The more time spent working and on related activities, the higher the need for recovery, [28] which is conceptualized as an intermediary between job strain and poor health.[32,33] Workers with a high need for recovery are much more likely to be at risk for fatigue, sleep problems, [24] cardiovascular problems, [34] and depression.[35]

Workers need adequate time to relax and to physically and mentally disengage from work.[30,36,37] Unfortunately, farmworkers may have few opportunities to recover. Some may live on farm property and never truly be "off the clock". Immigrant workers may be separated from their families and not have the social support needed to cope with their situation. A residual need for recovery may be prevalent among farmworkers, but no studies to the authors' knowledge have explored this concept.

Purpose of present study

Although prior studies have explored the effects of fatigue among farmworkers (e.g., occupational injuries and musculoskeletal complaints),[38,39] none have explored need for recovery and correlates of physical and mental fatigue. Therefore, this study sought to explore job and worker characteristics associated with physical and mental fatigue and the potential mediating effect of need for recovery among Latino/a immigrant cattle feedyard workers. We hypothesized that physical fatigue would have distinct correlates from mental fatigue and that the need for recovery would be a significant mediator on the relations between job and worker characteristics and physical and mental fatigue.

Methods

Participants

Data are from the research project, "Health and Safety among Immigrant Cattle Feedyard Workers in the Central States Region." In total, 243 interviews were conducted with Latino/a immigrant cattle feedyard workers in Kansas and Nebraska. However, given that participants were missing at least one value on variables of interest, 228

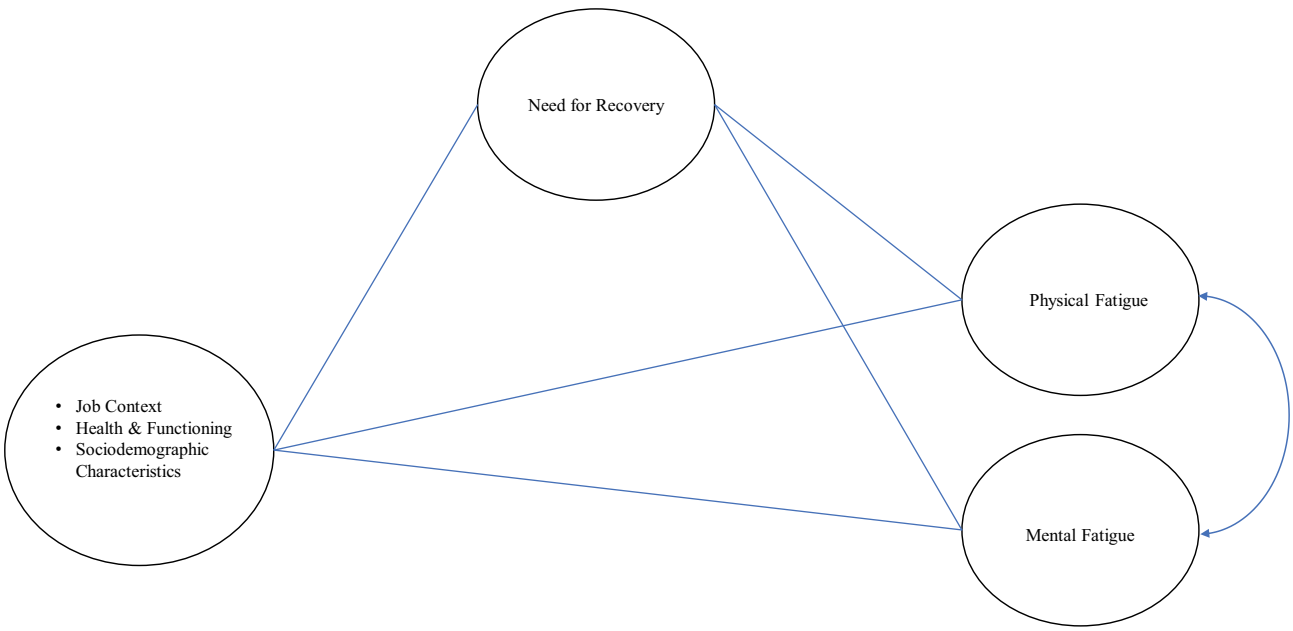

Figure 1. Conceptual Model of Physical Fatigue, Mental Fatigue, and Need for Recovery.

participants provided data for the main analyses. To be eligible to participate in this study, individuals had to identify as a Hispanic/Latino immigrant, be currently employed on a cattle feedyard in either Kansas or Nebraska, and be the age of majority in the state where data were collected (i.e., Kansas ≥ 18 or Nebraska ≥ 19).

Procedures

Individuals were informed of the study by word of mouth through social networks, flyers in community locations, employers, and Facebook advertising; however, most participants were recruited via word of mouth. Only 20 participants were recruited directly through employers and three through Facebook advertising. If individuals met the inclusion criteria and wanted to participate, a face-to-face interview with a member of the research team was scheduled. Most interviews were conducted in participants' homes or at community locations (e.g., library, church, restaurant) after working hours with the exception of the 20 participants who were directly recruited through their employer. Those interviews were conducted at the feedyard where those participants were employed during working hours. Research team members answered participants' questions and informed them of their rights as research participants. Informed consent was obtained prior to beginning the research interview. Individuals could choose to be interviewed in the language of their choice – either English or Spanish. All chose to be interviewed in Spanish except one. Interviews lasted approximately 60–75 minutes, and participants were given either a 25 USD or 30 USD gift card for completing the interview. Participant compensation was increased during the study period to improve recruitment. The study was approved by the Institutional Review Board at the University of Nebraska Medical Center.

Measures

Fatigue

Nine of the 11 items from the Iowa Fatigue Scale were used to assess fatigue.[40] The other two items were not used because they had been difficult to administer in a previous study that the authors had conducted with the Latino/a farmworker population. The nine items were divided into two subscales. Five items were used to assess physical fatigue including, "I felt energetic", "I felt worn out", "I felt drowsy", "Physically, I felt in good shape", and "I felt rested". Four items were used to assess mental fatigue including, "I felt slowed in my thinking", "I had trouble concentrating", "I had trouble with my memory", and "I could concentrate well". For each statement, participants were asked to indicate how they felt during the past month, and response options included "not at all" (1), "a little" (2), "moderately" (3), "quite a bit" (4), or "extremely" (5). Four items, "I felt energetic", "Physically, I felt in good shape", "I felt rested", and "I could concentrate well" were scored by subtracting the participant's response from six. A total score for each of the subscales was calculated by summing the items and averaging the scores. Higher scores indicated higher levels of fatigue. Both subscales had adequate reliability in this sample with Cronbach's α = .66 for physical fatigue and Cronbach's α = .63 for mental fatigue.

Need for recovery

Four items from the Need for Recovery Scale were used.[30] Items included: "By the end of the working day, I feel really worn out", "I find it difficult to relax at the end of a working day", "Often, after a day's work I feel so tired that I cannot get involved in other activities", and "When I get home from work, I need to be left in peace for a while." For each statement, participants were asked to indicate how they felt during the past month, and response options included "not at all" (1), "a little" (2), "moderately" (3), "quite a bit" (4), or "extremely" (5). A total score for the scale was calculated by summing the items and using the average. This scale had good reliability in this sample, Cronbach's α = .83.

Job characteristics

Job demands were assessed using two questions regarding whether the worker was required to "work very hard" and if they had to do an

"excessive amount of work" in their current job on the feedyard. Participants could choose to respond never (0), sometimes (1), often (2), or always (3). There was a significant correlation between these items, $r = .54$, $p < .001$. Decision latitude was measured using two questions assessing whether the worker "had a lot of say about what happened on the job" and "had the freedom to decide how to do the work." Participants could choose to respond never (0), sometimes (1), often (2), or always (3) .[41] There was a significant correlation between these items, $r = .51$, $p < .001$. Participants were also asked to provide the average number of hours worked per day. Finally, a binary variable was created to represent animal handling responsibilities. Participants who reported being a cowboy/pen rider, engaging in cattle processing, or working the hospital pen were coded as having an animal handling job (1), and those who reported working in the mill, delivering feed, or conducting administrative tasks, yard maintenance, or security were classified as having a non-animal handling-related job (0).

Basic health and functioning covariates

Pain was assessed with the question, "Do you have any physical pain in your body?" Experiencing a job-related injury on a feedyard was assessed by the question, "Have you ever been injured at work on a cattle feedlot?" Response options for both questions were either yes (1) or no (0). Self-rated health was assessed with the standard question, "Would you say that in general your health is … poor (0), fair (1), good (2), very good (3), or excellent (4)?[42]" Participants were also asked to provide their average number of hours of sleep per 24-hour period.

Sociodemographic covariates

Sociodemographic covariates included the years working on a cattle feedyard, age, sex, weekly pay, and education. Level of education was categorized into never attended school (0), completed 8th grade or less (1), completed 9th-11th grade (2), completed high school education/GED (3), completed 1–3 years of college or technical school (4), or completed 4 years or more of college or graduate school (5).

Data analysis plan

Using Mplus 8.0, a path model including direct and indirect relations among the main study variables was examined.[43] Physical and mental fatigue were regressed onto need for recovery. Both fatigue variables and need for recovery were regressed onto the job characteristics (average hours worked per day, job demands, decision latitude, and animal handling), basic health and functioning covariates (self-rated health, ever been injured, physical pain, and hours of sleep), and sociodemographic covariates (sex, age, time working on feedyards, weekly income, and education).

Full information maximum likelihood estimator was implemented to estimate any missing data. The bootstrap procedure ($N = 5{,}000$) was implemented to determine whether the estimates for the indirect effects in the model were statistically significant. An indirect effect was significant if the 95% confidence interval for the standard error estimate fell outside of zero for that particular indirect effect.[44] Since we tested a fully saturated model (i.e., a model that provides exact fit of the data), model fit indices are not reported.

Results

Univariate and bivariate results

The majority of participants were males (90.9%) and the average age was 37.7 years old ($SD = 10.1$). A majority of participants reported their country of origin as Mexico (69.5%) followed by Guatemala (17.3%). Most participants reported completing less than a high school education (60.2%). On average, participants had been working in cattle feedyards for six years and reported being paid an average of 677.02 USD ($SD = 161.77$ USD) per week. Demographic characteristics of study participants are reported in Table 1.

Participants were involved in all aspects of feedyard work. Although some participants worked only in one specific department, others engaged in multiple departments. More than half of participants reported processing cattle and being cowboys/pen riders (Figure 2). Women were represented across all work departments, but most frequently were engaged in processing

Table 1. Demographic Characteristics of Study Participants.

	Total (n = 243)		Males (n = 221)		Female (n = 22)	
	N (%)	M (SD)	N (%)	M (SD)	N (%)	M (SD)
Age (years)		37.7 (10.1)		37.7 (10.2)		37.9 (9.4)
19–24 years old	12 (4.9)		10 (4.5)		2 (9.1)	
25–40 years old	148 (60.9)		134 (60.6)		14 (63.6)	
Over 40 years old	83 (34.2)		77 (34.9)		6 (27.3)	
Country of Origin						
Mexico	169 (69.5)		154 (69.7)		15 (68.2)	
Guatemala	42 (17.3)		40 (18.1)		2 (9.1)	
El Salvador	15 (6.2)		13 (5.9)		2 (9.1)	
Other	17 (7.0)		14 (6.3)		3 (13.6)	
Relationship Status						
Married/Coupled Relationship	186 (76.5)		169 (76.5)		17 (77.3)	
Single	57 (23.5)		52 (23.5)		5 (22.7)	
# People in Household		3.5 (1.4)		3.5 (1.4)		3.6 (1.6)
# Children Under 18 in Household (n = 240)		1.0 (1.1)		0.9 (1.0)		1.2 (1.2)
Education (n = 241)						
Completed Less than High School	145 (60.2)		133 (60.7)		12 (54.5)	
High School Graduate	37 (15.3)		34 (15.5)		3 (13.6)	
Completed Some College or Technical Training	59 (24.5)		52 (23.8)		7 (31.9)	
English Proficiency						
Limited English Proficient	166 (68.3)		154 (69.7)		12 (54.5)	
English Proficient	77 (31.7)		67 (30.3)		10 (45.5)	
Time Working on Feedyards (years; n = 240)		6.1 (6.2)		6.2 (6.1)		5.2 (6.8)
Years at Current Job (n = 239)		3.3 (4.4)		3.1 (4.1)		4.6 (6.8)
Weekly Pay (n = 241)		$677.02 ($161.77)		$692.37 ($147.98)		$524.27 ($211.83)

(63.6%), feed delivery (57.1%) or in the hospital pen (52.4%).

Univariate statistics for the main study variables including fatigue and need for recovery are reported in Table 2.

Bivariate correlations among the main study variables and sociodemographic characteristics are reported in Table 3. Physical fatigue, mental fatigue, and need for recovery were significantly negatively correlated with self-rated health, average hours of sleep, and decision latitude, and significantly positively correlated with pain, average hours worked per day, and job demands. Need for recovery was significantly positively related to weekly income and ever injured. Physical fatigue was significantly negatively correlated with animal handling.

Path model results

Mplus 8.0 was used to examine a path model including direct and indirect relations among job characteristics; health, functioning, and sociodemographic covariates; need for recovery; and physical and mental fatigue. The overall model (Figure 3) fits the data perfectly as we examined the saturated model. The R^2 values for need for recovery (.40), physical fatigue (.57), and mental fatigue (.35) were statistically significant (p's < .001). Need for recovery was significantly positively related to both physical and mental fatigue. Lower self-reported health, experiencing physical pain, not handling animals, and decreased decision latitude were directly related to increased physical fatigue. Fewer number of years working in cattle feedyards, lower education, experiencing physical pain, and increased job demands were directly related to heightened mental fatigue. Being female, experiencing physical pain, an elevated average of hours worked per day, increased job demands, and less decision latitude were directly related to an increased need for recovery. These significant direct predictors of need for recovery were indirectly related to physical and mental fatigue via need for recovery. The 95% confidence interval for all tested indirect effects fell outside of zero (Table 4). Thus, the relations among sex, physical pain, average hours worked per day, job demands, and decision latitude and physical and mental fatigue were mediated by need for recovery.

Discussion

The findings demonstrate that physical and mental fatigue are distinct constructs. Worker's health,

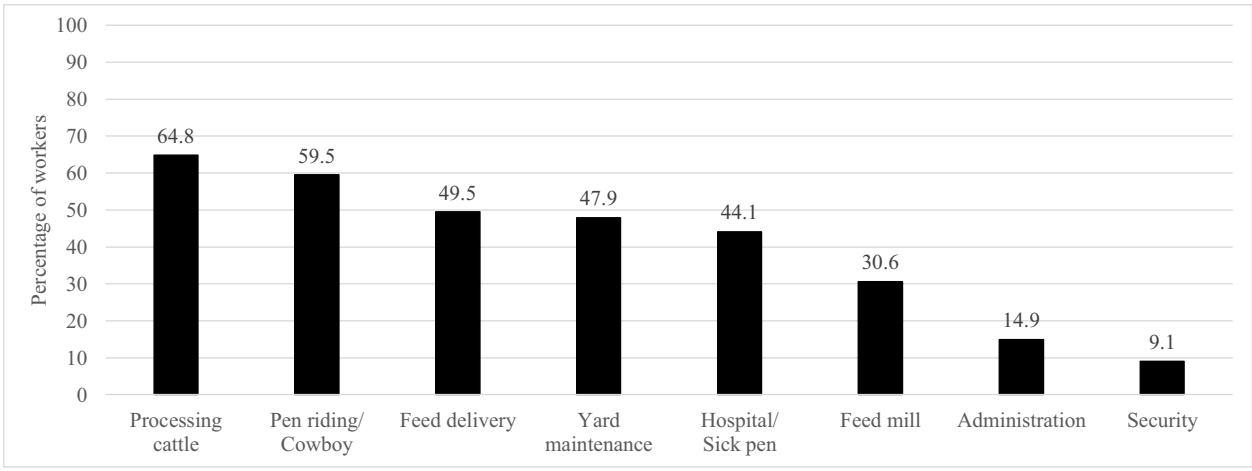

Figure 2. Reported Work Activities of Study Participants (N = 243).

Table 2. Univariate Statistics for Fatigue, Need for Recovery, Basic Health and Functioning Covariates, and Job Characteristic Predictors.

	N (%)	M (SD)
Physical Fatigue		2.34 (3.33)
Mental Fatigue		1.59 (.54)
Need for Recovery		1.69 (.47)
Job Demands		1.03 (.73)
Decision Latitude		1.78 (.87)
Hours Worked per Day		9.99 (1.49)
Hours of Sleep		7.18 (1.05)
Have Physical Pain	93 (40.8)	
Been Injured at Work on a Feedyard	163 (71.5)	
Handle Animals at Work	185 (81.1)	

pain, type of work, and decision latitude were significantly associated with physical fatigue. Mental fatigue was significantly associated with feedyard tenure, education, pain, and job demands. Need for recovery was related to more pain, working longer hours per day, increased job demands, and less decision latitude, all of which were indirectly associated with both physical and mental fatigue. These direct and indirect relations were robust even after controlling for several demographic factors and were in general accord with the Effort-Recovery Model and prior research.[14,24,27]

The pattern of direct relations between job and worker characteristics and physical and mental fatigue suggests that certain characteristics serve as protective factors (e.g., education, good health, feedyard tenure, animal handling, decision latitude) and others as risk factors (e.g., pain, job demands, hours worked per day), consistent with risk and resilience and ecocultural stress theories.[45] Examination of indirect effect tests showed a similar pattern of relations in predicting fatigue. Specifically, need for recovery accounted for the relations between both physical and mental fatigue and pain, decision latitude, hours worked per day, and job demands. These findings extend prior models of worker safety and adjustment by identifying need for recovery as a mediating mechanism that can reduce both physical and mental fatigue, thereby having important implications for effective intervention efforts.

Cattle feedyard workers in our study engaged in a wide variety of tasks, but the majority were engaged in animal handling work such as processing and pen riding. These jobs require physical movement, strength, agility, outdoor work in all weather conditions, and stockmanship skills including knowledge of cattle behavior and handling abilities. Workers in the feedmill or administration do not have the same type of demands. Therefore, addressing the job context including demands and the ability to decide how to do work-related tasks could both directly and indirectly via the need for recovery reduce both physical and mental fatigue. Such efforts could be cost-effective, enhance productivity, and promote worker retention.[37]

Women reported a greater need for recovery and consistent with previous studies also more physical and mental fatigue.[9,15,27] These findings

Table 3. Bivariate Correlations for the Main Study Variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Sex[a] (1)	–															
Age (2)	.03	–														
Time on Feedyards (3)	−.06	.49**	–													
Weekly Income (4)	−.29**	.06	.15*	–												
Education (5)	.02	−.32**	−.13*	.17**	–											
Self-rated health (6)	−.10	−.31**	−.15*	.04	.17**	–										
Ever Injured[b] (7)	−.30**	.13*	.23**	.18**	−.05	−.15*	–									
Physical Pain[c] (8)	−.02	.26**	.15*	.13*	−.03	−.28**	.21**	–								
Hours of Sleep (9)	.07	.04	.03	−.13*	−.15*	.10	−.01	−.10	–							
Animal Handling[d] (10)	−.02	−.11+	−.09	.11	.03	.20**	−.06	−.08	.06	–						
Hours Worked per Day (11)	−.27**	.05	.09	.46**	.13*	−.14*	.25**	.11+	−.30**	−.16*	–					
Job Demands (12)	−.01	−.09	.08	.02	.12+	−.02	−.05	.09	−.30**	.01	.15*	–				
Decision Latitude (13)	.16*	.00	.07	−.02	−.05	.04	−.26**	−.17**	.20**	.10	−.18**	−.08	–			
Need for Recovery (14)	.02	.01	.07	.19**	.09	−.21**	.17**	.35**	−.30**	−.07	.36**	.41**	−.27**	–		
Physical Fatigue (15)	.08	.05	.01	.11	.02	−.38**	.10	.37**	−.22**	−.20**	.30**	.24**	−.28**	.68**	–	
Mental Fatigue (16)	.03	−.02	−.05	.07	−.05	−.23**	.13+	.34**	−.18**	−.11+	.20**	.30**	−.20**	.50**	.44**	–

+$p \leq .10$, * $p < .05$, ** $p < .01$
[a]Sex coded as 0 = Men, 1 = Women
[b]Ever Injured (at Work on a Feedyard) coded as 0 = No, 1 = Yes
[c]Physical Pain coded as 0 = None, 1 = Any
[d]Animal Handling coded as 0 = Never, 1 = Any

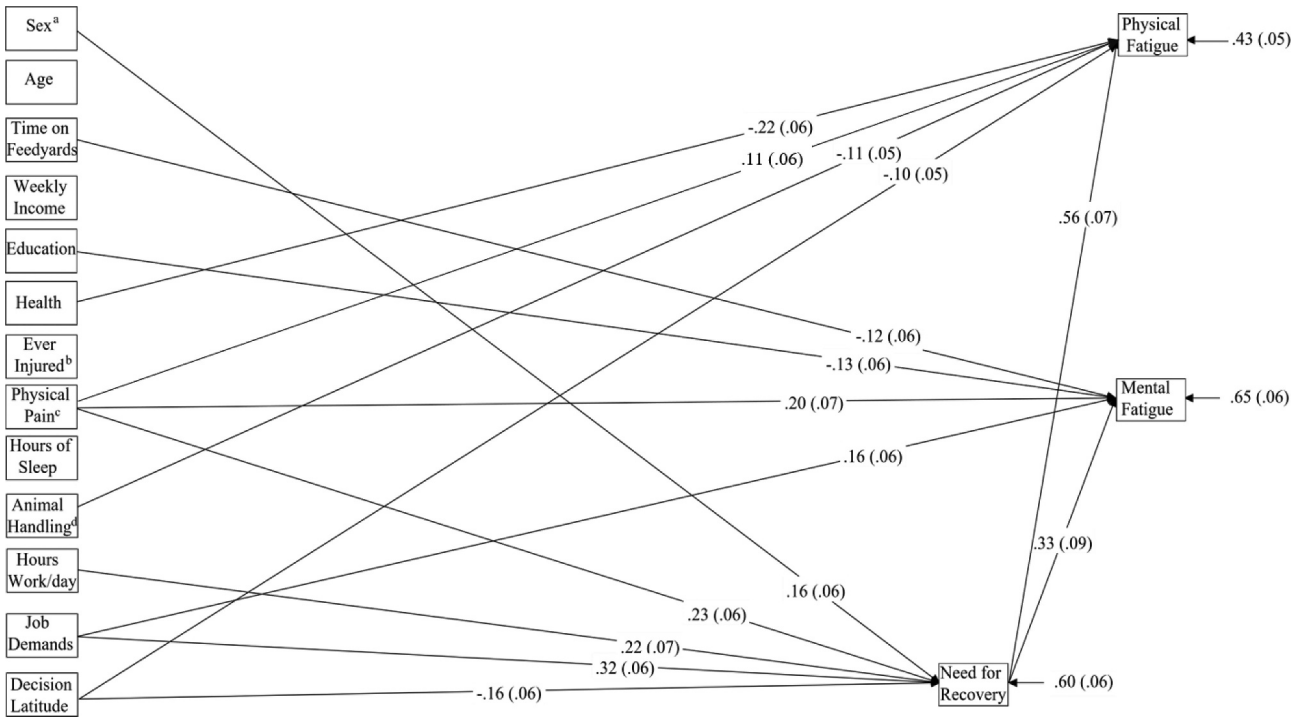

Figure 3. Direct and Indirect Relations Among All Predictors, Need for Recovery, and Physical and Mental Fatigue.

Note: Standardized coefficients (standard errors) are presented. Nonsignificant paths (i.e., $p > .05$) and covariances were omitted from the figure. Most indirect effects depicted in the model (via Need for Recovery) were statistically significant. Results of the tests for the indirect effects can be found in Table 4. [a]Sex coded as 0 = Men, 1 = Women. [b]Ever Injured (at Work on a Feedyard) coded as 0 = No, 1 = Yes. [c]Physical Pain coded as 0 = None, 1 = Any. [d]Animal Handling coded as 0 = Never, 1 = Any.

Table 4. Summary of the Significant Standardized Indirect Effects via Need for Recovery (NFR) [95% Confidence Intervals].

	Physical Fatigue	Mental Fatigue
Sex NFR Fatigue	.09 [.02,.16]**	.05 [.01,.11]*
Physical Pain NFR Fatigue	.13 [.06,.20]**	.08 [.02,.15]*
Hours of Work per Day NFR Fatigue	.12 [.04,.21]**	.07 [.02,.14]*
Job Demands NFR Fatigue	−.09 [−.16, −.02]*	−.05 [−.12, −.01]$^{+}$
Decision Latitude NFR Fatigue	.18 [.10,.26]**	.10 [.04,.17]**

$^{+}p \leq .10$, * $p < .05$, ** $p < .01$

are in accord with gender role theories and related research[46] that suggest women have additional demands and responsibilities outside of the work environment. For example, female workers might have to care for children or other household members, which could increase stress, contribute to a greater need for recovery, and result in more fatigue. These findings suggest the need for flexible workplace policies. More research with larger samples of female workers and with greater attention to gender-related expectations and stressors is needed to better examine these issues.

Our findings also suggest possible intervention opportunities for reducing fatigue.[47] Workers and supervisors should be trained to recognize common signs and symptoms of physical and mental fatigue and the need for recovery. Unfortunately, few feedyards have dedicated safety personnel to develop such a topic and add it to their repertoire of safety training.[48] Therefore, it would be valuable for agricultural health and safety professionals to create industry-specific, culturally and linguistically appropriate educational materials and short-trainings (e.g., tailgate trainings) that could be easily implemented at the workplace[49] and incorporate evidence-based practices like communicating the need for help, promoting healthy habits, and managing pain and stress. This is especially important for newer feedyard workers and those with less formal education.

Operational strategies like reducing perceived demands and hours a worker is expected to work may reduce the need for recovery and mental fatigue. Feedyard employers should consider hiring enough employees to adequately staff their operation and compensate employees appropriately so that working beyond one's physical and mental limit is not the norm or a financial necessity. To reduce physical fatigue, workers should have more control over how they complete the required tasks. Anecdotally, some workers mentioned that they were able to have a conversation with their supervisor or other team members about delaying a task or asking for assistance if they felt they would not be able to complete it safely without any negative consequences. Ensuring that agricultural employers provide adequate rest breaks and sheltered break facilities may contribute to better internal recovery, and restructuring tasks and the typical work schedule may improve opportunities for external recovery. Having workers arrive at work fully recovered may have benefits such as fewer errors and injuries and less fatigue, which in the long term may result in lower workers' compensation rates.[50,51]

Although the present study is unique in studying the distinct correlates of physical and mental fatigue and the need for recovery among Latino/a immigrant cattle feedyard workers, the study had several limitations. First, the study was cross-sectional; therefore, we cannot confidently determine cause-and-effect nor the direction of causal relations. Indeed, bidirectional effects are likely. Longitudinal and intervention studies would enable future researchers to better infer causality. Second, the study relies on self-reported data, which is subject to inherent bias. Research using multiple methods (e.g., self-reports, observations, physiological indices) may reduce such biases and more comprehensively assess the constructs of interest. Data were collected from a select subgroup of Latino/a immigrant workers in one region of the United States. Future research would benefit from sampling U.S.-born Latino/a workers, non-Latino/a workers, and workers from other regions of the U.S. who might have different experiences. Latino/a farmworkers face many stressors beyond those that were examined in the present study. Although no one study can account for all the possible sources of fatigue, future research would benefit from studying the effect of immigrant status on the assignment of work tasks and the sociopolitical climate on community norms and practices that may take a toll on a worker's psychological well-being and ability to cope with demands and stress. Policy development

and enforcement efforts such as compensating workers at least minimum wage for all hours worked, paying overtime, ensuring access to workers' compensation, and overhauling the immigration system could greatly improve workers' conditions both on and off the job.

Conclusion

Physical, psychosocial, and structural factors that affect fatigue, the need for recovery, and well-being among farmworkers must be addressed. This was the first study to explore relations between physical and mental fatigue and the need for recovery among Latino/a livestock workers in the United States. We found that pain, self-rated health, animal handling, and decision latitude were directly associated with physical fatigue, and feedyard tenure, education, pain, and job demands were directly associated with mental fatigue. Indirect effects supported the notion that the effects of job and worker characteristics on fatigue were accounted for by the need for recovery. These findings provide supportive evidence for models related to stress and adjustment among farmworkers and have important implications for intervention efforts. Changes to the work environment and policy efforts aimed at protecting workers could help to reduce fatigue and need for recovery, improve productivity, and prevent subsequent health problems and work injuries. Finding ways to balance productivity and the well-being of workers should be a high priority for cattle feedyards across the country.

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