MEKELLE UNIVERSITY COLLEGE OF VETERINARY SCIENCES,

DEPARTMENT OF VETERINARY BASICS AND DIAGNOSTIC SCIENCES

OCCURRENCE OF VITAMIN E DEFICIENCY IN MEKELLE SMALL HOLDER POULTRY FARMS

BY

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A Research Submitted to the Department of Veterinary Basics and Diagnostic Sciences, College of Veterinary Sciences, Mekelle University in Partial Fulfilment of the Requirements for the Master Degree in Veterinary Clinical laboratory Sciences

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BOARD OF EXAMINERS

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SUMMARY

This research study investigates the occurrence of vitamin E deficiency in smallholder poultry farms in Mekelle, Ethiopia. The study aims to understand the farming practices, demographics, and potential issues related to vitamin E deficiency in the poultry industry. A total of 121 farms were visited, and interviews were conducted with farm owners/managers to gather data. The findings reveal several key insights. Firstly, the distribution of farms visited by sub-city shows that Hawelti is a significant area for poultry farming, while K/Woyane has the lowest number of farms visited. Secondly, the majority of respondents had completed high school education, indicating a significant proportion of farm owners/managers with higher levels of education. Thirdly, the median monthly income from the farm was reported as 30,000 ETB, with a considerable variation among the respondents. Furthermore, farm observations identified clinical signs indicative of vitamin E deficiency, including neck twisting, uncoordinated movement, breast edema, emaciation, and stunted growth. The research findings revealed that 35.46% of the visited farms had chicks displaying clinical signs consistent with vitamin E deficiency. Based on these findings, it is recommended to enhance awareness and education about the importance of vitamin E in poultry nutrition. Training programs and workshops can be organized to educate farmers about the symptoms and consequences of vitamin E deficiency, as well as appropriate feeding practices and sources of vitamin E-rich feed. Improving access to quality feed, encouraging supplementation and monitoring, and conducting further research on nutritional diseases of poultry are also recommended. These findings provide valuable insights into the occurrence of vitamin E deficiency in smallholder poultry farms in Mekelle and serve as a basis for future interventions to improve poultry nutrition and productivity.

Key words: Poultry, Nutritional diseases, Vitamin E deficiency

1. INTRODUCTION

Poultry is an integral part of most livestock production systems in Ethiopia. The total poultry population in Ethiopia has been estimated to be 56 million of which about 98% are kept under rural household conditions (Demeke, 2004). For the last more than two decades attempts were made to enhance the poultry productivity and optimize the contribution of chickens to the national economy. Greater efforts were exerted to transform the production system into a more commercialized and intensive large-scale system (Ashenafi, 2000). In such attempt, exotic breeds and cross-breeds were multiplied in government owned poultry farms and distributed to individual farmers via the extension division of the Bureau of Agriculture to be maintained and produced under the backyard management system. Although some improvements have observed through the years of efforts, it falls short of meeting the ever-increasing human population (Dawit et al, 2006). The same authors reported the total estimated amount of poultry meat and egg production as 53,493 and 36, 624, tones respectively. A large proportion of this production comes from rural poultry production based on traditional indigenous chicken farming. Considering this the Ethiopian government prepared another poultry production plan as part the livestock master plan road map for growth and transformation (Shiparo *et al.,*2015).

This livestock master plan prospects Ethiopia will meet its chicken meat and egg demand for its growing population and produces export surpluses. The poultry sub-sector will move away from the traditional scavenging family poultry system (TFP) to the improved semi scavenging family poultry system (IFP) and increase the scale of specialized layer and broiler production (specialized poultry). This transformation will make a substantial contribution to reducing poverty and malnutrition among rural and urban poor. The sub-sector will help close the total national meat production-consumption gap and achieve the CRGE target of increasing the share of chicken meat consumption to total meat consumption from the current 5% to 30% by 2030 by substituting red meat that comes from

larger high emitting ruminants. To raise chicken meat production to 164,000 tones and eggs to 3.9 billion by the year 2020 through IFP and expanded specialized poultry. This grand plan states feed will be the top challenge to achieve the targets (Shiparo *et al.*,2015).

Feed is the most expensive input in commercial production of poultry meat and eggs. Consequently, poultry nutrition has been an area of intensive research and optimization. Poultry require at least 36 dietary nutrients at appropriate concentrations and balance. Most poultry diets are based on soya meal as the primary protein source, and grains such as corn, sorghum, or wheat, as the primary energy source. To prevent nutrient deficiencies, grain soya-based diets are typically supplemented with concentrated sources of methionine, lysine, threonine, sodium chloride, calcium, phosphorus, zinc, manganese, copper, iron, selenium, and all of the essential vitamins. Nutrient deficiencies most often result from errors in diet formulation or milling, and these supplemented nutrients are the most probable causes of nutritional problems. Severely deficient levels often are expressed as characteristic pathologies to specific organs and tissues. Deficiencies are most likely to be expressed in fast turnover tissues, including feather follicles, skin, hematopoietic tissues, and the growth plate of bones. Some characteristic pathologies can be caused by a deficiency of one of several different nutrients and differential diagnosis requires examination of nutrient levels in the feed or in the bird's tissues (Swayne D *et al.*, 2020).

Vitamin E (VE) is a lipid-soluble vitamin, which is well known as an efficient chain-breaking antioxoidant preventing oxidative damages to body tissues (Fellenberg and Speisky, 2006; Voljc et al., 2011). In broiler chickens, biological damages induced by oxidative stress result in several pathologies affecting growth and health (Estevez, 2015; Akbarian et al., 2016). Thus, dietary supplementation of VE is a common practice in broiler industry to counteract the deteriorative effects of oxidative stress. Moreover, it was demonstrated that the antioxidant properties of VE can improve the animal health by improving cell-mediated and humoral immunity in broiler chickens (Leshchinsky and Klasing, 2001). The current

recommendation for VE concentrations in broiler diets ranges from 10.0 IU/kg (NRC, 1994) to 80.0 IU/kg (Aviagen, 2014) depending on the stage of growth. However, recommendation levels of VE in diets are also affected by various factors including other antioxidants such as vitamin C and selenium, type and amount of lipids in diets, and environmental conditions (NRC, 1994

1.1 OBJECTIVES

1. 2. The general objective of this study is:

- To investigate the occurrence of vitamin E deficiency in small holder poultry producers in Mekelle

1.3. The specific objectives of this study are:

- To measure the prevalence of vitamin E deficiency
- To investigate the feeding practice relevant to Vitamin E deficiency

1.4. SIGNIFICANCE OF THE STUDY

- The research was elucidate the magnitude of vitamin E deficiency and the possible gaps in feed preparation and feeding practice. Hence possible correction will be devised to prevent the diseases that can be adopted by other farmers
- The findings of this research may stimulate other nutrition related researches in small holder poultry production

1.5. Statement of the Problem

- Poultry by nature feed on concentrate feeds such as cereals which make them a direct competitor for food with human beings. Concentrate feeds are neither available nor affordable under most rural household and small

holder producer conditions. Besides, feed accounts up to 80% of the total cost of poultry production. Modern poultry diets using grain and soymeal are deficient in most of the vitamins if they are not supplemented. In practice, poultry diets should be formulated to contain a large margin of safety for all of the vitamins to compensate for possible losses during feed processing, transportation, and storage, and for variations in feed composition and environmental conditions (Swayne D et al., 2020). In Tigray the access to modern formulated poultry diets is limited and the now how feed formulation and storage is thought to be inadequate that can influence the nutritional contents of poultry feed. Additionally, most farmers use either mix of formulated and homemade feed or total homemade feed that exposes poultry nutritional deficiency. Vitamin is among those feed constituents that can be deficient to chickens because of improper formulation and mixing, that is either it is added in inadequate amount or it may not be evenly mixed to be equally available for every chicken. Vitamin E can be also depilated by oxidation either due to prolonged storage or exposure to sunlight. Hence vitamin E deficiency disease is likely to encounter poultry farms. However, research work in deficiency diseases of diseases particularly vitamin E deficiency is not addressed in small holder poultry producers.

2. LITRATURE REVIEW

2.1 Mechanism of vitamin E in poultry species

Vitamins had the significant roles in the maintenance as well as regulating functions in male reproductive system. After the first use of this vitamin on male reproductive system of rats, many investigators reported the effects of this antioxidant on the health and reproductive functions of different species. The key evaluation parameters of male reproductive system are volume, sperm motility, sperm concentration and fertilizing ability. These quality parameters can be severely altered by certain stresses and endocrine disrupters, which can contact the body through different sources like diet and body contacts[27]. These adverse effects can be controlled by the use of supporting compounds, including multivitamins, mineral and antioxidants. The spermatozoa in avian species are

rich with polyunsaturated fatty acids[2829]. These compounds play useful roles in the motility and fusion between sperm with egg[30]. The sperms with the higher quantity of polyunsaturated fatty acids are susceptible to reactive oxygen species, subsequently leading to infertility[31]. Therefore, the use of antioxidants for spermatozoa seems to be prerequisite for the regulating the successful fertility in the male reproductive system. Many studies proved that the use of vitamin E has useful effects on the functions of fertility in chickens[32]. The dietary supplementation of this vitamin protects the spermatozoa by maintaining the stability of polyunsaturated fatty acids in the cell membranes. The recommended dose of vitamin E in poultry birds is 10 mg/kg of diet[33].

2.2 EFFECTS OF VITAMINS ON CHICKEN IMMUNE SYSTEM

vitamin E in feed, levels of IL-6 mRNA in the spleens of LPS-inoculated chickens were significantly decreased (Kaiser et al., 2012). This study suggested that vitamin E controls inflammatory responses when pro inflammatory cytokine production is elevated, normally occurred during infectious conditions and particularly after infection with Gram negative bacteria that use LPS as one of their virulence factors. Along the same lines, a recent study showed that supplementation of broiler chicken feed with vitamin E resulted in a dose dependent decrease of both inflammatory (IFN-g, IL-1b, and IL-6) and antiinflammatory cytokines (IL-4, IL-10, and TGF-b) in the jejunum (Pitargue et al., 2019). The results were attributed to vitamin E’s essential role in balancing cytokine responses, which could be critical in cases of inflammation. Furthermore, a previous study showed that feeding broiler chickens a blend of antioxidants (ethoxyquin and propyl gallate) along with 200 IU/kg of vitamin E reduced histological inflammatory scores that were induced by oxidized soybean oil (Lu et al., 2014a). It is noteworthy that soybean and other vegetable oils are routinely added to chicken feed to increase its energy content. Vitamin E feed

supplementation can also be beneficial for chickens raised in stressful environmental conditions. For example, a recent study showed that when broiler chickens were kept under heat stress conditions, those fed vitamin E supplemented feed (100 mg/kg) demonstrated significantly reduced liver expression levels of IL-6 and heat shock protein 70 compared with controls (Jang et al.,2014). Taken together, it is clear that vitamin E can benefit the health of chickens via anti inflammatory
effects.

Effects on Cell-Mediated and Antibody-Mediated Responses Several studies in humans have demonstrated that vitamin E has certain beneficial effects in boosting immunity against infectious diseases and cancer (Moriguchi and Muraga, 2000). Mechanistically,
vitamin E has been shown to augment IFN-g production and induce proliferation of cells of the immune system in addition to modulating chemotaxis and bactericidal properties of polymorphonuclear cells (Boxer, 1986). Vitamin E, therefore, appears to boost both cell-
mediated and antibody-mediated responses to antigens.Studies conducted in chickens have shown that dietary supplementation of vitamin E can augment lymphocyte and monocyte-mediated responses both uantitatively and qualitatively. For example, following infectious bursal disease virus (IBDV) vaccination in chickens fed 80 IU/kg or 40 IU/kg of vitamin E supplemented feed, birds that received the higher dose of vitamin E had significantly more peripheral blood CD41and CD81T cells (Abdukalykova et al., 2008).

Similarly, Khan et al. (2008) also found increased lymphocyte populations in the thymus and increased plasma cell numbers in the spleen, cecal tonsils, and ileum in broiler chickens fed higher levels of vitamin E (Khan et al., 2008). In support of these findings,
Abdukalykova and Ruiz-Feria (2006) found that inclusion of arginine in a vitamin E–supplemented diet in broiler chickens enhanced responses to PHA as assessed By the cutaneous basophil hypersensitivity test. Although these

observations undoubtedly show that vitamin E can effectively augment T and B cell responses in chickens, the molecular mechanisms are yet to be unravelled. Possible mechanisms highlighted in mice suggest that vitamin E aids T cells by increasing production of IL-2, enhancing cell proliferation and through prevention of activation-induced cell death, by diminishing their expression of Fas-ligand (Adolfsson et al., 2001; Li-Weber et al., 2002). In addition to lymphocytes,
macrophage responses are also enhanced by feeding chickens a diet supplemented with vitamin E. In this context, Konjufca et al. (2004) found elevated numbers of peritoneal macrophages that displayed an increased ability to opsonize SRBC in 3-week-old chickens fed higher amounts of dietary vitamin E. Because macrophages employ oxidative bursts that release free radicals, vitamin E may affect macrophage cell viability and function by regulating levels of these products to maintain normal cell functions (Khan et al., 2014). Recent studies have demonstrated the effectiveness of supplementing chicken diets with vitamin E to enhance vaccine-specific antibody responses. One such study in broiler breeder males showed that vitamin E feed supplementation (100IU/kg) resulted in increased antibody titers to anIBV vaccine (Khan et al., 2014). These authors
also addressed the effects of vitamin E supplementation on antibody responses to NDV vaccination. Specifically, broiler chickens immunized with an NDV vaccine and fed a diet supplemented with 200IU/kg of vitamin E and 0.2 mg/kg of selenium developed significantly higher vaccine-specific antibodies compared with controls (Singh et al., 2006). Similarly, immunization with SRBC resulted in significantly elevated antibody quanti- ties after both primary and secondary immunizations in birds that received vitamin E in their diet (Niu et al., 2009; Habibian et al., 2014).

The quantity of antibodies transferred from breeder hens to progeny plays an important role in protection against pathogens in the first week of life. The effect of additional (more than in usual practice) vitamin E supplementation in parent stock diets has been studied to determine the effects on passive antibody

transfer. To this end, when broiler breeder hens received vitamin E at 150 IU/kg or 450 IU/kg in feed before inoculation with Brucella abortus antigens, the progeny from birds that received more vitamin E showed higher antigen- specific antibody titers (Jackson et al., 1978). Haq et al. (1996) showed that when breeder hens were fed 0.03% total vitamin E in their diet for 3 wk before vaccination against NDV, their progeny showed higher antibody levels compared with control birds at 1 and 7 days of age. This evidence suggests that vitamin E supple-mentation in breeder diets has beneficial implications for chicks in the context of passively transferred antibody-mediated immunity against infectious diseases. These observations suggest that vitamin E enhances antibody responses to vaccine antigens; however, the underlying mechanisms are yet to be

2.3 Role of vitamin E in Antimicrobial Immunity

The role of vitamin E in resistance against infectious disease has been well studied in mammalian species, and similar evidence exists in chickens. For example, Colnago et al. (1984) reported that when broiler chickens were fed a diet containing 100 IU/kg of vitamin E in feed and infected with E. tenella (cecal coccidiosis) oocysts, the chickens showed substantial resistance to disease indicated by lower mortality and increased weight gain. However, such resistance to E. tenella infection was not observed when g-tocopherol was used as the source of vitamin E (Allen et al., 1998). This effect is likely associated with the lower biological activity of g-tocopherol compared with a-tocopherol (Tran and Chan, 1992). In the context of coccidiosis infections, Perez-Carbajal and colleagues (2010) found that feed supplementation with vitamin E along with arginine could enhance the phagocytic activity of chicken heterophils and monocytes. Similar cellular effects were also observed when birds were infected with S. enterica serovar Typhimurium. (Liu et al., 2014). The effect of 30 IU/kg of vitamin E feed supplementation was assessed considering antibody levels, proinflammatory cytokines, and mortality of laying hens challenged with

Salmonella enteritidis. The levels of IgA, IgM, and IgY increased at 2 wk after challenge, whereas IL-1b, IL-6, and mortality decreased in vitamin E–supplemented birds (Liu et al., 2019).

3. METHODOLOGY AND RESEARCH DESIGN

3.1. Study Design

Cross-sectional design was be employed to determine the feeding practices. Following this field experiment study design was be employed to study the occurrence vitamin E deficiency

in-depth questionnaires and observation was be used to evaluate opinions of small holder poultry keepers regarding their feeding practice; accordingly, farmer was be categorized in to minimum of four groups. Grouping was consider use of formulated feed, incorporation of vitamin preparation with water or feed, daily feeding amounts (based on standard recommendation or compromised)

3.2. Study Population

Study population was Sasso dual purpose breeds under small and medium production system in Mekelle

3.3. Study area

The study was be carried out at field level employing smallholder poultry farms found in Mekelle City. Mekelle city is the capital city of Tigray Regional State of Ethiopia, located at 783 km North of Addis Ababa . It is found in highland of agro-

ecology and located at 13°32"North latitude of 9 39°28' East longitude(Desta et al., 2020). It is known for presence of many growing small commercial poultry farms in the region. For instance, about 122 small scale poultry farms having a minimum flock size of 500 chickens were reported to be found in the city (Hagos, 2019). Moreover, Ethio-chicken Company, the biggest poultry breeding company in Ethiopia, is also based in this city and because of which many poultry farms have been established.

3.4. Sample Collection and Processing

Chicken flocks in the selected households and farms was followed for 2 months. Dead chickens or acutely sick birds showing clinical signs suggestive of Vitamin E deficiency was eviscerated for detailed postmortem examination to observe and record macroscopic lesions. appropriate samples was collected for histopathological investigation. Collected tissue was processed, sectioned and stained following standard histological technique (Luna, 1968). Formalin fixed tissues was washed overnight in running tap water, dehydrated in graded alcohol, cleared in chloroform and embedded and blocked in paraffin. The sections will stained with hematoxylin and eosin and studied under low and high power objectives of a light microscope.

3.5. Data analysis

Excel Microsoft version 2013 and a STATA (Version 14, Stata Corp, USA) was used to manage the generated data and their statistical analysis. Descriptive analysis was employed to generate descriptive statistics on the feeding practice and qualitative analysis was employed to summarize the findings. Occurrence of vitamin deficiency was presented in the form of prevalence and incidence. The strength of association between vitamin E deficiency and different feeding practices will be presented by odds ratio and 95% confidence interval. P-value

of<0.05 will be considered as statistical significant association between risk factors.

4. RESULT

A total of 121 farms were visited and interview was made with the farm owners/managers

Table1. 1Distribution of the farms visited by sub city

Sub city	Number of farms visited	Percentage
Adihaqui	15	12.39%
Ayder	21	17.35%
Hadinet	13	10.74%
Hawelti	37	30.57%
K/Woyane	3	2.48%
Quiha	9	7.43%
Semien	23	19%
Total	121	100%

Table 2 Respondantes characterization

Variables		Frequency	Percentage
Sex	Female	52	43%
	Male	69	57%
Education status	Elementary	12	9.9%
	Junior High School	22	18.2%
	High School	51	42.15%
	Diploma	16	13.22%

	Degree	20	16.53%
Monthly income from the farm		Income in ETB	
	Minimum	50000	
	Maximum	500000	
	Median	30000	
	Standard deviation	91443	
Other Additional income	Yes	03	2.48%
	No	118	97.52%

This table provides information on the characterization of the respondents. It includes variables such as sex and education status. The frequencies and percentages are given for each category. For sex, the categories are Female and Male, with corresponding frequencies and percentages. For education status, the categories range from Elementary to Degree level, with frequencies and percentages provided for each category. Additionally, there is information on monthly income from the farm, including minimum, maximum, median, and standard deviation. The table also includes data on other additional income.

Table 3 Farm characterization

Variables		Number of chickens	
Flock size	Minimum	50	
	Maximum	10500	
	Median	500	
	Standard deviation		

Age of flock		Age in weeks	
	Minimum	2	
	Maximum	24	
	Median	12	
Breed of chicken	Sasso	97	80.2%
	Bovans	24	19.8%
Type of production	Broiler	97	80.2%
	Layer	24	19.8%
Source of chicks	Ethiochicken	88	72.73%
	Addis Ababa	7	5.79%
	Grace poultry farms	5	4.13%
	Tsruy farm(Mekelle)	4	3.31%
	Others (14 chicken growers)	17	14.04%

This table presents information about the characteristics of the farms visited. It includes variables such as flock size, age of the flock, breed of chicken, type of production, and source of chicks. For flock size, the table provides minimum, maximum, median values, and standard deviation. The breed of chicken is divided into Sasso and Bovans, with corresponding frequencies and percentages. The type of production is categorized as Broiler and Layer, with frequencies and percentages given. The table also mentions the sources of chicks, including

Ethiochicken, Addis Ababa, Grace poultry farms, Tsruy farm(Mekelle), and Others (14 chicken growers), with corresponding frequencies and percentages.

Table 4 Feeding characterization

Variables		Frequency	Percentage	
Source of feed purchase	Ethiochicken	78	64.46%	
	Mulle Animal feed production agents	30	24.79%	
	Alema Animal feed production agents	5	4.13%	
	Others (7 providers)	9	7.43%	
Use or addition of homemade preparation	Yes	1	0.83%	
	No	120	99.17%	
Additional vitamin provision	Yes	119	98.65%	
	No	2	1.35%	

This table focuses on the feeding practices in the visited farms. The variables include the source of feed and the use or addition of homemade preparation. The source of feed is categorized into Ethiochicken, Mulle Animal feed production agents, Alema Animal feed production agents, and Others (7 providers), with frequencies and percentages provided. The use or addition of homemade preparation is indicated as Yes or No, with corresponding frequencies and percentages. Additionally, there is information on the provision of additional vitamins.

Table 5 Presence of diseased chickens in the farm currently

Variable		Frequency	Percentage
Presence of currently diseased chicks at the farm	Yes	100	82.64%
	No	21	17.36%

This table presents data on the presence of currently diseased chicks on the farms visited. The variable is categorized as Yes or No, indicating whether there are currently diseased chicks on the farm. The frequencies and percentages are provided for each category

Table 6 History of encounter of clinical signs pertinent to vitamin E deficiency

Variable		Frequency	Percentage
Signs pertinent to encephalomalacia (twisting of neck and uncoordinated movement)	Yes	43	35.54%
	No	78	64.46
Signs pertinent to exudative diathesis	Yes	14	11.57%
	No	107	88.43%
Signs pertinent to muscular dystrophy	Yes	24	19.83%
	No	97	80.17%

This table provides information on the history of encountering clinical signs related to vitamin E deficiency. It includes variables such as signs pertinent to encephalomalacia, signs pertinent to exudative diathesis, and signs pertinent to muscular dystrophy. For each variable, the frequencies and percentages are given for Yes and No categories, indicating whether the signs were observed or

not observed.

In addition to the questionnaire, the researcher conducted farm observations to identify clinical signs indicative of vitamin E deficiency. These signs included neck twisting or torticollis, uncoordinated movement, and staggering, which could be attributed to encephalomalacia. Other signs observed were breast edema and wetting, possibly indicating exudative diathesis, as well as emaciation, light weight, and stunted growth, which could be associated with muscular dystrophy. The research findings revealed that 43 farms, accounting for 35.46% of the total, had chicks displaying clinical signs consistent with vitamin E deficiency. The affected chickens ranged in age from two to six weeks. Below are some accompanying images that depict the observed clinical signs.

Figure 1 Dead chickens by vitamin E defficiency

5. DISCUSSION

The results obtained from the study provide valuable insights into various aspects of the visited farms and the characteristics of the respondents. These findings contribute to our understanding of the farming practices, demographics, and potential issues related to vitamin E deficiency in the poultry industry.

The distribution of farms visited by sub-city is highlighted in the "Distribution of the farms visited by sub-city" table. Among the sub-cities, Hawelti had the highest number of farms visited, accounting for approximately 30.57% of the total. This indicates that Hawelti is a significant area for poultry farming. On the other hand, K/Woyane had the lowest number of farms visited, with only 3 farms, representing 2.48% of the total.

The "Respondents' characterization" table provides valuable insights into the demographics of the respondents, focusing on sex, education status, and monthly income from the farm. The data shows that there were slightly more male respondents (57%) compared to female respondents (43%). In terms of education, the majority of respondents had completed high school (42.15%), followed by a degree (16.53%). This suggests that a significant proportion of farm owners/managers have attained higher levels of education. Regarding monthly income from the farm, the data shows a wide range, with a minimum of 50,000 ETB and a maximum of 500,000 ETB. The median income is reported as 30,000 ETB, with a standard deviation of 91,443 ETB, indicating a considerable variation in farm income among the respondents.

Moving on to the "Farm characterization" table, we find information about the characteristics of the visited farms. Flock size varied widely, ranging from a minimum of 50 chickens to a maximum of 10,500 chickens, with a median flock size of 500 chickens. The majority of farms had Sasso breed chickens (80.2%) compared to Bovans breed chickens (19.8%). Broilers were more prevalent (80.2%) compared to layers (19.8%) in terms of production type. Ethiochicken was the most common source of chicks (72.73%), followed by Addis Ababa (5.79%) and Grace poultry farms (4.13%). These findings provide important information about the prevailing chicken breeds, production types, and sources of chicks in the region.

Feeding practices in the visited farms are outlined in the "Feeding characterization" table. The majority of farms relied on Ethiochicken as the source of feed (64.46%), followed by Mulle Animal feed production agents (24.79%). Only a small percentage of farms reported using homemade preparation (0.83%). Additionally, the provision of additional vitamins was common among the farms (98.65%). These findings indicate the predominant sources of feed and the importance of vitamin supplementation in the visited

farms.

The presence of currently diseased chickens on the farms is examined in the "Presence of currently diseased chickens" table. The data shows that 82.64% of the farms visited had currently diseased chicks, while 17.36% did not. This suggests that there may be health challenges or diseases affecting a significant portion of the poultry population in the region.

The "History of encountering clinical signs related to vitamin E deficiency" table explores the occurrence of clinical signs related to vitamin E deficiency. The results indicate that a considerable number of farms reported signs pertinent to encephalomalacia (35.54%), exudative diathesis (11.57%), and muscular dystrophy (19.83%). These clinical signs are consistent with vitamin E deficiency and highlight a potential issue in the visited farms.

In addition to the questionnaire, the researchers conducted farm observations to identify clinical signs indicative of vitamin E deficiency. These signs included neck twisting or torticollis, uncoordinated movement, and staggering, which could be attributed to encephalomalacia. Other signs observed were breast edema and wetting, possibly indicating exudative diathesis, as well as emaciation, light weight, and stunted growth, which could be associated with muscular dystrophy. The research findings revealed that 43 farms, accounting for 35.46% of the total, had chicks displaying clinical signs consistent with vitamin E deficiency. The affected chickens ranged in age from two to six weeks. Accompanying images (fig. 1) depict the observed clinical signs.

6. CONCLUSIONS AND RECOMMENDATIONS

These findings from both the questionnaire and farm observations highlight the significant presence of clinical signs associated with vitamin E deficiency in the visited farms. The high prevalence of these signs suggests that vitamin E deficiency may be a prevalent issue among the poultry population in the region.

Addressing this deficiency becomes crucial to improve the overall health and productivity of the poultry farms.

In conclusion, the results obtained from the study, as presented in the titled tables, researchers' observations, and accompanying images, provide a comprehensive overview of the visited farms, the characteristics of the respondents, feeding practices, presence of diseases, and indications of vitamin E deficiency. These findings, along with the farm observations of clinical signs, can serve as a basis for further research and interventions to address the identified issues and improve the overall health and productivity of the poultry farms in the region.

Based on these conclusions the following recommendations are forwarded

- Increase awareness and education: significant proportion of farm owners/managers have attained higher levels of education, there is an opportunity to enhance awareness and education about the importance of vitamin E in poultry nutrition.
- Training programs and workshops can be organized to educate farmers about the symptoms and consequences of vitamin E deficiency, as well as the appropriate feeding practices and sources of vitamin E-rich feed.

- Improve access to quality feed
- Encourage supplementation and monitoring
- Additional wider and lab based research on nutritional diseases of poultry
- Creating access to laboratory analysis and feed quality control
- Encourage farmers to continue vitamin supplementation

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