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Determination of risk factors in cattle and small ruminant livestock enterprises from the perspective of animal life insurance: a case study in Turkey

[*Determinação dos fatores de risco em empresas de gado e pequenos ruminantes a partir da perspectiva do seguro de vida animal: um estudo de caso na Turquia*]

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ABSTRACT

The objective of this study was to determine the risk factors in the production processes of cattle and small ruminant breeding enterprises, along with developing a scale that could be used during the insured breeding process in different regions of Turkey. In this study, we obtained information from 252 enterprises from different provinces (Afyonkarahisar, Aksaray, Ankara, Burdur, Karaman, and Konya) of Turkey. Reliability and validity analyses were conducted using the "Risk Assessment Form in Cattle and Small Ruminant Animal Production". The Cronbach alpha (α) coefficient was used to analyze reliability, while the exploratory factor analysis was applied to analyze the validity. About 68.7% (173) of the enterprises included cattle breeding, while the remaining 31.3% (79) involved small ruminant breeding. To determine the risk factors, twenty-four questions were directed toward the livestock enterprises, and the following six factors were determined: Economic-Political Risks, Yield/Product Losses, Enterprise Technical Risks, Credit/Financing, Workforce, Enterprise Follow-up, and Registration. In the politico-economic risk scoring, the score of enterprises already having Animal life insurance (ALI) was observed to be higher than those who did not have it, with the difference being statistically significant ($p<0.05$). We interpreted that producers with higher politico-economic risk factor scores preferred insurance. Although the producers could determine the risk factors well, not all producers were necessarily aware of risk measures. Thus, it was necessary to improve the farmers' perception of risks and support their efforts to manage and reduce these risks. Also, the importance of insurance practices within and out of the farm is predicted to increase gradually to develop more conscious, sustainable, and profitable breeding in agriculture and animal product markets, which are becoming more liberalized day by day.

Keywords: risk perception, risk management, livestock insurance, factor analysis

RESUMO

O objetivo deste estudo foi determinar os fatores de risco nos processos de produção de bovinos e pequenos ruminantes, juntamente com o desenvolvimento de uma escala que pudesse ser utilizada durante o processo de criação segurada em diferentes regiões da Turquia. Neste estudo, obtivemos informações de 252 empresas de diferentes províncias (Afyonkarahisar, Aksaray, Ankara, Burdur, Karaman e Konya) da Turquia. As análises de confiabilidade e validade foram realizadas utilizando o "Formulário de Avaliação de Risco na Produção Bovina e de Pequenos Animais Ruminantes". O coeficiente Cronbach alfa (α) foi usado para analisar a confiabilidade, enquanto a análise exploratória de fatores foi aplicada para analisar a validade. Cerca de 68,7% (173) das empresas incluíram a criação de gado, enquanto os restantes 31,3% (79) envolveram a criação de pequenos ruminantes. Para determinar os fatores de risco, vinte e quatro perguntas foram dirigidas aos empreendimentos pecuários, e os seis fatores seguintes foram determinados: Riscos Econômico-Políticos, Rendimento Perda de Produto, Riscos Técnicos da Empresa, Crédito/Financiamento, Força de Trabalho, Acompanhamento da Empresa e Registro. Na pontuação do risco político-econômico, a pontuação das empresas que já tinham seguro de vida animal (ALI) foi

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observada como sendo maior do que aquelas que não tinham, sendo a diferença estatisticamente significativa (p<0,05). Interpretamos que os produtores com pontuação mais alta no fator de risco político-econômico preferiam o seguro. Embora os produtores pudessem determinar bem os fatores de risco, nem todos os produtores estavam necessariamente cientes das medidas de risco. Assim, era necessário melhorar a percepção dos agricultores sobre os riscos e apoiar seus esforços para administrar e reduzir esses riscos. Além disso, a importância das práticas de seguro dentro e fora da fazenda deve aumentar gradualmente para desenvolver uma criação mais consciente, sustentável e lucrativa na agricultura e nos mercados de produtos animais, que estão se tornando mais liberalizados a cada dia.

Palavras-chave: percepção de risco, gerenciamento de risco, seguro pecuário, análise de fatores

INTRODUCTION

Livestock enterprises encounter various risk factors during their entire process, i.e., from the beginning of production to the marketing of the final product, and put in efforts to manage them. Economic risk factors in livestock enterprises include a decrease in their livestock capital due to animal diseases, yield losses, and animal death. Depending on these factors, loss of income and income irregularity can also be added to the economic risk factors. (Akcaoz *et al*., 2006; Schaper *et al*., 2010; Komarek *et al*., 2020). To achieve sustainability of livestock activities and animal production, insurance becomes an important risk transfer tool in compensating economic losses arising due to such risks (Akcaoz *et al*., 2006; Mat *et al*., 2020). An important way to reduce economic losses is the ability of farm owners to perceive and manage different types of risks (Zhou *et al*., 2012). A significant role in effectively implementing necessary measures involves a healthy determination of risks in the production process (Çevrimli and Sakarya, 2019). As a result of the clear determination of risk factors, the insurance company can insure these risks. Therefore, studying risk factors is important for both producers and policymakers (Figure 1).

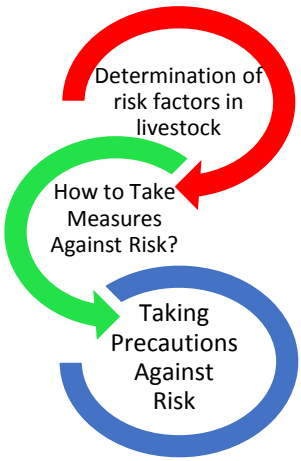

Figure 1. Risk Management Process

Figure 1 examines the implementation of necessary measures against the risk, which consists of a three-step process. The first step of the process is an accurate perception or determination of the risk factors. The second step involves the farmers or producers proposing the precautionary methods to the occurred or perceived risk. The last step includes the risk to be eliminated or its impact to be minimized with the right measures to complete the risk management process.

Animal life insurance (ALI) is created to control the risks that may occur within and/or outside the animal production enterprise. However, significant problems arise in overcoming the low insurance coverage rates in ALI, such as producers' inability to objectively evaluate the risks and apply adequate measures against them and their failure to assess the effective tools available (Mat *et al*., 2020). Additionally, an increase in demand for animal-based food due to an increase in the global population makes it more

important to manage the risks than ever (Komarek *et al*., 2020) since effective risk management is important in terms of price stability and supply security. Due to a lack of studies in this aspect, little is known about the risk perception in livestock activities, risk management strategies, or the determinants of such risks and strategies (Gebreegziabher and Tadesse, 2014; Bishu *et al*., 2016). To provide enhanced institutional support for risk management, it is necessary to understand the socioeconomic factors affecting the producers' perceptions of risk along with their possible response to such risks and barriers for implementing management strategies (Sulewski and Kloczko-Gajewska, 2014; Lewerin *et al*., 2015; Duong *et al*., 2019).

The factor analysis method was used to determine the overall risk factors in such studies for animal production worldwide. (Schaper *et al*., 2010; Nanseki, 2011; Girdziute *et al*., 2014; Duong *et al*., 2019). To determine the risk factors in terms of comparability, it was necessary to measure them using a cross-sectional and sustainable measuring parameter depending on the time (Emhan, 2010).

Agricultural Insurance Pool of Turkey (TARSIM) is the only authorized institution in Turkey for animal life insurances. TARSİM was established in 2005 and is responsible for carrying out all the transactions of transferring risks in agriculture and livestock farming of all enterprises in Turkey (Yazgı, 2017). In 2019, the number of insured cattle in Turkey was 1 630 478, while the number of small ruminants reached 3 516 477 (Turkish…, 2019). In Turkey, the insurance rate for cattle is 9.12% and 7.25% for small ruminants. TARSIM aims to increase animal life insurance rates in Turkey. To increase the level of participation of producers in animal life insurance, it is important to clearly know their risk perceptions and attitude toward risk. The motivation of this study was to collect data related to the field and improve ALI products, insurance coverage expansion, and obtain scientific facts in line with our findings. Thus, we aimed to determine the risk factors in the production processes of cattle in small ruminant farms operating in Turkey. Also, we aimed to develop and use a scale during the insured breeding process that could be used in different regions of Turkey. Also, the risk was measured using a cross-sectional and sustainable measuring parameter based on the time. The measurement tool and risk factors were determined from different regions of Turkey, thus, enabling to offer an increase in the insurance rates by providing ALI products to the livestock enterprises in line with their needs.

This study was carried out within the project's scope and was funded by the TARSIM since there is a lack of studies for risk measurement in Turkey, especially for animal life insurances.

MATERIALS AND METHODS

The provinces from in the Mediterranean, Aegean, and Central Anatolian regions of Turkey, Afyonkarahisar, Aksaray, Ankara, Burdur, Karaman, and Konya, were included in this research. These provinces were preferred since intense livestock farming activities were carried out here, and these provinces mostly comprised of small and medium-scale enterprises. The interviews with livestock enterprises were carried out between June and October 2018. The minimum number of enterprises required to be interviewed from the relevant provinces and their distribution by provinces were calculated according to the Neyman stratified sampling method (Fugard and Potts, 2015).

The sample calculation and formula derived from the information in the chart are presented below.

$$n_0 = \frac{Nt^2 pq}{d^2(N-1) + t^2 pq} = \frac{163933(1{,}96)^2\, 0{,}85 * 0{,}15}{0.05^2(163933-1) + (1{,}96)^2 * 0{,}85 * 0{,}15} \cong 196$$

t-table value = 1.96, with 95% probability
P = 0.85 q = 0.15, the rate of acceptance of surveys by enterprises
N = number of individuals in the population
p = the frequency of occurrence of the case
q = the frequency of non-occurrence of the event
t = the theoretical value found in the t-table at the given degree of freedom and detected level of error.
d = desired deviation according to the frequency of occurrence of the case $\pm$
Strata weight $=\frac{196}{163933}=$ 0.0012 (whole sample)

The strata weight formula shows how accurately the sample is distributed in the strata.

According to Table 1, a total of 196 livestock breeding establishments were determined, including 140 cattle and 56 small ruminants. The distribution of the minimum number of enterprises to be visited by provinces is as follows: Afyonkarahisar 47, Aksaray 27, Ankara 21, Burdur 26 small ruminant, Karaman 13, Konya 67 enterprises.

Table 1. The total number of enterprises according to the livestock activity types and their distribution

Livestock Activity Type	Number of Enterprises	Strata Weight (Wh)	Number of Enterprises per Strata (nh)
Cattle	116,875	0.713	**140**
Small Ruminant	47,058	0.287	**56**
Total	163,933	1	**196**

A scale was developed to determine the risk factors specific to the ALI of the producers, namely the Risk Assessment Form of scale in Cattle and Small Ruminant Animal Production (24 items). It aimed to determine the risk factors for the producers in the animal production processes. To prepare the items for the scale, a question pool was created by the authors and academicians of the field, which was further negotiated with ALI company employees and managers. The questions (form) were finalized using the Delphi technique (Lees and Lievaart 2013).

The data were evaluated via SPSS 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). The values of $p<0.05$ and $p<0.01$ were considered significant. The variables were expressed using mean ±standard deviation, percentage, and frequency values. In this study, reliability and validity analysis were done using the "Risk Assessment Form in Cattle and Small Ruminant Animal Production". Cronbach alpha (α) coefficient was used to analyze reliability. Exploratory factor analysis was applied to analyze the validity. Factor analysis is a multivariate statistic, which is used to obtain a small number of identifiable significant variables from many variables measuring the same structure. There are three methods used to determine the suitability of the dataset for factor analysis. These include the creation of the correlation matrix, the Bartlett Test, and the Kaiser-Meyer-Olkin Test. The Bartlett test decides whether the data matrix is the unit matrix and whether the correlation between the variables is sufficient. It also tests the null hypothesis showing all correlation coefficients to be zero. If P-value < 0.05, the dataset is considered suitable for factor analysis, and it also determines whether the sample is sufficient for analysis. The KMO has a value between 0 and 1; the closer it is to 1, the more suitable it is for factor analysis. Also, the KMO value should be greater than 0.50. The "Risk Assessment Form in Cattle and Small ruminant Animal Production" was a result of the varimax rotation method and was determined as a 6-factor structure. Factor loading and the addition of sub-factors were evaluated by Turkey's additivity test. For discrete and continuous variables, descriptive statistics (mean and standard error of means) were used. Additionally, the homogeneity of the variances, one of the prerequisites of parametric tests, was checked through Levene's test. The assumption of normality was tested via Shapiro-Wilk's test. To compare the differences between three or more groups, a two-way analysis of variance was used in the case of parametric test prerequisites being fulfilled, while the Kruskal Wallis test was used in the case of such prerequisites not being fulfilled. The Bonferroni correction method, a multiple comparison test, was used to evaluate the significance of the results among three and more groups.

RESULTS

In this study, information was obtained from 252 entrepreneurs. About 68.7% (173) of them were cattle-breeding enterprises, while 31.3% (79) were small ruminant-breeding enterprises. The findings of the current insurance, educational status, and professional experiences of the producers are presented in Table 2.

Table 2. ALI insurance, educational status, and professional experience of the producers

Animal life insurance status	n	%
I have never taken any insurance	102	40.5
I had it done before. but I currently do not have insurance	76	30.2
I am currently insured	74	29.3
Educational Status		
Primary School	91	36.1
Secondary School	42	16.7
High School	74	29.3
University	45	17.9
Professional Experience		
Less than 5 years	39	15.5
5–10 years	52	20.6
11–20 years	75	29.8
20 years and above	86	34.1
Total	252	100.0

Table 2 shows that 40.5% of the producers did not have ALI before, while 30.2% had taken ALI before but were having no active ALI policy. However, 74 producers (29.3%) had active ALI policies. The educational status of the producers indicated that 52.8% of them had primary education (primary and secondary). Regarding professional experience, a large percentage (34.1%) was engaged in livestock activities for at least 20 years.

Considering the categorical identifiers group, Table 3 indicates the findings regarding their status of additional business, type of structure of the enterprises, the social security status of the producers, their risk-taking status, and views on ALI.

Table 3. Data regarding producers' additional businesses, enterprise structure, social security, risk-taking, and their views on ALI

Additional Activity-Occupation Status	**n**	**%**
Livestock Only	24	9.5
Agriculture and Livestock	132	52.4
I have another job income in addition to those	96	38.1
The Structure Type of the Enterprise		
Within the Scope of the Project (Young Farmer-Government Project Etc.)	23	9.1
Reinforced concrete	167	66.3
Conventional	58	23.0
There is no structure. Stock yard, etc.	4	1.6
Social Security Status		
Yes	183	72.6
No	69	27.4
Disease-Free Certificate		
Yes	15	6.0
No	237	94.0
Your Risk-Taking Status		
Aversion to risks	84	33.3
Risk is neutral	20	7.9
Liking risks	148	58.7
Do You Think ALI is Necessary?		
Yes	183	72.6
No	69	27.4
Total	252	100

Table 3 shows that 52.4% of the producers conducted both agricultural and livestock activities together while most of the producers (66%) had reinforced concrete structures, with 72.6% of the producers having social security. Only 15 enterprises (6%) showed no animal diseases (disease-free certificate). Regarding the attitude toward risk, 58.7% were risk-liking, 33.3% were risk-averse, and 7.9% were risk-neutral. Although 70.7% of the producers did not have insurance, 72.6% of them considered ALI necessary.

The perception and evaluation of some risk factors are suggested to exist during the production process of cattle and small ruminant breeders. For this purpose, the producers were recommended to evaluate the effective risk factors as very risky, risky, neither risky nor risk-free, risk-free, and no risk at all (a 5-point Likert scale).

Twenty-four questions were asked to the producers to determine the risk factors related to the cattle and small ruminant-breeding activities. Based on the answers, the reliability coefficients of the questions were obtained, which are presented in Table 4.

Table 4. Reliability coefficients obtained based on the risk questions

Risk Questions	Will be average if is deleted from the scale	Will be average if the item is deleted from the scale	Reliability coefficient if the item is deleted from the scale
1 No Record Keeping in the Enterprise	58.99	81.924	0.71
2 Burglary	58.69	78.957	0.70
3 No Contractual Production	58.42	81.903	0.71
4 Alien Labor Insufficiency	58.35	80.014	0.71
5 Loan Facilities	58.40	77.660	0.69
6 Changes in Loan Interest Rates	58.92	75.448	0.68
7 High Alien Labor Wages	58.11	80.075	0.70
8 Insufficiency of structures like a barn, building, etc., of the enterprise	58.05	77.515	0.70
9 Lack of Technical Knowledge on Livestock	58.04	80.879	0.71
10 Increase in the Debt of the Enterprise	59.08	78.937	0.69
11Insufficient Family Workforce	58.06	76.061	0.69
12 Change in the Government's General Policies	59.37	80.976	0.70
13 Insufficiency of Tools and Equipment Belonging to the Enterprise	57.95	76.647	0.69
14 Insufficiency of Product Marketing Opportunities of Enterprises	58.08	76.982	0.69
15 Animal Products Quickly Spoiling in the Marketing Chain	58.17	76.716	0.69
16 Changes in the Government's Livestock Policies	59.63	80.202	0.70
17 Infrastructure Insufficiencies in the Rural	58.25	77.011	0.69
18 Changes in the Country's Economy	59.49	80.131	0.70
19 Rise in Exchange Rates	59.71	79.354	0.69
20 Low Yield Due to Animal Diseases	58.62	75.520	0.68
21 Partial Product Losses Due to Animal Diseases	58.52	75.940	0.68
22 Calf/Lamb/Goat Deaths	58.51	77.104	0.70
23 Changes in Feed Item Prices Due to Drought	59.53	79.637	0.70
24 Changes In Input Costs (Feed-medicine etc.)	59.62	81.719	0.70

None of the items in the form had a reliability coefficient below 0.50. As all 24 items had high-reliability values, no item was removed. Next, the reliability coefficient of the applied form was examined. The different ways to calculate the reliability coefficient differed depending on the type, source, and the number of applications of the variables. The reliability coefficient is desired at

0.70. Since each item of the scale was measured using a 5-point Likert scale, the form was reliable in terms of internal consistency, as seen in Cronbach's α coefficient. The Cronbach's alpha (α) coefficient of the form used in this study was calculated for 24 items and was determined as 0.706. Since the coefficient value was above 0.60, the measurement tool was considered suitable to measure the risk factors (Table 5).

Table 5. Results of factor analysis obtained using the Varimax Method

Factors	Sum of Squares of Factor Loads as a Result of Varimax Rotation		
	Total	Explained Variance %	Cumulative Variance %
Factor 1	2.812	11.718	11.718
Factor 2	2.357	9.823	21.541
Factor 3	2.213	9.219	30.760
Factor 4	2.134	8.892	39.651
Factor 5.	1.684	7.017	46.668
Factor 6	1.294	5.393	52.061

Kaiser-Meyer-Olkin sampling adequacy: 0.645; The chi-square value of Bartlett's test of sphericity is 469.632; Degree of freedom 153 p = 0.001

Table 5 shows the total explained variance and the 6-factors according to the application data for 24 items. Also, it explains 52.06% of the features measured by this 6-factor measurement tool. In social sciences, if at least 50% of the total variance is explained, the measurement tool is said to be sufficient. The fact that the Kaiser-Meyer-Olkin sampling adequacy statistic is above 0.50, the sample size of our data is considered sufficient. Bartlett's test of sphericity analyzes the suitability of chi-square data for factor analysis. Since a higher ratio indicates a more suitable dataset for factor analysis, our data are considered suitable for it ($p < 0.05$).

Table 6 presents the questions of the measurement tool determined as the total of six factors, namely Economic-Political Risks, Yield/Product Losses, Enterprise Technical Risks, Credit/Financing, Workforce, and Enterprises Follow-up and Recording. Also, it determines the distribution of the questions to each of these factors.

Table 7 presents the data on whether a scoring could be achieved by obtaining the total score from the factors after the factor analysis.

In this analysis, the additivity test of ANOVA was applied using Tukey's posthoc test to obtain a total scale score by addition of the scale. The additivity column suggested that the scale was suitable to obtain a total scale score by summing it up as $p < 0.05$.

Insurance status was evaluated in three categories. The differences between the six sub-factor scores and the total score were determined between these three categories. A statistically significant difference was found in enterprises having insurance in the categories with economic and political risk scores.
Table 8.

Table 8 shows that the six risk factors and the related scores vary according to the producers having ALI. In the politico-economic risk scoring, the scoring of the producers who never had ALI was 25.70 while the scoring of those who had taken ALI before but not currently was 24.97, and the scoring of those who were actively insured was 27.14, which was significantly higher than the other two groups ($p < 0.05$). We interpreted producers with high politico-economic risk factor scores to prefer insurance. No statistically significant relationship was found between the mean scores of the other risk factors and the insurance status. In other words, except for the politico-economic risk factors, the scores of the producers' approach to all other risk factors were found to be similar. The total risk scores presented in the table showed that the groups with higher risk scores had all taken up insurance.

Table 6. Factor loading of risks determined in cattle and small ruminant breeding

	Factor Sub-Items/Factor Names	1-Economic-Political Risks (6–30)	2-Yield/Product Losses (3–15)	3-Enterprise Technical Risks (7–35)	4-Credit/Financing (3–15)	5-Workforce (2–10)	6-Enterprise Tracking and Recording (3–15)
1	No Record Keeping in the Enterprise						0.717
2	Burglary						0.523
3	No Contractual Production						0.373
4	Alien Labor Insufficiency					0.798	
5	Loan Facilities				0.742		
6	Changes in Loan Interest Rates				0.811		
7	High Alien Labor Wages					0.763	
8	Insufficiency of structures like a barn, building, etc., of the enterprise			0.608			
9	Lack of Technical Knowledge on Livestock			0.440			
10	Increase in the Debt of the Enterprise				0.605		
11	Insufficient Family Workforce			0.370			
12	Change in the Government's General Policies	0.720					
13	Insufficiency of Tools and Equipment Belonging to the Enterprise			0.700			
14	Insufficiency of Product Marketing Opportunities of Enterprises			0.466			
15	Animal Products Quickly Spoiling in the Marketing Chain			0.486			
16	Changes in the Government's Livestock Policies	0.716					
17	Infrastructure Insufficiencies in the Rural			0.589			
18	Changes in the Country's Economy	0.780					
19	Rise in Exchange Rates	0.699					
20	Low Yield Due to Animal Diseases		0.837				
21	Partial Product Losses Due to Animal Diseases		0.834				
22	Calf/Lamb/Goat Deaths		0.652				
23	Changes in Feed Item Prices Due to Drought	0.530					
24	Changes In Input Costs (Feed-medicine etc.)	0.559					

Table 7. Additivity of the ANOVA (Tukey's posthoc test)

			Sum of Squares	Degree of Freedom	Mean of Squares	F	p
Within the population			112.549	105	1.072		
Out of population			111.317	10	11.132	31.393	0.001
	Leftovers	Additivity	.425a	1	.425	1.198	0.274
		Balance variable	371.894	1049	.355		
		Total	372.319	1050	.355		
	Total		483.636	1060	.456		
Total			596.185	1165	.512		

Table 8. Risk scoring and evaluation based on the status of insurance

Risk Factors and Max-Min Score Ranges	I Have Never Taken Any Insurance	I have done before but I am currently not insured	I am currently insured	p
1-Economic-Political Risks (6–30)	25.7 ±3.26	24.97 ±3.48	27.14 ±2.93	0.001**
2-Yield/Product Losses (3–15)	9.77 ±2.89	10.01 ±2.56	10.01 ±3.05	0.81
3-Enterprise Technical Risks (7–35)	20.16 ±4.93	19.96 ±3.95	19.49 ±4.37	0.61
4-Credit/Financing (3–15)	10.82 ±2.3	10.59 ±2.56	10.59 ±2.71	0.77
5-Workforce (2–10)	5.72 ±2	6.13 ±1.96	6.19 ±2.12	0.23
6-Enterprise Tracking and Recording (3–15)	10.24 ±1.94	10.34 ±2.01	10.59 ±1.75	0.46
Total risk (24–120)	82.4 ±9.83	82.01 ±8.35	84.01 ±9.11	0.36

DISCUSSION

The data of the producers showed that 61.5% of them were primary school graduates, 21.7% were high school graduates, 9.8% were secondary school graduates, and 4.9% were university graduates (Akcaoz *et al*., 2006). Another study conducted on risk factors in agricultural production in Turkey indicated that the percentage of producers who were primary school graduates was 78.6% (Mancı and Eren, 2017). In this study, although the percentage of primary school graduates was lower, the percentage of high school and university graduates was higher compared to other similar studies. Although the educational level of the producers involved in animal production was found to be higher than those engaged in plant production, the percentage of insurance taken by animal producers was lower and similar to that observed among plant-producing enterprises. This may be due to the presence of a proportionally increased number of risk-liking producers in animal production enterprises compared to the ones in plant production.

A study on agricultural insurance in the province of Antalya in Turkey stated that 77.6% of the enterprises did not have insurance due to the insufficiency of income and high rates of premium (Akcaoz *et al*., 2006). In another study on agricultural insurance in Urfa, 81.4% of the enterprises did not have insurance (Mancı and Eren, 2017). In our study, the percentage of enterprises without any insurance was 70.6%, which was like the above studies. In another study, 39.9% of the producers in Antalya were risk-liking, 53.1% were risk-averse, and 7.0% were risk-neutral (Mat *et al*., 2020). Similarly, in a study conducted in European countries, 41.5% of the farmers were willing to take risks, 25.2% were significantly risk-averse, while the remaining farmers responded either indifferently (14.1%) or inconsistently (19.2%). The risk factors included production risk, political risk, and marketing risk (Schaper *et al*., 2010). In this study, the rate of risk-liking producers in enterprises engaged in livestock activities was 58.7%, which was higher than those engaged in agricultural production.

A study was conducted on risk factors in enterprises of Bursa, Turkey, which were having ALI's. Here, a 27-point risk assessment form was applied, and eight enterprise risk factors were identified. The risk factors included loss of production, finance, enterprise size, labor productivity, insurance, birth, animal health, and natural conditions (Özsayın and Çetin, 2004). The most common risks in the livestock were reported as prices and productivity. Based on the factor analysis, an 8-factor structure explained 72.6% of the risk factors (Özsayın and Çetin, 2004). Meanwhile, in our study, six risk factors were determined using a 24-item risk measurement form, which included economic-political risks, yield/product losses, technical risks of the enterprises, credit/financing, workforce, and enterprise tracking and registration. Among these, yield/product loss, credit/financing, and workforce were observed to be remarkably similar to the previous study, whereas the economic-

political risk, technical risks of the enterprise, and enterprise tracking and record were found to be different. This 6-factor structure explained 52.6% of the risk factors. Another remarkable point is that the workforce factor consists of 2 items. The reason for this is that the two items with the highest factor loadings were taken. When subject experts in this field were consulted, it was determined that two items explained the relevant factor. Usually, a 2-item factor structure is not customarily preferred; however, it was considered necessary to score the scale correctly.

An article that compiled several studies around the world reported weather conditions, biosecurity, human-related factors, marketing, finances, institutions, and technology as risk factors to farmers. The measures against risk included prevention of diseases and pests, additional work outside the farm, agriculture/livestock insurance, off-farm investment, debt reduction, low-cost production, co-operatives, diversification of breeding type, use of technology, and educational and training activities (Duong *et al*., 2019).

In Japan, the high-level risks in livestock enterprises were reported to be reduced production due to animal death and reduced product quality due to equipment failure (Nanseki, 2011).

In another study conducted on the risk factors in dairy cattle in China, a 7-factor structure was presented using a 19-item risk questionnaire, and the risks reported were production, institution, animal disease, input market, milk contamination, personal risk, and product market (Zhou *et al*., 2012).

A study conducted in Ethiopia perceived the shortage of family labor, high feed prices, and limited farm income as the most important risks. The use of veterinary services, parasite control, and credit was reported as the most important strategies for managing risks (Bishu *et al*., 2016).

Considering the risk factors in general, some common risk factors existed both in the agricultural and livestock sectors. However, studies on animal husbandry showed that the factors such as high input prices (especially feed prices), animal deaths, and related losses, along with a rise in commodity prices, were considered more prominent risk factors. This reveals the necessity of considering and evaluating these two sectors separately during risk analysis studies. In developed countries, product quality is a prominent risk factor, while in developing countries, changes in input costs and lack of income are more significant.

The fact that whether the producers can take measures against the risk or not as well as determining the risk factors is critical for the reduction of economic losses and sustainability. It is essential to educate farmers on how to manage the risks associated with animal husbandry since farmers need accurate and precise information to predict risk, make the right decision, and manage risk when they face it along with any other uncertainties (Zhou *et al*., 2012). Generally, there is an incompatibility between the risk sources perceived by farmers and strategies to manage the risk (Duong *et al*., 2019). In this study, we observed that although the producers identified the risk factors well, they lacked the necessary awareness in terms of risk measures. In this respect, it was necessary to improve the perception of risks faced by farmers and also support the efforts required to manage and reduce these risks. Accurate identification of the management strategies and successful management of the risks is directly associated with several factors, such as farmers' level of knowledge, institutional support, and capital accumulation (Knutson *et al*., 2011; Woods *et al*., 2017).

A study conducted by Meuwissen *et al*. (2001) identified the risks and determined the risk management strategies in 612 livestock farms in the Netherlands. Here, it was observed that the farms that carried out mixed production and the ones that produced only milk were exposed to different risks. While production risks were more prominent in mixed production farms, price risks due to volatility in cost prices were more prominent in dairy farms. Although it was deemed appropriate to have insurance for animals in mixed production farms as a risk-management strategy, it was emphasized that the public should reduce cost-price volatility for dairy producers (Meuwissen *et al*., 2001).

The identified risk-management strategies for dairy farms in China include cost reduction, income stability, income increase, cooperation,

taking up insurance, and consultation. Also, it is important to understand and predict potential risks quickly and accurately, which is the first step in risk management. Although ALI is reported to be a helpful tool in risk management, such risk-transfer tools have not yet gained popularity among dairy farms in China (Zhou *et al*., 2012). In this study, the presence of mixed-production models in Turkey, perceived to guarantee income, leads to differences in risk perception during the animal production process.

The correct perception of risk factors and subsequent measures need to follow each other. It is important to constantly explain the nuances of insurance, one of the main precautionary measures against the risks in animal production, to producers and disseminate complete information on this subject continuously.

Farmers are alleged to be reluctant payers of insurance premiums for an intangible product whose benefits are not yet being experienced or demanded by them. However, they prefer to opt for the insured farming system since they are not fully informed. Insurance companies need to constantly inform low-income producers about the need to reduce and manage risk in their enterprises. Policies targeting micro and small enterprises were recommended to be differentiated from traditional insurance products, offering ALI products to small family enterprises while implementing incentive pricing and payment packages (Siegel *et al*., 2001).

Also, to disseminate insurance-related information, campaigns are needed in areas with low insurance awareness. To prevent farmers from losing faith and interest in insurance policies, microinsurance companies need to resolve their claims quickly and compensate them for the damages. Moreover, to make microinsurance plans successful and attractive, insurance companies need to keep their customers informed through comprehensive programs with clear language and procedures. Also, the insurance service providers need to be supported and subsidized by the government and other beneficiaries to make their insurance plans available at a reasonable premium (Fischer and Qureshi, 2006). However, 50% of the premium paid by the farmers for ALI is covered by the government in Turkey, and this practice is still being continued today. This has contributed to an increase in the premium production process and the amount/ rate of compensation being paid to the producers (Turkish…, 2019). Hence, this practice is useful to manage financial risks and sustainability, especially in small and medium-sized farms.

CONCLUSION

Risk factors among the agriculture and livestock sectors in Turkey and the world need to handle separately, and different measures should implement according to the sector. Moreover, the three steps, including determining the risk factors, revealing the risk prevention tool, and taking precautions against the risk, need to follow each other. Producers who perceive the risk factors correctly cannot always take suitable precautions against these risk factors. This study clearly explains that the producers need the information to implement the most accurate measures against the risks. As economic-political risk perception and technical risk perception develop, especially in livestock enterprises, the tendency to take out insurance increases. Eliminating the manufacturers' lack of information in taking precautions against the risk with the right tool may indicate the importance of ALI, which is a clear understanding in the last step, i.e., prevention and transfer of the risk. The importance of ALI, which is one of the main risk transfer tools in the Turkish livestock sector, needs to be clearly understood by the producers. Education and information activities on ALI and risk factors should continue uninterruptedly with the producers/enterprises in the field.

In summary, the liberalization of agricultural and animal product markets globally makes internal and external risks more critical. Thus, it becomes inevitable to have insurance practices in farm management for a conscious and sustainable profitable livestock activity.

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