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Original Research Article

Awareness of Feed Regulations and its Impact on Quality of Feed Resources by Feed Dealers

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Abstract: This study aimed to evaluate awareness of feed regulations and its impact on quality of feed resources by feed dealers. Using a cross-sectional survey, 40 feed dealers were randomly selected from five sub-counties of Mukono District. Data were analyzed using the descriptive statistics to characterize feed dealers, and their awareness of the regulations guiding feeds industry. Logistic regression model was used to assess factors affecting awareness of feed regulations by feed dealers. Results shows that majority (60%) of the feed dealers were aware of the regulations guiding feed industry. Suppliers were the major (62.5%) source of information and delivery of quality feeds services to farmers (57.4%), among others, were the foremost feed regulations mentioned and followed by feed dealers. Distance to the main access road (P≤0.05), access to credit (P≤0.05), access to extension services (P≤0.05), access to water (P≤0.05), membership to group (P≤0.001), and record keeping (P≤0.05) significantly influenced awareness of feed regulations by feed dealers. Majority (60%) maintained the storage facilities with no vermin (32.50%), pallets were placed on ground (30%), proper ventilation (17.5%), routinely scouted and controlled the pathogens (12.5%), and used recommended packaging containers (7.5%). There was a strong positive relationship between awareness and feeds mixing (79.8%), transportation (90.8%), grade/state of raw materials used (72.4%), and business rules and regulation (81.0%). Results also showed a negative relationship between awareness and state of storage facility (69.3%) and mechanization (80.5%). In conclusion, most feed dealers were aware of the feed regulations, and distance to the major access road, and membership to group, among others, were the major determinants of factors affecting awareness of feed regulations by feed dealers.

Keywords: Awareness, feed regulations, feed quality, and feed dealers.

1. INTRODUCTION

Livestock production in Uganda has been increasing over the years (Kasule *et al.*, 2014). This is attributed to the increasing demand for livestock products due to the rapid human population growth and urbanization (Ishagi *et al.*, 2003). Several livestock species are kept, of which poultry is the most common (Katongole *et al.*, 2011). The predominance of poultry is attributed to the readily available market for eggs and chicken meat, quick returns to investment, less space requirement, no cultural or religious taboos, and less social tensions compared to the rearing of other livestock species (Katongole *et al.*, 2011). However, high cost of feed is limiting poultry farming in Uganda (Katongole *et al.*, 2012). Feed cost has often been reported as the major element in the total cost of poultry farming accounting for over 80 % of the total variable costs (Walker and Gordon, 2003). Consequently, this has led to many commercial broiler feed dealers and farmers to adopt feed cost-saving mechanisms, particularly improvising own feed formulation and mixing (Kasule *et al.*, 2014). Own-mixed feed cost less than the standardized feed, since feed manufacturers raise the prices of their feed so high (Apantaku et al. 2006). Additionally, the variable operating expenses involved in producing commercially mixed-feed also lead to higher prices, which is not the case when feed dealers and farmers too mix their own feed. Uganda has a concrete and very well elaborated, mandatory poultry feed quality standards in the national animal feeds policy of March 2005 by the Ministry of Agriculture, Animal Industry and Fisheries. However, information

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on awareness of feed dealers about feeds regulation and its impact on quality of feed resources is limited. Therefore, this study was conducted to assess awareness of feed dealers about feeds regulation and its impact on quality of feed resources.

2. MATERIALS AND METHODOLOGY

2.1. Study Area

This study was conducted in Mukono district (Latitude:0.480567; Longitude:32.770567) in Central Uganda, sharing borders with Kayunga District to the north, Jinja District to the east, Kalangala District to the south-west, Kira Town and Wakiso District to the west, and Luweero District to the north-west (Figure 1). The district was purposively selected based on the intensive status of commercial broiler production. Consequently, five sub counties selected for the study were those that were majorly involved in commercial broiler production.

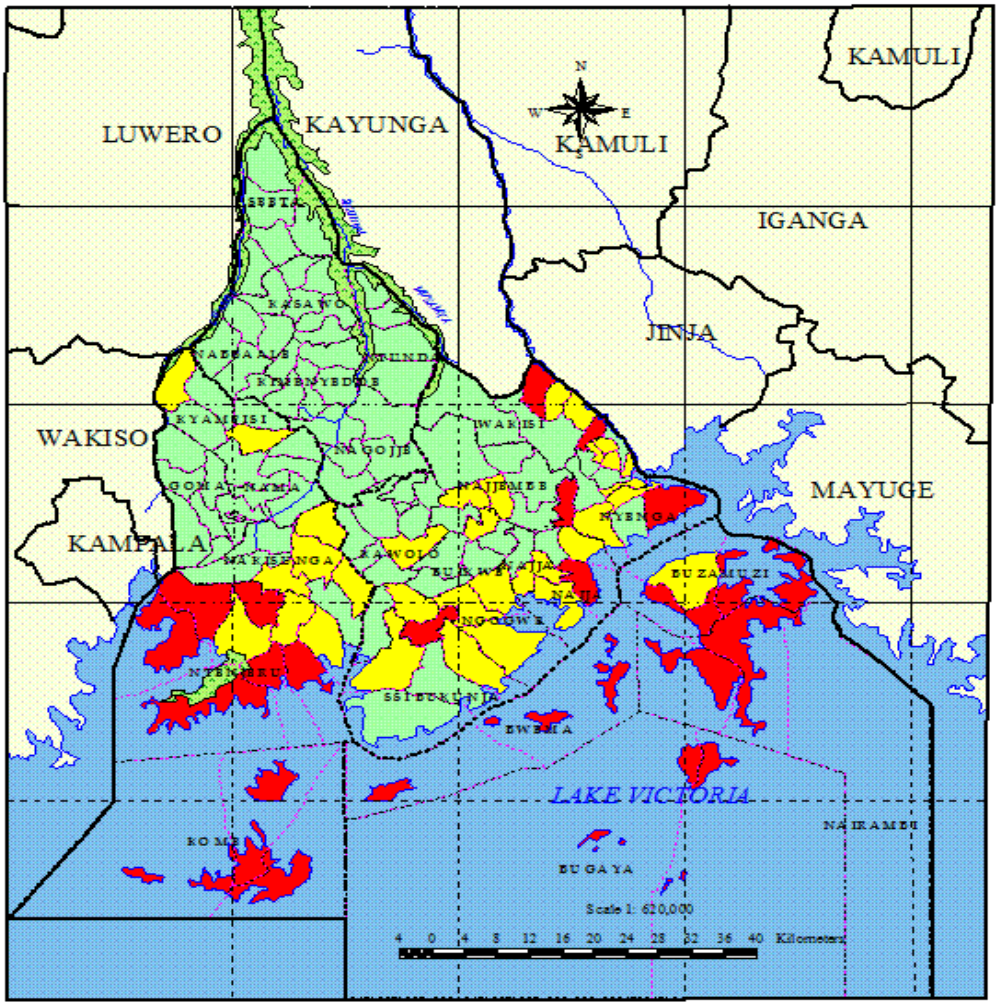

Figure1: Mukono District
Source: Mukono District HRV Profile

2.2. Research Design

The study adopted a cross-sectional survey research design. Cross-sectional survey research design allows for collection of data from a cross-section of respondents at one point in time. This design was appropriate given that the study was interested in assessing the awareness of feed dealers about feed regulation and its impact on quality of feed resources.

2.3. Study Population and Sampling Design

The study population consisted of all feed dealers involved in feeds business. Multistage sampling technique was used to select the study sample. Mukono district was purposively selected basing on the status of commercial broiler production. Five sub-counties intensively involved in commercial broiler production were purposely selected from which a sample of 40 feed dealers were randomly selected from Mukono division, Goma division, Nama sub-county, Kyampisi Town council, and Nakisunga sub-county, respectively.

2.4. Data Types and Data Collection

The study employed cross-sectional primary data collected using a pre-tested structured

questionnaire. The questionnaire enclosed questions on feed dealers' awareness of the regulations guiding feeds industry, sources of information, adherence to regulations, basic knowledge on rules and regulations, quality of feed resources. Data on feed dealers' socio-economic characteristics (Feeds dealers' income, education, gender, age, and marital status), and institutional factors (Access to markets, access to credit, feed dealers' organizations, access to media and access to inputs) were also collected.

2.5. Data Analysis

Collected data was entered into SPSS vs. 25 prior to analysis. After entry, the data was cleaned for possible errors during entry. Descriptive analysis was then performed in SPSS, before the data was exported to STATA v. 14 for econometric analysis. Descriptive statistics and simple inferential statistics involved computations of means and standard deviations for continuous feeds dealers' characteristics, frequency distribution for categorical feeds dealers' characteristics, feeds dealers' awareness of the regulations guiding feeds industry, sources of information, adherence to regulations, basic knowledge on rules and regulations, and quality of feed resources. Logistic regression model was used to assess factors affecting awareness of feed regulations by feed dealers as presented below;

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \beta_nX_n + \varepsilon i$

Where;

Y: Dependent variable (Awareness of rules and regulations),
β_0: Intercept,
$\beta_{1\text{-}n}$: Coefficient of the explanatory variables,
$X_{1\text{-}n}$: Explanatory variables (social, economic and institutional variables).

Table 1 presents detailed description of the independent variables and their measurement, in addition to their hypothesized effect on the dependent variable.

Table 1: Description of variables in the binary logistic regression model

Variable	Label	Measurement/Description	*A priori*
X_1	Marital status	Marital status of feed dealer (1=married, 0=otherwise)	+/-
X_2	log_age	Log transformed age (years) of feed dealer	+
X_3	log_exp	Log transformed feed dealing experience (years)	-
X_4	Membership to group	Membership to a group (1=yes, 0=no)	+
X_5	Access to water	Access to water (1=yes, 0=no)	+
X_6	Extension	Access to feed specific extension visits (1=yes, 0=no)	+
X_7	Access to power	Access to power (1=yes, 0=no)	+
X_8	Gender	Gender of feed dealer (1=male, 0=otherwise)	+
X_9	log_Distance to the main road	Log transformed to the distance main road (years)	+
X_{10}	Presence of other suppliers,	Presence of other suppliers (1=male, 0=otherwise)	+
X_{11}	Record keeping	Record keeping (1=male, 0=otherwise)	+

The conditional probability of the logit model was estimated from specification in equation as shown in the equation below;

$$\Pr(y_i = 1|x) = F(x_i'\beta$$

Where: $F(x_i\beta)$ is the cumulative logistic density function that applies to the binary logit model. Therefore, the above equation was rewritten as follows below;

$$\log\left[\frac{P}{1-P}\right] = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \cdots + \beta_{10}X_{10}\beta_{10} + u$$

Where: P is the conditional probability that a given dealer was aware of feed rules and regulations at the time of study i.e. $\Pr(y_i = 1|x)$, and $(1 - p)$ is the conditional probability that a given dealer was not aware of feed rules and regulations at the time of study i.e. $\Pr(y_i = 0|x)$.

Peason's correlation analysis was carried out to assess the impact of awareness of feed regulations on quality of feed resources.

3. PRESENTATION OF RESULTS

3.1. Awareness of Feeds Regulations By feed dealers in the Study Area

Table 2 indicates the awareness of feed regulations by Feed dealers in Mukono district. Results show that majority (60%) of the feed dealers were aware of the regulations guiding feed industry, however, most (65%) of them were not adhering to the regulations. Suppliers were the major (62.5%) source of information, followed by government through the extension services (10%), NGO (7.5%), newspapers (7.5%), internet (7.5%), and radio/televisions (5%), respectively. Delivery of quality feeds services to farmers (57.4%), supporting capacity building of farmers (16.1%), and offering advisory dealers.

Table 2: Awareness of feed regulations by feed dears in the study area

Variable	Response	Frequency	Percentage
Awareness of regulation	Yes	24	60
	No	16	40
Adherence to regulations	Yes	14	35
	No	26	65
Source of information	Government (Extension agents)	4	10
	NGO	3	7.5
	Suppliers	25	62.5
	Newspapers	3	7.5
	Radio/TV	2	5
	Internet	3	7.5
Rules and regulations	Offering advisory services to farmers	5	13.5
	Representing farmers' interests	1	1.0
	Participating in policy formulation	1	3.0
	Mobilizing credit for their farmers	1	2.0
	Promoting the animal feeds industry	3	7.0
	Supporting capacity building of farmers	6	16.1
	Delivery of quality feeds services to farmers	22	57.4

Source: Survey 2022

3.2. Factors Affecting Awareness of Feed Regulations by Feed Dealers

Table 3 shows logistic regression estimates of the factors affecting awareness of feed regulations by feed dealers. Distance to the major access road, access to credit, access to extension, access to water, record keeping, and membership to group were the major determinants of factors affecting awareness of feed regulations by feed dealers, with a significant F- value of 0.000 and R^2 for the estimated regression of 0.6460 (64.60%).

Table 3: Logistic regression analysis of factors affecting awareness of feed regulations by feed dealers

Factors	Coefficient	Std. Err.	z	P>z
Gender	-0.76417	1.364971	-0.56	0.576
Marital status	-15.4003	3930.14	0.00	0.997
Education level	0.100319	0.204651	0.49	0.624
Age of a dealer	0.072743	0.088395	0.82	0.411
Experience	0.060404	0.086424	0.70	0.485
Other activates	-0.07272	0.131247	-0.55	0.58
Distance main road	-0.03792	0.024672	-1.54	0.024*
Access to credit	1.005274	1.043015	0.96	0.035*
Access to extension services	0.633287	0.838119	0.76	0.046*
Access to power	1.603244	1.296424	1.24	0.216
Access to water	1.788896	0.994591	1.80	0.012*
Presence of other suppliers	0.444885	0.946165	0.47	0.638
Record keeping	1.01045	1.08882	0.93	0.053*
Membership to group	1.525769	1.099112	1.39	0.001***

***, **, * indicates significance at 1%, 5% and 10% respectively; Number of obs = 40; LR chi^2 (8) = 34.21; Prob > chi2 = 0.000; Log likelihood = -62.418947; Pseudo R^2 = 0.6460; Obs. summary: 16 left-censored observations at awareness<=0; 24 uncensored observations; 0 right-censored observations

Source: Survey 2022

Distance to the main access road showed a negative and significant (P≤0.05) influence on awareness of feed regulations by feed dealers. Access to credit, access to extension, access to water, and record keeping positively and significantly (P≤0.05, P≤0.05, P≤0.05) influenced awareness of feed regulations by feed dealers. Similarly, membership to group showed a positive and significant (P≤0.001) influence on awareness of feed regulations by feed dealers. Gender, marital status, and other activates had a negative and non-significant relationship with awareness of feed regulations by feed dealers. Similarly, education level, age of feeds dealer, experience, access to power and presence of other suppliers showed a positive relationship with awareness of feed regulations by feed dealers that was not significant.

3.3. Quality of Feed Resources among Feed Dealers

Figure 2 shows the attributes of quality of feed resources among Feed dealers in Mukono district. Feed dealers were group into two groups, and these included: those that were properly implementing (Good) and not properly implementing (poor). Results showed that majority (60%) of the feed dealers maintained the storage facilities with no vermin (32.50%), pullets well placed on ground (30%), proper ventilation (17.5%),

routinely scouted and controlled the pathogens (12.5%), and used recommended packaging containers (7.5%). However, there was no significant difference between dealers that maintained the storage facilities and those that did not (Table 4).

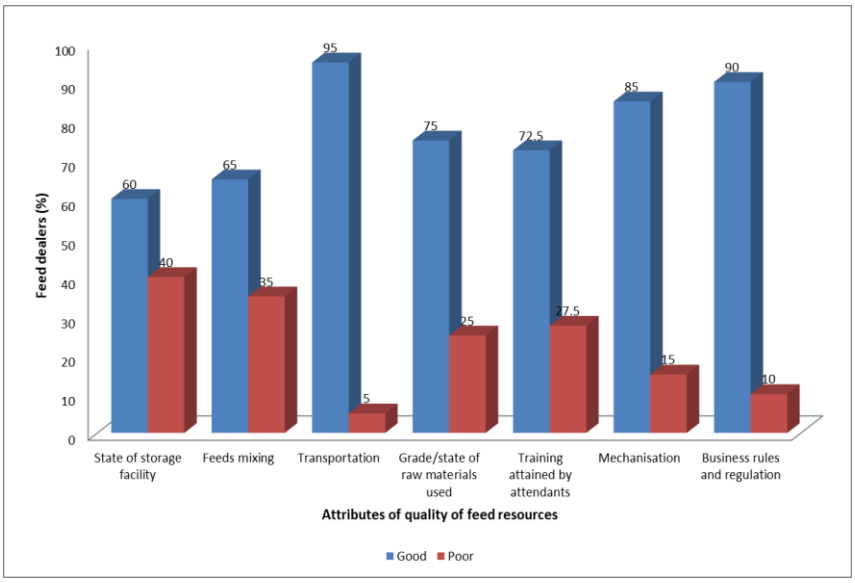

Figure 2: Quality of feed resources among feeds dealers in Mukono districts

Table 4: Quality of feed resources among feed dealers

Attributes of quality of feed resources	**Measurements of quality**						**Chi2-stat**	**P-value**
	Overall mean (n=40)		**Good**		**Poor**			
	Freq	**%**	**Freq**	**%**	**Freq**	**%**		
State of storage facility								
Proper ventilation	7	17.5	5	20.83	2	12.50	14.800	0.539
Presence of pallets on ground	12	30.00	7	29.17	5	31.25		
No vermin	13	32.50	8	33.33	5	31.25		
Recommended packaging containers	3	7.50	1	4.17	2	12.50		
Routine scouting and control of pathogens	5	12.50	3	12.50	2	12.50		
Feeds mixing								
Recommended quantities of additives	17	42.50	6	25.00	11	68.75	0.485	0.785
Hygiene mixing environment	15	37.50	10	41.67	5	31.25		
Mixing of feeds from cool dry place	8	20.00	8	33.33	0	0.00		
Transportation								
Use of recommended containers	12	30.00	5	20.83	7	43.75	6.286	0.018*
Dump free environment along the way	17	42.50	13	54.17	4	25.00		
Hygiene of means of transport	11	27.50	6	25.00	5	31.25		
Grade/state of raw materials used								
High quality texture	12	30.00	7	29.17	5	31.25	4.827	0.566
Pathogen free	15	37.50	9	37.50	6	37.50		
Recommended moisture content	8	20.00	3	12.50	5	31.25		
Proven target nutrient content	5	12.50	5	20.83	0	0.00		
Training attained by attendants								
Formal trainings	28	70.00	19	79.17	9	56.25	0.163	0.687
Informal trainings	12	30.00	5	20.83	7	43.75		
Mechanization								
Feeds mixing machines	16	40.00	9	37.50	7	43.75	19.175	0.026*
Weight measuring machine	9	22.50	7	29.17	2	12.50		
Moisture content machine	8	20.00	6	25.00	2	12.50		
Temperature gauge machine	3	7.50	1	4.17	2	12.50		
Sealing machine	4	10.00	1	4.17	3	18.75		
Business rules and regulation								
Presence of guiding rules and regulations	25	62.50	14	58.33	11	68.75	0.291	0.59
Enforcement of rules and regulations	15	37.50	10	41.67	5	31.25		

Freq: Frequency, %: Percentage

Source: Survey 2022

Similarly, most (65%) of the feed dealers properly mixed their feed with 42.50% using recommended quantities of additives, proper hygiene mixing environment (37.50%), and mixing of feeds from cool dry place (20.00%). There was no significant difference between dealers that properly mixed their feeds and those that did not. Furthermore, results indicated that 95% of the feeds dealers ensured proper and recommended transportation of feeds to ensure quality assurance. These included ensuring of dump free environment along the way (42.50%), use of recommended containers (30.00%), and hygiene of means of transport. There was significant (P≤0.05) difference between dealers that ensured proper and recommended transportation of feeds and those that did not. Majority (75%) of the feeds dealers were very keen on the grade/state of raw materials used to prepare the feed. Texture of the raw materials (30.00%), being free from pathogens (37.50%), recommended moisture content (20.00%), and proven target nutrient content (12.50%) were some attributes considers to grade their raw materials. There was no significant difference between dealers that kept keen on the grade/state of raw materials used to prepare feeds and those that did not. 72.5% of the feeds dealers considered education/training as a major factor required for proper running of the business and quality assurance. 70.00% of the dealers received formal training whereas 30.00% acquired non-formal training (30.00%) in feed mixing. There was no significant difference between dealers that acquired formal training and those that acquired non-formal. Most (85%) of the feed dealers had mechanized a number of activities at their storage facilities for efficiency and quality assurance. Presence of machines for food mixing (40.00%), weighing (22.50%), and moisture content (20.00%), among others, indicated significant difference between feed dealers that had mechanized activities and those that were not. Majority (90%) of the feed dealers expressed their support on the role of business guiding internal rules and regulations for quality assurance, however, only 62.50% had and enforced business guiding internal rules and regulations and the rest did not. There was a significant difference between dealers that had and enforced business guiding internal rules and regulations and those that did not.

3.4. Impact of Awareness of Feed Regulations on Quality of Feed Resources

Results for Peason's correlation analysis of the impact of awareness of feed regulations on quality of feed resources in the study are presented in table 5. Feed mixing, training attained by attendants, and grade/state of raw materials used and extent of mechanization were the major determinants of the impact of awareness of feed regulations on quality of feeds. There was a strong positive relationship between awareness and feeds mixing (79.8%), transportation (90.8%), grade/state of raw materials used (72.4%), and business rules and regulation (81.0%). On the contrary, results showed a negative relationship between awareness and state of storage facility (69.3%) and mechanization (80.5%).

Table 5: Peason's correlation analysis of the impact of awareness of feed regulations on quality of feeds

Attributes of quality of feed resources	Peason's correlation	Coefficient	Std. Err.	R^2	P>t
State of storage facility	-0.693	-0.014	0.098	0.590	0.887
Feeds mixing	0.798	0.455	0.148	0.670	0.004**
Transportation	0.908	0.016	0.163	0.882	0.92
Grade/state of raw materials used	0.724	0.131	0.110	0.685	0.024*
Training attained by attendants	0.725	0.440	0.248	0.701	0.018*
Mechanization	-0.805	-0.112	0.097	0.864	0.025*
Business rules and regulation	0.810	0.115	0.216	0.798	0.598

***, **, * indicates significance at 1%, 5% and 10% respectively

Source: Survey 2022

Mixing of feeds showed a positive and significant (P≤0.001) impact of awareness of feed regulations by feed dealers on feed resources quality. Similarly, grade/state of raw materials used and training attained by attendants showed a positive and significant (P≤0.05) impact of awareness of feed regulations by feed dealers on quality feed resources. On the contrary, degree of mechanization showed a negative and significant (P≤0.05) impact of awareness of feed regulations by feed dealers on quality feed resources. State of storage facility had a negative and non-significant relationship with awareness of feed regulations by feed dealers on feed resources quality, whereas compliance to internal business rules and regulation showed a positive and non-significant relationship.

4. DISCUSSION OF RESULTS

4.1. Awareness of Feed Regulations by Feed Dealers

Results show that majority of the feeds dealers were aware of the regulations guiding feed industry. This could be attributed to intensive information dissemination about feed regulations by a number of players, including: inputs suppliers and government through the extension services, among others. Present findings are consistent with the results of Adem (2017); Dolkar *et al.*, (2013); Islam *et al.*, (2014), and Valentine

(2015). Results further showed that most of the feeds dealers were not adhering to the regulations. This may be related to the consistent failure to engage and involve feed dealers in the process of drafting and operationalizing the regulations, their poor and inconsistent training by regulatory authority and reliance on non-trusted sources of information about feed regulation. Okumah *et al.,* (2018a) confirmed that raising awareness alone is not sufficient to improve compliance; stakeholders must engage in learning by participating in activities that may also lead to the creation of new values. Similar findings were reported by Porfírio *et al.*, (2018); Hossain *et al.*, (2003); and Ike *et al.*, (2011). On contrary, Khan *et al.,* (2003) found divergent findings. Inputs suppliers and government through the extension services were the major sources of information. Related findings by Muatha (2014) reported similar findings during evaluation of farmers' awareness of agricultural extension devolution and preferences for participatory design of the agricultural extension program in Kenya.

4.2. Factors Affecting Awareness of Feed Regulations by Feed Dealers

The adjusted coefficient of determination (R^2) obtained from the estimate was 0.6460. This indicates that 64.60% of variations in dependent variable were explained by the independent variable, while the remaining 35.4% was explained by the variation of other variables not included in the model (Santoso, 2000). Access to credit facilities significantly influenced feed dealers' awareness of feeds regulations. This implies that, as the access to credit increases, the likelihood of the feed dealers' awareness of the regulations and their adoption increases as well. Previous literature has recognized the potentials of credit in enhancing the farmers' awareness and adoption of the improved wheat varieties (Missiame *et al.,* 2021). The primary reason for the feeds dealers' low levels of awareness and their decisions to comply, is identified by the studies as poverty, whereas credit helps to alleviate financial constraints and enables them to access and therefore become aware (Wossen *et al.,* 2017; Leng *et al.,* 2020). Present findings are in agreement with previous studies which reveal the positive and significant effect of access to credit on awareness of feed regulations (Kumar *et al.,* 2020; Ullah *et al.,* 2020; Tambo *et al.,* 2012). Findings as well agrees with the work of Mohamed and Temu (2008) who reported that access to credit loan stimulate the awareness and therefore technology adoption. The extension contacts boost the likelihood that the feed dealers are aware ($p < 0.05$) and that they will comply with the set regulations. These results imply that the extension contacts play a very important and effective role among feed dealers' awareness and their adoption of feeds regulations. Present finding are consistent with those of Kumar *et al.,* (2020) and Ullah *et al.,* (2020). Distance to the main access road showed a negative and significant influence on awareness of feed regulations by feed dealers. This indicates that the more the feed dealer is far away from the sources of information, the lesser they are aware of feeds regulations. Access to water showed a positive and significant influence on awareness of feed regulations by feed dealers. Presence of enabling infrastructure like water and electricity stimulates compliance to regulations. Present findings are in agreement with Mariano *et al.,* (2012). Record keeping positively and significantly influenced awareness of feed regulations by feed dealers. Most of the feed dealers had at least attained primary education, an element that improves ones' ability to keep business records. Education influences one's ability to understand and decide to comply with regulations or not. The results agree somewhat with those of several other studies that education has mixed effects on the ones' decision making and their awareness of many innovations (Ullah *et al.,* 2021; Shah *et al.,* 2017). Membership to group showed a positive and significant influence on awareness of feed regulations by feed dealers. The result is consistent with the findings of Abegunde (2019) and Wamalwa (2017). Alene *et al.,* (2000) similarly found in their study in the central highlands of Ethiopia that adoption and intensity use of improved maize varieties was determined and significantly influenced by the of the farmers' membership to group. Gender, marital status, and other activates had a negative and non-significant relationship with awareness of feed regulations by feed dealers. These results are in accordance with previous studies, and they reveal a negative correlation of the farmers' characteristics with their awareness of the extension-recommended improved technology (Tsegaye *et al.,* 2017; Faye and Deininger, 2005). Similarly, education level, age of feeds dealer, experience, access to power and presence of other suppliers showed a positive relationship with awareness of feed regulations by feed dealers that was not significant. Osman (2014) and Khan (2016) found similar relationship in their study between age and use of ICT based media by farmers, whereas, Khan (2016) in his research also found similar relationship between education and awareness about agricultural information.

4.3. Quality of Feed Resources among Feed Dealers

Results showed that majority of the feed dealers maintained the storage facilities with no vermin, pallets well placed on ground, proper ventilation, routinely scouted and controlled the pathogens, and used recommended packaging containers. Quality control in dealers' storage facilities reduces the chances of spread and subsequent infection of birds with pathogenic bacteria (Mindy and Sagar, 2007; Afolabi *et al.,* 2019; Leggieri *et al.,* 2020). Storage life is an important consideration in animal feeds facilities (Richards & Hicks, 2007). Jute, polypropylene, and polyethylene bags are commonly used to store animal feeds (Chattha, 2015; Sunarno *et al.,* 2017). Numerous studies indicate that infections agents like *Salmonella* can survive for at least several days, and for as long as

nine months, on insects, rodents, and surfaces of building materials such as wood, concrete, iron, steel, and brick (Berends *et al.*, 1997; EFSA 2019). Other disease causing agents can as well survive in rodent feces for up to five months which underlines the need for adequate rodent control, and frequent and thorough cleaning of feeds storage facilities (Moretti *et al.*, 2017; Iqbal *et al.*, 2015; Udomkun *et al.*, 2017). 42.50% supported used of recommended quantities of additives, hygiene mixing environment (37.50%), and mixing of feeds from cool dry place (20.00%) as major quality variables during feeds mixing. Presence of foreign agents in poultry feeds and feed ingredients compromises farm production parameters including feed intake, feed conversion, weight gain, reproductive performance of the birds; and at the same time risking the introduction of these toxins into the human food chain (Nemati *et al.*, 2014; Ráduly *et al.*, 2020). Formal training (70.00%) and non-formal training (30.00%) in feeds mixing had no significant difference between dealers that had received formal education and those that did not. Being literate improves access to information, capability to interpret, understand and analyze the situation better than illiterates. So, feed dealers who are literate are more likely to be aware and comply with feeds regulations compared to illiterate one. This result has been supported by previous studies such as the findings of Lelissa and Mulate (2002), Yitayal (2004) and Komba *et al.*, 2019. Furthermore, results indicate that dump free environment along the way (42.50%), use of recommended containers (30.00%), and hygiene of means of transport had significant ($P \leq 0.05$) association between dealers that compiled to quality attributes and those that didnot. Findings are associated with those of Setsetse (2019). Good-quality feed transportation facilities ensures that the feed are free of contaminants like bacteria, viruses, toxins, drug residues, dust, stones, metal pieces and any other material which could be directly harmful to the animal or indirectly harmful to humans (ILRI, 2022). Improper drying, poor storage conditions, such as excessive heat and moisture, insects and other annoyances make feeds vulnerable to fungal infection and subsequent aflatoxin contamination during storage (Hell *et al.*, 2000, Williams, 2008). Presence of machines for feed mixing, weighing, and moisture content, business guiding internal rules and regulations and their enforcement showed an influence on the quality of feed resources. Present findings are related to previous findings of Bulent *et al.*, (2006) and Ball *et al.*, (2001). 42.50% supported used of recommended quantities of additives, hygiene mixing environment (37.50%), and mixing of feeds from cool dry place (20.00%) as major quality variables during feed mixing. Mycotoxigenic fungal growth can arise in storage because of moisture variability within the feeds in the storage container/silo (Kabak *et al.*, 2006). Hence, it is important to control aeration and periodical monitoring of the moisture content of storage facilities, adequately because it plays a major role in restriction of contamination during storage period (Kabak *et al.*, 2006; Magan *et al.*, 2011).

4.4. Impact of Awareness of Feed Regulations on Quality of Feed Resources

There was a strong positive relationship between awareness and feeds mixing, transportation, grade/state of raw materials used, and business rules and regulation. This indicates that an increase in the level of awareness of feed regulations improves the quality of feed resources. Results further showed a negative relationship between awareness and state of storage facility and mechanization. This as well indicates that increase in the level of awareness decreases the quality of feeds. Proper feeds storage and transportation practices make feeds free from disease causing agents and other sources of contamination (Williams 2008; Leggieri *et al.*, 2020; Chattha, 2015). Findings are related to previous studies of Fitzsimons *et al.*, (2014); Bonilha *et al.*, (2015); and Thais *et al.*, (2016). Mixing of feed, grade/state of raw materials used and training attained by attendants showed a positive and significant. Training improves ones' ability to understand and practice the recommended practices that would minimize presence of foreign agents in raw materials and during feed mixing which would compromise farm production parameters including feed intake, and feed conversion, among others, and at the same time risking the introduction of such toxins into the human food chain (Ráduly *et al.*, 2020). On contrary, degree of mechanization showed a negative and significant impact of awareness of feed regulations by feed dealers on quality feed resources. Finding are contrary to Demissie (2020); FAO (2010) and AEA (2006) who reported a positive relationship between feeds regulations and mechanization during animal feed production.

5. CONCLUSION

Majority of the feed dealers were aware of the regulations guiding feeds industry. Distance to the major access road, access to credit, access to extension, access to water, record keeping, and membership to group were the major determinants of factors affecting awareness of feed regulations by feed dealers.

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