Int.J.Curr.Res.Aca.Rev.2022; 10(03): 67-78

EXCELLENT PUBLISHERS

International Journal of Current Research and Academic Review

ISSN: 2347-3215 (Online) Volume 10 Number 03 (March-2022)

Journal homepage: http://www.ijcrar.com

doi:https://doi.org/10.20546/ijcrar.2022.1003.007

The Effect of Feed Supplementation for Cow Milk Productivity and Milk Quality in Ethiopia

Abdi Hassen[1, 2*], Petros chavula[2], SirajShek Mohammed[1] and Abrahim Dawid[3]

[1]*East Hararge, Meta Agricultural Office, Animal productions in Haramaya University, School of Animal and Range Sciences, Haramaya, Ethiopia*
[2]*Africa Center of Excellence for Climate Smart Agriculture and Biodiversity Conservation, Department of climate smart agriculture, Haramaya University, Haramaya, Ethiopia*
[3]*Veterinary Drug and Animal Feed administrations and control authority in Dire-dawa, eastern Ethiopia*

**Corresponding author*

Abstract

Milk and milk products are an important source of food that provides nutritional energy, high-quality protein, minerals, and vitamins. Feed supplementation could be an excellent way to improve nutrient digestibility and absorption in dairy cattle, resulting in higher milk output and productivity by addressing the cow's nutritional needs through a feeding schedule. Whatever improvements in the genetic makeup of local dairy cows, they only account for about 30% of productivity; the remaining 70% depend on nutrition, appropriate supplementary diet, and other factors management. Supplementing different types of feeds and giving a balanced diet has a major effect on milk production and productivity, but not on milk quality. However, milk production efficiency affects milk quality because of the efficiency of nutrient absorption as described by dry matter intake. The ability to increase milk productivity depends on the ingredients formulated in the feed supplement. Even though indigenous milking cows are low milk producers because of the shortage of nutrition and unavailability of feed, if smallholders use appropriate supplementation of different feeds and improve the nutritive values of feeds for dairy cows, the production, productivity, and quality of milk from dairy cows should increase as well.

Article Info

Received: 10 February 2022
Accepted: 10 March 2022
Available Online: 20 March 2022

Keywords

Milk productions, Cow milk productivity, milk quality, and feed supplement.

Introduction

Dairy productions play an important role in the Ethiopian agricultural sector and the national economy (Azage *et al.*, 2013). The sector is a source of livelihoods for a vast majority of the rural population in terms of consumption, income generation and employment. Furthermore, Milk and milk products are an important source of food and contributors to dietary energy requirements, high quality protein, minerals, and vitamins, particularly in vegetarian diets for human (Górska *et al.*, 2019). Ethiopia is known for the largest livestock population in Africa (Metaferia *et al.*, 2011).

The total cattle population for the country is estimated to be about 70 million. Out of 70 million, the female cattle constitute about 56 percent and the remaining 44 percent are male cattle. Dairy cows are estimated to be around 7.56 million and milking cows are about 15.04 million heads (CSA, 2020). Although for the large dairy cattle

population, milk production per cow per day is very low in Ethiopia that has great importance for human's consumptions. this Low productivity is primarily due to inefficient nutritional and management practices, low genetic potential of the indigenous cows, high levels of disease and parasitic incidence, poor access to extension and credit services, and inadequate information to improve animal performance, lack of feeds availability and poor nutrition during the dry season and a lack of high-quality feed supplementations (Zegeye, 2003; Asaminewand Eyasu, 2009 ; Aynalem *et al.,* 2011; Yilma *et al.,* 2011; Getahun, 2012; Belay *et al.,* 2013; Abdi, 2022). Milk consumption is predicted to increase yearly in line with the increasing world population thought global. A greater income potential exists for the availability of milk and milk products to meet human requirements. Feed supplements may be an effective way to improve nutrient digestibility and absorbance in dairy cattle because Shortage of feed was one of the major tailbacks for the development of dairy sector (Martono *et al.,* 2016; Eshetu *et al.,* 2019).

The changes in nutritional ingredients for animals generally and for dairy cattle in particular are therefore directed at enhancing the milk productivity of an individual with increased availability and higher nutrient use efficiency of energy, protein, and other essential nutrients (Tripathi, 2014). High energy supplements such as fat and oils are added to increase the energy density of animal diets, while protein sources of better amino acid composition that are extracted at higher levels for milk synthesis are used in dairy animal diets (Multari *et al.,* 2015; Miri *et al.,* 2013). Technologically producing Feed which hydroponically produced fodder increases the digestibility of the nutrients in the ration, which could increase milk productivity (Abdi, 2022). Energy supplementation is used in dairy cows to increase milk production per cow, stocking rate and milk production per unit of land, improve forage use with a higher stocking rate, maintain length of lactation, and milk protein content (Kellaway and Porta, 1993).

Supplementations are adding a xylanase-cellulase enzyme solution to a dairy cow's total mixed rations based on alfalfa hay and silage reported a possible increase in milk production (Lewis *et al.,* 1999). Others also stated that the use of bovine ST, thrice daily milking, and long day photoperiod can increase milk yield (Dohoo *et al.,* 2003; Rigout *et al.,* 2002). Improved circulating glucose may have supported increased lactose synthesis and therefore milk yield, because lactose is the osmotic regulator for the mammary glands uptake of water (Rigout *et al.,* 2002). Milk production efficiency could be interpreted as 1 kg of milk yield from 1 kg of dry matter intake by an animal, where the optimal values range from 1.4 to 1.8 milk production efficiency was increase.

Milk production efficiency values could optimize dry matter intake through feed supplements that can improve the digestion and absorption of nutrients (Rigout *et al.,* 2002). This might be related to the building blocks formulation of feed supplement as a source of tannins, saponin, coconut cake, minerals, urea, and molasses that can help increase the production of microbial protein in the rumen so that the use of more efficient fiber and nutrient supply to the host's intestinal utilize increases, especially in the fermentation process and digestion of nutrients. Exogenous feed enzymes help to enhance fiber digestion in the rumen, which could lead to improved feed conversion efficiency (Holtshausen *et al.,* 2011). On a dry matter basis, milk production efficiency increased by 2 to 4% when the ration level of 11 to 22 grams of monensin per ton of total ration dry matter rations was used (Hutjens, 2005).

Some feed supplements contain combinations of materials such as non-protein nitrogen slow release, legumes, molasses, minerals and vitamins. Tannins could protect protein as protein by passing through rumen metabolism at specific doses (Ismael, 2019). Rumen microbes used a cheap source of protein feed that could be used continuously all day by the rumen microbes and was synchronized with the energy expenditure of the ruminant. Fiber use in the rumen would be more efficient and would provide nutrients to the intestine. Minerals, molasses, and vitamins also increase the productivity of dairy cows because they are utilized by rumen microbes that can assist in the process of fermentation and digestibility.

The Most importance of this paper was to combine different feed supplementation for dairy cows to improve milk production and productivity with significant feed and feeding system necessities. Another feed supplements which containing single cell protein and even from seaweed feed have good nutritional value for ruminants, especially for dairy cows' milk production in order to increase their productivity during dry seasons (Syarwani, 2008; Hutjens, 2005). Micro minerals contained in feed supplements (cobalt, selenium, and zinc) increase the activity of rumen microbes and improve the digestibility of feed (Uhi, 2005). Consequently, based on the different literature more

deliberations of relevant information about supplementary feeding for dairy cow is imperative to maximizing milk productions. Therefore, the main objective of this paper was to reviews the effect of feed supplementation on cow milk productivity and milk quality in Ethiopia

The Effect of Feed Supplementation for Cow Milk Productivity and Milk Quality in Ethiopia

Define and concept of supplementary feed for dairy cattle

Supplementary feed is any stuff added to the total diet of the animal to increase the nutritive value of the feed and to increase the content of a single nutrient or compound nutrient. Early in a drought, there is usually plenty of poor quality dry feed, which animals cannot use efficiently. Supplementary feeding at this stage aims to make better use of this feed by supplying those nutrients that the pasture is deficient in so that animals can be cheaply maintained while decisions are being made. Supplements are classified by their ability to supply additional energy, protein, vitamins, and minerals to dairy cows (Moran, 2005). These supplementary feeds include protein supplements (legumes, oilseed cause, meat meal, fish meal), mineral supplements (salt (sodium), limestone (calcium), bone meal (calcium and phosphors), vitamin supplements (natural and synthetic) and energy supplement (fat and carbohydrate like concentrate feed those the high amount of energy and low fiber content and high digestibility with high protein content (kayo, 2019).

In addition, supplemental feeding is only an option when paddock feeding is available. Survival or production feeding should be performed if paddock feed availability is limited. ”Survival feeding” means feeding the animals. The minimum amount of food they need to survive (Paterson, 2007). Dietary supplements are a semi-concentrated source of one or more nutrients used to increase the nutritional value of feeds that improve milk productivity in dairy cows.

Effect of supplementation on production performances of dairy cows by grassing

Supplementary feeding of grazing cows decreases pasture dry matters intake while increases total dry matters intake. Decreasing of pasture dry matters intake is indicated by value of substitution rate. Milk production of high producing grazing dairy cows in early lactation increases linearly as the amount of concentrate increases from 1.8 to 10 kg DM/day with milk response of 1 kg milk/kg concentrate, whereas in late lactation, milk response is lower (Bargo *et al.*, (2003).

In early lactation, cows partition more nutrients toward milk production thus milk response to supplementation may be higher than in late lactation, when more nutrients are directed to BW. Milk production increases with the amount of concentrate supplementation, as well as the milk fat and protein yield, while milk fat percentage decreases. Supplementation of 8.7 kg of corn for the grazing dairy cows (Stojanovic, 2014).

Supplementing dairy cow feed for milk production in Ethiopia

The main objective of a dairy cow feeding routine based on feed supplements is to maximize milk productions by addressing the cow's nutrient requirements (Bach and Cabrera, 2017). The dietary requirements of dairy cows are mostly determined by the amount of milk produced, which is in turn determined by the stage of lactation (the time between calving and the end of lactation).

Pregnancy and maintenance are two more factors that influence nutritional requirements dairy cows (Kebede, 2009). The amount of upkeep required is mostly determined by the cow's weight, ambient temperature, and activity. Because milk production follows a curve (lactation curve), the amount of nutrients needed will vary depending on where on the curve you are (King *et al.*, 2006). During the dry period, the goal should be to feed a diet that promotes the fast-growing fetus, energy storage, and mammary gland regeneration (Lukuyu, 2012.)

Furthermore, when compared to different types of un-supplemented meals, feed supplements can improve milk yield by 20.88 percent and 8.07 percent, respectively. The effect of 4% fat-adjusted milk yield was equivalent to the effect of 0% fat-adjusted milk yield (Martono *et al.*, 2016). Supplemented cows produced suggestively more milk yield than those grazed on natural pasture alone (Kebede, 2009). In additions to this crossbred cows fed urea treated teff straw and wheat straw, respectively and provided with supplemented diet had significantly higher milk yield than for non-supplemented animals of cross bred cows (Mesfin *et al.*, 2009; Getu, 2008). Feed supplementation of dairy cow milk output in various areas varies according to management practices. The following Figure 1 depicts a variety of feeding

supplements on crossbred in various parts of Ethiopia, as well as their milk output.

Composite Different feed to maximize dairy cow productivity

Animal feeding practices in Ethiopia generally rely on local grassland and crop leftovers (Hassen *et al.*, 2010). Crop wastes, including teff, barley, wheat, oats, and cereal straws Stover's from maize, sorghum, and millet, as well as haulms from pulse crops such as peas, beans, lentils, chickpeas, and vetch, are valuable feed supplies (Kebede, 2009). However, feed supply is seasonal, and a lack of green grass is one of the principal reasons for animal nutrition deterioration (Kebede, 2009; Hassen *et al.*, 2010). They are poor in minerals and have low crude protein, digestibility, and consumption (Kebede, 2009). Rumen efficiency, rumen micro-fauna, and milk production performance all suffer as a result of the reduced nutritional load. Lactating cows, for example, are unable to meet their nutritional requirements, i.e., they lose weight and body condition during lactation due to high nutrient demand for milk production. If fed well, 20–25% more milk could be produced from the same livestock (Herrero *et al.*, 2016)

Feed rations should be balanced in terms of quantity, quality, concentrate amounts, protein, mineral, and vitamin content for a healthy and productive cow. Napier grass, Boma Rhodes, lucerne, desmodium, and sweet potato vines are examples of fodder. Desmodium and Napier grass are best intercropped, harvested, and fed together. Depending on individual productivity, a dairy cow should be fed 3 kg of concentrates (dairy meal) every day after calving. Increase the dairy meal rations to an appropriate level to challenge the animals further. When the quantity of helpful bacteria grows, the amount of microbial protein produced also increases.

This, when combined with higher net energy, results in increased milk production. After milking, the cow should be fed dairy food to keep her standing until the teat canal shuts. This helps to prevent mastitis and teat infection.

To increase milk output, farmers should add yeast to their dairy cows' diets or drinking water. The addition of yeast to a dairy cow's diet improves feed digestion, intake, and overall performance and productivity. Yeast extracts boost the amount and activity of beneficial bacteria in the rumen, resulting in a faster rate of ruminal fermentation and a higher net energy output (Lukuyu *et al.*, 2012).

Types of Feed supplements for milking cow's

The milk productions outcome from different authors show that initial milk yield after supplementation plays a positive role in maintaining and improving milk production after the initial feeds supplementation. When compared to early milk production, animals without supplementation exhibited a lower milk yield of 0.70 kg/day. Furthermore, some report show that increased milk production necessitates from dairy cow by the use of high crude protein diets supplementations (Law, 2009; Martono *et al.*, 2016). The quality of feed consumed has an effect on milk output as well. The potential of supplements to provide more calories, protein, fiber, vitamins, and minerals to milking cows is classified. Concentrates, stored fodder, fodder crops, and by-products are all examples. (Dalley, 1997). Energy has a larger effect on milk output than protein (Mekuriaw *et al.*, 2020). Supplements designed with rich protein sources such as coconut meal and urea (NPN), as well as the energy sources cassava and molasses, have a greater effect on milk output than controls.

Energy supplements

Starch and sugar-rich feeds, such as grain and by-product feeds, are used as energy supplements. Energy intake, such as concentrated feed, is a dual-purpose system, as reduced energy intake of low-feed dairy cows is the main cause of low milk yield to improve milk yield. It should be considered essential on any farm. In addition to this supplemental concentrated feed, it is the high energy feed that contributes to minimizing the negative energy balance and has a significant influence on later lactation performance. Therefore, early lactating cows are usually given large amounts of concentrate to increase milk production and maintain physical condition, thereby improving the economic feasibility and efficiency of early lactating cows (Bargo *et al.*, 2003; Senbeta and Taffa, 2019). For this reason, early lactating cows are usually fed a high concentration of concentrated feed to increase the nutritional density of the feed. However, high concentrate diets when consumed for short periods might result in ruminal acidosis and other metabolic disturbances. But twice daily feeding of concentrates is a common practice in many commercial operations (Macleod *et al.*, 2004).

Traditionally, energy supplements are based on cereal grains that include barley, sorghum, wheat, cats, maize, etc. Molasses is a very popular energy source for cattle grazing on tropical pastures. Agri industrial byproducts

are fed as supplements to roughage-based diets, particularly in the dairy production system for milking. Blending with high-energy blends or other concentrates depends on the quality and production level of the base fiber. Agni-Industrial by-products can be used by blending two or more ingredients to make a concentrate at home, or by using a single gradient. These are of special value when feeding cattle primarily in urban or suburban dairy production systems, or in situations where animal performance is relatively likely and high nutritional requirements are required (Schlecht *et al.*, 2019). These by-products are high in energy and/or protein, have low fiber content, high digestibility, and high energy levels compared to other feeds (Tonamo, 2016). Most grains are low in calcium and can be important when feeding high levels of grain early in lactation, where milk fever is a potential problem. The return of milk to supplementary feeding varies greatly where these Responses depend on lactation, supply quality, pasture quality, pasture substitution, and storage density (Castle and Gil, 1983).

Fat supplements

Fat is a concentrated form of energy containing up to 35 MJ / kg Dry Matters. Some farmers cook fats and tallow in grain-based concentrates. Milk's response to fat supplements is on the order of 3 liters of milk, with every 1 pound of fat increasing the fat test by 0.3%. Due to the limited ability of animals to digest fat in the lower gastrointestinal tract, there is an upper limit to the use of bypass fat. When using bypass fat, the total dietary fat should not exceed 7%. Fat comes from the following sources: one third of plant source, one third of Vegetable oil and one third of Bypass fat. Adding fat to a dairy cow's feed generally increases milk yield (when feed energy is limited) and increases milk protein yield, but milk protein concentration usually decreases by 0.1 to 0.2 percent. The metabolic processes that contribute to this reduction in milk protein concentration have received considerable attention, but the mechanism may still be unknown (Schingoethe, 1996; Wu and Huber, 1994). Rumen-protected fat supplements have a positive effect on milk production when concentrates are added at a rate of less than 4 kg DM/day (milk yield less than 30 kg/day). When 0.5 kg/day lumen inert fat was added to 3.3 kg DM/day concentrated barley of pastured cows, the milk fat ratio was higher (4.02-4.36%) (King *et al.*, 1990). Farmers in developed countries often give fat supplements to provide extra energy, but some fats are specially treated to bypass rumen digestion. The fat present in the lumen can cover fiber in the diet and reduce fiber digestion if you eat too much. It was fed to high-yielding cows above 30 L / day early in lactation. (Moran, 2005).

Protein supplement

The nutritional value of some high-protein dietary supplements is urea, cereal legumes, and animal and vegetable protein meals. Urea is a common source of nitrogen, but it is not a protein. It has no energy value and can be 100% degradable within the rumen.

It is primarily used as a substitute for the actual protein source in feed mixes and pellets. Urea is only effective when supplied in combination with energy sources such as grain fruits and corn silage. It is recommended that urea only be fed to animals that have a fully functioning rumen and at a maximum rate of 1 percent of total dry matter intake. Grain legumes are multipurpose; they are good sources of both protein and energy.

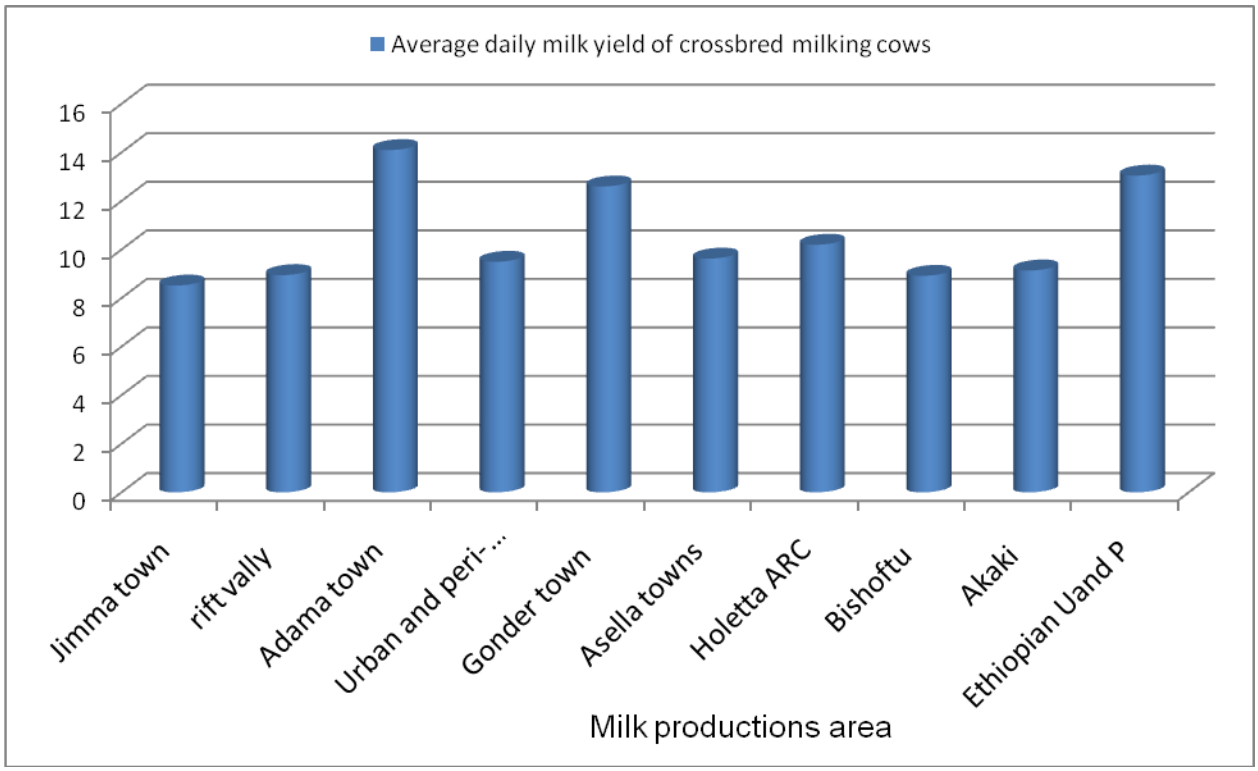
However, their protein is very degradable in the rumen. Fish meal has the highest supply of un-degraded protein and a good balance of amino acids for milk production. Protein meals from plants generally have only moderate levels of undegraded protein. The amino acids supplied in the protein of oilseed meals do not match the requirements of lactating cows the amino acids supplied from animal sources. Results from feeding trials in Australia indicate that milk responses from protein supplements can be up to 1.5 liters per kg supplement than from equal weights of cereal grains. Usually, the responses are much lower when energy is first limited.

In most cases, milk production from tropical pastures is limited primarily by energy (Royal and Tseffery, 1992). When energy is limited, protein supplements give similar milk responses to an equal amount of cereal grains, and surplus nitrogen is converted to ammonia and excreted as urea. However, as the energy supply from cereal grains is increased, the protein content of the diet becomes limited for milk production. Protein supplementation can increase milk yields with only slight changes in milk composition (Kayo *et al.*, 2019).

Table.1 Different Feed Supplementation on the dairy cattle productions and Milk Quality.

Supplements feeding	Effect of feed supplement on milk productivity and quality	Authors
Concentrate feeding	Increased production of milk, butterfat and protein per lactation and a higher condition score.	Negash., 2018
Open forage feeding or Roughage	higher ratio of unsaturated to saturated fatty acids (FA) and a higher content of nutritionally beneficial *trans*-fatty acids than milk from cows fed silage or hay	Davis *et al*., 2020
Concentrate: roughage ratio	recommended feeding to animals at 40:60 rations which improve the level of milk yield percentage and quality	Salomon, 2006
Additives	Buffer added to the diet help reduce the acid load placed on the rumen when high levels of grain are fed.	Michael *et al*., 2001

Fig.1 In different parts of Ethiopia the average daily milk yield of crossbred dairy cows by liters/day/cow



Mineral supplements

In providing proper nutrition to dairy cows, the dairy keeper needs to consider minerals in addition to protein, energy, water, and vitamins. Even though minerals are needed only in small amounts, they are very important for optimum reproduction, immune function, and optimal milk production (Moate, 1987). Minerals are divided into two groups by the amount needed. Macro minerals are required in larger amounts, while micro minerals are required in smaller amounts. The macro minerals required include calcium, phosphorus, magnesium, potassium, sodium, chloride, and sulfur. Required trace minerals include iron, cobalt, copper, manganese, zinc, iodine, and selenium.

Cows get some micro minerals from the feed the yeat (Yadessa, 2015).However, feed and grains do not provide enough feed, so minerals need to be added to the ration to meet the requirements. For example, selenium deficiency can lead to retained placenta. These mineral supplements are taken in various parts of Ethiopian dairy farmers. The amount provided and the animal species given this mineral need further study for proper ration

prescribing. Similarly, Belay *et al.,* (2012) in West Shewa Zone stated that majority of dairy cattle was supplemented with common salt. Additionally, in eastern Ethiopia, it is also acceptable to provide dairy cows with minerals such as salt, which provides to animals during the rainy season (Berihu *et al.,* 2014). Milk production was most affected by the intake of mineral when there were balanced supplements (Hall, 2019). Minerals should only be replenished if the deficiency is corrected. The percentage of farmers using other mineral sources for dairy cattle feeding in the highland was higher than in the mid and lower land, which might be due to the availability of the mineral sources in that particular area. (Hall, 2019). Therefore, supplementing essential minerals to dairy cow feeds increases milk productivity.

Forage and fodder conservation for milking cow

Because rain-primarily based totally pasture and fodder manufacturing is seasonal, there are instances of lots and instances of scarcity (Mugwika, 2019). It is accordingly vital to preserve the extra to be used in instances of dry season scarcity. The goal of conservation is to reap the most quantity of dry depend from a given vicinity and at an surest level for usage through animals. It additionally permits for re-increase of the forage (Mubiru, *et al.*, 2013). The important methods of holding fodder are through making hay or making silage and barely in fodder financial institution form (Anderson, 1981). Fodder vegetation have turn out to be an vital complement to pastures over summer time season and autumn. Some dairy farmers have additionally sown fodder vegetation in autumn to try and fill the iciness feed gap. Some forage vegetation may be poisonous at sure degrees of development. Therefore, their grazing controls have to be mentioned with nearby dairy officials and consultants. In the past, oats have been the handiest fodder crop generally grown as an iciness feed, despite the fact that they're now no longer nicely tailored to grazing. Now it's miles not unusual place exercise to over sow paddocks with annual ryegrasses or to sow ryegrasses as a fodder crop due to the fact they're higher tailored to grazing through cattle (Moate, 1997)

Silage supplements

Silage is high-moisture fodder preserved through fermentation in the absence of air. These are fodders that would deteriorate in quality if allowed to dry. Silage can be made from grasses, fodder sorghum, green oats, green maize or Napier grass. Harvesting stages: Napier grass should be harvested when it is about 1 m high and its protein content is about 10%. Maize and sorghum should be harvested at dough stage, that is, when the grain is milky. At this stage, maize and sorghum grains have enough water-soluble sugars. However, when ensiling Napier grass, it is necessary to add molasses to increase the sugar content and improve silage quality (Kumar, 2019).

Corn silage supplementation to grazing cows may increase milk production if pasture offered is restricted - low pasture allowance, but if pasture is offered ad libitum - high PA, milk production does not change or can decrease (Stojanovic *et al.,* 2014).

Different forms and amounts of hay supplementation reduced pasture dry matter intake, whereas the effect on total dry matter intake depended on the Substitution rate values: with lower Substitution rate (0.33) total dry matter intake was increased, and higher Substitution rate (0.81-0.97) resulted in similar total dry matter intake (Bargo *et al.*, 2003).

Effect of Feed Supplementation on the Milk Quality

Supplementation of different feeds increases the components in milk such as fat, protein, SNF, total solids, density and lactose (Martono *et al.*, 2016).

Chemical composition, particularly milk fat content is used as quality test. Milk fat and protein are most important components of different varieties of most shelf stable milk products. It is therefore very important to determine the major chemical compositions of milk by supplementing high quality feeds (Haile, 2015).

Same value of dry matter intake might not effect on same milk yield and quality, depend on milk production efficiency value. Milk production efficiency describes a quality value of feed for dairy Cows, especially protein quality (Susanti and Marhaeniyanto, 2007; Martono *et al.,* 2016). The yield of milk fat and milk protein was significantly higher for cotton seed cakes supplement compared with other treatments without concentrate supplement and cows fed on clover and Sorghum Stover (Morrison and Pattersonhe, 2007; Broderick and Sterrenburg, 1996; Anila and Muhammad, 2009; Matovu, 2016). Genotype had a significant effect on all milk production parameters, high merit cows had the highest yield of milk, fat, protein, and lactose, whereas the low merit cows had the lowest milk fat, protein, and lactose concentrations (Kennedy *et al.*, 2003; Xue. *et al.*, 2011).

Concentrate Feeding

In Jersey breed feeding of concentrates did result in increased production of milk, butterfat and protein per lactation and a higher condition score. The butterfat and protein percentage of milk was not affected by the feeding of concentrates over two lactations (Meeske *et al.*, 2006). Concentrates rich in energy are feedstuffs such as grain, brans from different cereals, maize and middling's while Concentrates rich in protein include noug seed cake, linseed cake, cotton seed cake, brewers and Grains (Wayu *et al.*, 2021).

How much energy and protein a concentrate mixture should contain will depend on the quality of the basal roughage and the level of production (Negash, 2018). As a rule of thumb, 1 kg good concentrate will increase milk production by 1.5 kg (Yator, 2018).

Open forage feeding

Milk from cows grazed or fed fresh forage, especially from species-rich grasslands or forage legumes, has a considerably higher ratio of unsaturated to saturated fatty acids (FA) and a higher content of nutritionally beneficial *trans*-fatty acids (e.g. vaccenic acid) than milk from cows fed silage or hay (Kalač, 2010).

A low-input feeding system based on grazing increases them proportion of beneficial FAs (Frelich *et al.*, 2009; Davis *et al.*, 2020). Additionally, Multi-nutrient supplement that rises milk productions and sustains the persistence of productions extended. The high content of crude fibers caused the conceptions of feed decrees whereas when dairy cow got forage feeds as much as 17% dry matters the quality and productions of milk will increase (Suharyono *et al.*, 2018)

Supplementing Concentrate and roughage ratio

Diet can alter fat and milk protein content of milk. The lactose and mineral content of milk do not vary much with dietary manipulations (Looper, www.uaex.edu). Generally, less roughage and high energy feeds will encourage higher fat content with a little increase in protein content to provide a higher protein to fat ratio (Schroeder, 2012). Milk SCC is found be higher than those observed under low concentrate feeding. Some amino acid content may low while others may high under prolonged feeding of concentrate. Similarly, others scholar reported that highest concentrate diet might have an important impudence on mammary health (Xie *et al.*, 2017). It is recommended to feed animals at 40:60 concentrate to roughage ratio in order to improve the level of milk composition percentage and yield (Salamon, 2006). furthermore, Supplementation of feed increased milk fat content contents this means fatty acids in the diet can be transferred directly into milk fat formation that regulate milk yields and quality. Total milk fat production was depend on the balance transfers of long-chain fatty acid ration to milk fat and milk fat synthesis in the mammary gland of dairy cows to improve milk quality(Pramono *et a.*, 2017)

Additives

Nutritional supplementation slightly but significantly increased the contents of casein protein, fat and lactose and frequent milking increased fat and lactose but not protein (Fardet and Rock, 2018; Sorensen *et al.*, 2008). Buffers added to the diet help reduce the acid load placed on the rumen when high levels of grain are fed. Sodium bicarbonate, magnesium oxide or combinations are the primary buffers recommended (Michael *et al.*, 2001). Short summery of Feed Supplementation on the dairy cattle productions and Milk Quality in table 1.

Recommendations

The changes of dietary constituents of animals are therefore directed in enhancing milk productivity of an individual with increased availability and higher nutrient use efficiency of energy, protein and other essential nutrients. For productive cow, feed rations should have a balance of quantity, quality, amounts of concentrates, protein, mineral and vitamins. Supplements are grouped through their capacity to bring more energy, protein, fiber or nutrients and minerals to dairy cow. They originated in the form of concentrates, conserved fodder, fodder crops and by-products. Conserved forages are generally high in fiber. The summary of this review indicated that supplementation of different feed supplement was significantly effect to increase milk productivity because, dry matter have high nutritional value. However, there was a tendency increasing milk yield depending on ingredients formulated in the feed supplement. In addition, milk production efficiency affected to milk quality because of efficiency nutrient absorb was described by dry matter intake. Maximizing milk yield and productivity by meeting the cow's nutrient requirements is the purpose of a feeding package. Additionally, Improvements of genetic make up only contribute up to 30% to production, while the 70% is dependent on nutrition and management. Milk

production increases with the amount of concentrate supplementation especially Corn silage supplementation to grazing cows may increase milk Production as well as milk fat and protein yield, while milk fat percentage decreases

As recommended, Even though indigenous milking cows are low milk producers because of the shortage of nutrition and unavailability of feed, if producers use to appropriate supplementation of different feeds and improve nutritive values of feeds the production, productivity and quality milk cows should increase as well.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article

References

Abdi Hassen Abdula. Contribution of Hydroponic Feed for Livestock Production and Productivity. *Science Frontiers*. 2022;Vol. 3, No. 1, pp. 1-7. doi: 10.11648/j.sf.20220301.11

Anderson, P. M, W. L. Kjelgaard, L. D. Hoffman, L. L. Wilson, and H. W. Harpster. Bauman1981.

Anila M. and Muhammad. S. Q. Variation in milk composition and its relationship with physiological states and management in crossbred cattle under tropical conditions.2009.

Asaminew T, Eyasu S Smallholder dairy system and emergency of dairy cooperatives in Bahir Dar Zuria and Mecha Woredas, northern, Ethiopia. World J Dairy Food Sci. 2009; 4(2):185 192Kenya

Aynalem H, Workneh A, Noah K, Tadele D, Azage T. Breeding strategy to improve Ethiopian Boran cattle for meat and milk production. IPMS (improving productivity and market success) of Ethiopian farmer project, working paper no.26.ILRI (International Livestock Research Institute), Nairobi.2011;

Azage, T., Gebremedhin, B., Hoekstra, D., Belay, B., & Yosef, M. Smallholder dairy production and marketing systems in Ethiopia: IPMS experiences and opportunities for market-oriented development [IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper,2013. 31, p. 4]. Nairobi: ILRI

Bach, A. and Cabrera, V, Robotic milking: Feeding strategies and economic returns. *Journal of dairy science*. 2017; *100*(9), pp.7720-7728.

Bargo F, Muller L D, Kolver E S and Delahoy J E. Invited Review Production and Digestion of Supplemented Dairy Cowson Pasture. J. Dairy Sci, 2003; 86, 1-42.

Belay, D., Azage, T. and B. P., Hegde., Smallholder Livestock Production System in Dandi District, Oromia Regional State, Central Ethiopia. *Global Veterinarian*.2012.;8 (5): 472-479.

Belay, D., Azage, T. and B. P., Hegde., Smallholder Livestock Production System in Dandi District, Oromia Regional State, Central Ethiopia. Global Veterinarian, 2013; 8 (5): 472-479.

Berihu, H., Aleme, A. and Mulata, H., Assessment on Major Production System and Constraints of Livestock Development in Eastern Zone of Tigray; the case of GantaAfeshumWoreda Northern Ethiopia. *Agricultural Science, Engineering and Technology Research*. 2014; 2(1): 01- 09.

Broderick G. and Sterrenburg. E. Effect of replacing alfalfa silage with red clover silage in the diets of lactating dairy cows. Research Summaries. Online. 1996; pp. 113-115.. http://www.dfrc.wisc.edu/ResearchSummaries/RS96_pdfs/RS96- 49.pdf

Castle, Gill Animal production.1983;36: 79-85.

CSA (Central Statistical Agency). Federal Democratic Republic of Ethiopia Central Statistical Agency Agricultural Sample Survey 2020 or 2013 E.C.Volume II, Report on livestock and livestock characteristics private peasant holdings. Addis Ababa, Ethiopia: CSA, 2020.

Dalley, D. E. Effect of energy and protein supplementation on milk production and pasture intake of high producing dairy cows offered high levels of supplement in early lactation. DRDC Milestone Report 4, February 1997.

Davis, H., Chatzidimitriou, E., Leifert, C. and Butler, G., Evidence that forage fed cows can enhance milk quality. *Sustainability*.2020;*12*(9),p.3688.

Dohoo, I. R. Leslie, K. DesCôteaux, L. Fredeen, A. Dowling. P. Preston, A and W. Shewfelt, A meta-analysis review of the effects of recombinant bovinesomatotropin. 1. Methodology and effects on production," Can. J. Vet.Res. 2003;.vol. 67, pp. 241-251.

Eshetu, G., Mummed, Y. Y., & Adugna, M. M. Milk Production, Marketing and Quality in Meta District of Eastern Hararghe Zone,Ethiopia. *Jas.Ccsenet.Org Journal of Agricultural Science*.. 2019; *Vol. 11,N*(April), 535-546. https://doi.org/10.5539/jas.v11n

Fardet, A. and Rock, E.,. In vitro and in vivo antioxidant potential of milks, yoghurts, fermented milks and cheeses: a narrative review of evidence. *Nutrition Research Reviews*. 2018; *31*(1), pp.52-70

Frelich, J., Šlachta, M., Hanuš, O., Špička, J. and Samková, E. Fatty acid composition of cow milk fat produced on low-input mountain farms. *Czech Journal of Animal Science*, 2009;54:532-539

Getahun D Assessment of the livestock extension service in Ethiopia: the case of southern region. Int J SciTechnol Res. 2012; 1(10):24–30

GetuKitaw, Replacement of formulated concentrate mix with vetch (*Viciadasycarpa*) hay to Lactating crossbred dairy cows fed on urea treated wheat straw. M.Sc.Thesis, Alemaya University, Ethiopia. 2008

Górska-Warsewicz, H., Rejman, K., Laskowski, W. and Czeczotko, M., Milk and dairy products and their nutritional contribution to the average polish diet. *Nutrients*, 2019; *11*(8), p.1771.

Hall, H Evaluating the Impact of Feed Supplementation on Productive and Reproductive Efficiency in Smallholder Dairy Cattle in Arusha, Tanzania A. 2019.

Hassen, A., Ebro, A., Kurtu, M. and Treydte, A. C., Livestock feed resources utilization and management as influenced by altitude in the Central Highlands of Ethiopia. Livestock research for rural development. 2010.22(229).

Herrero, M., Henderson, B., Havlík, P., Thornton, P. K., Conant, R. T., Smith, P.,Wirsenius, S., Hristov, A.N., Gerber, M. and ButterbachBahl, K. Greenhouse gas mitigation potentials in the livestock sector. *Nature Climate-Change.*2016., *6*(5), pp.452-461.

Holtshausen, L. Chung, H Y. Gerardo-Cuervo, H. Oba, M. and Beauchemin. K. A. Improved milk production efficiency in early lactation dairy cattle with dietary addition of a developmental fibrolytic enzyme additive," J. Dairy Sci., 2011.,vol. 94, no. 2, pp. 899- 907,

Hutjens, M. F. Dairy efficiency and dry matter intake in Proc. 7th Western Dairy Management Conference, Reno, NV, 2005.pp. 71-76.

Ismael, A.M., Association of molecular structure spectral features with nutrient profiles and availability and milk production performance of newly developed blend-pelleted products in high producing dairy cows.2019.

Kalač P. and Samková E.The effects of feeding various forages on fatty acid composition of bovine milk fat: A review. *Czech Journal of Animal Science*,.2010; 55(12):521–537.

Kayo Garamu. Significance of Feed Supplementation on Milk Yield and Milk Composition of Dairy Cow. Dairy and Vet Sci J.2019; 13(2): 555860.DOI:10.19080/JDVS.2019.13.555860

Kebede, A. B. Characterization of milk production systems, marketing and on-farm evaluation of the effect of feed supplementation on milk yield and milk composition of cows at Bure district, Ethiopia Doctoral dissertation, Bahir Dar University.2009.

Kellaway R. and Porta, S. Feeding concentrates supplements for dairy cows, Dairy Research and Development, Corporation, Melbourne, Australia,1993.

Kennedy, J. P. Dillon, L. Delaby, P. Faverdin, G. Stakelum, and M. Rath,. Effect of genetic merit and concentrate supplementation on grass intake and milk production with Holstein Friesian dairy cows," Journal of Dairy Sci. 2003; vol. 86, no. 2, pp. 610-621,

King, J. M., Parsons, D. J., Turnpenny, J. R., Nyangaga, J., Bakari, P. and Wathes, C. M., Modelling energy metabolism of Friesians in Kenya smallholdings shows how heat stress and energy deficit constrain milk yield and cow replacement rate. *Animal Science*.2006; *82*(5), pp.705-716.

Kumar, R., Year Round Green Fodder Production and Conservation for Sustainable Dairy Farming in India. *Sustainable Agriculture*, 2019; p.38.

Lewis. G. E, Sanchez, W. K., Hunt, C. W. Guy, M. A. Pritchard, G. T. Swanson B. I., and Treacher, R. J. "Effect of direct-fed fibrolytic enzymes on the lactational performance of dairy cows," J. Dairy Sci. 1999;vol. 82, pp. 611-617,

Lukuyu B, Gachuiri C K, Lukuyu M N, Lusweti C and Mwendia S (eds). Feeding dairycattle in East Africa. East Africa Dairy Development Project, Nairobi, Kenya.2012.

Macleod G K, Coluccil P E, Moore A D, Grieve D G, Lewis N. The effects of feeding frequency of concentrates and feeding sequence of hay on eating behavior, ruminal environment and milk production in dairy cows. Canadian Journal of Animal Science.2004; 74: 103-113.

Martono, Setiawan, Windu Negara, Ruslan Abdul Gopar, and Muhamad Nasir Rofiq. Combination Effect of Feed Supplements on Milk Yield and Milk Quality of Dairy Cattle. *Journal of Advanced Agricultural Technologies*2019; Vo.3. 136–39.doi: 10.18178/joaat.3.2.136-139.

Matovu, M. Feed and feed supply characterization on peri-urban smallholder dairy farms with improved breeds in the tigray region, northern Ethiopia in Doctoral dissertation, KatholiekeUniversiteit Leuven.2016

Meeske, R., Rothauge, A., G. D. van der Merwe. andGreyling, J.F. The effect of concentrate supplementation on the productivity of grazing Jersey cows on a pasture-based system. *South African Journal of Animal Science.*2006; 36(2).

Mekuriaw, S., Tsunekawa, A., Ichinohe, T., Tegegne, F., Haregeweyn, N., Kobayashi, N., Mekuriaw, Y., Walie, M., Tsubo, M. and Okuro, T., Effect of Feeding Improved Grass Hays and Eragrostistef Straw Silage on Milk Yield, Nitrogen. 2020.

Mesfin Dejene, Seyoum Bediye, Aemiro Kehaliw, Getu Kitaw and Kedir Nesha, On-farm evaluation of lactating crossbred milk cows fed a basal diet of urea treated teff (Eragrostistef) straw supplemented with escape protein source during the dry season in crop-livestock production system of north *Shewa*, Ethiopia. Livestock Research for Rural Development.Volume 21, Article #61. Retrieved April 5, 2009, from.http://www.lrrd.org/lrrd21/5/deje21061.htm

Metaferia, F., Cherenet, T., Gelan, A., Abnet, F., Tesfay, A., Ali, J. and Gulilat, W. Review to Improve Estimation of Livestock Contribution to the National GDP. Ministry of Finance and Economic Development and Ministry of Agriculture.Addia Ababa, Ethiopia. 2011.

Michael, L., Looper, Sandra, R., Stokes, Dan, N., Waldner and Ellen, R. J. Managing milk composition, feed additives and production enhancer's extension dairy specialist, New Mexico State University. 2001.

Miri, V. H., Tyagi, A. K., Ebrahimi, S. H. and Mohini, M. Plant extract enhanced ruminal CLA concentration, in vitro. *Journal of Animal and Feed Sciences*.2013; *22*(3), pp.219-228.

Moate, P J. Mineral supplements for locating cow's Dairy production research report 1987. Department of Agriculture, Victoria, pp.74-77.

Moate, P. J., Dalley, D. E., Roche, J. R. and Grainger, C. Fodder turnips and supplements for dairy cows grazing dryland summer pasture. Final Report to the DRDC Dav 344, September 1997

Moran, J. Tropical dairy farming: feeding management for small holder dairy farmers in the humid tropics, Landlinks Press. 2005; pp, 312

Morrison S. J. and D. C. Pattersonhe "Effects of offering a range of forage and concentrate supplements on milk production and dry matter intake of grazing dairy cows," J. Grass and Forage Science, 2007; vol. 62, no. 3, pp. 332-345,

Mubiru, R., Namirimu, T., Owino, S., Kyalingonza, L., Nyadoi, P. and Buyinza, J. From Extensive to Semi-intensive Livestock Production Systems in Uganda's Albertine Rift: Practical Interventions Manual. *UWS and BDLG, Uganda*. 2013

Mugwika, P. K.,. Assessment of the Impacts of Climate Change and Variability on Food Security in Kenya: a Case Study of Kisii County (Doctoral dissertation, University of Nairobi).2019

Multari, S., Stewart, D. and Russell, W.R., Potential of fava bean as future protein supply to partially replace meat intake in the human diet. *Comprehensive Reviews in Food Science and Food Safety*.2015. *14*(5), pp.511-522

Negash, D., Review on Dairy Cow Feed and Feeding Aspects in Ethiopia. *CPQ Nutrition*, 2018; *1*(1), pp.01-19

Paterson. Supplementary feeding of cattle prime-fact.2007.341, www.dpi.nsw.gov.au/primefacts

Pramono, A Handayanta, E Widayati, D T PutroP and Kustono. Dietary Protected Feed Supplement to Increase Milk Production and Quality of Dairy Cows.*IOP Publishing*, 2017; doi:10.1088/1757-899X/193/1/012034

Rigout, S. Lemosquet, S. Bach, A. Blum, J. W. and Rulquin, H. "Duodenal infusion of glucose decreases milk fat production in grass silage-fed dairy cows," J. Dairy Sci.2002; vol. 85, pp. 2541-2550,

Royal A JE, Tseffery H. Energy and protein supplements for dairy cows grazing tropical pasture. Proceeding of the Australian society at animal production. 1992; pp. 292-295.

Saba Haile, Quality Assessment of Cattle Milk in AdeaBerga and Ejerie Districts of West Shoa Zone, Ethiopia. MSc in agriculture (Animal productions) Haramaya, Ethiopia: Haramaya university. 2015;http://hdl.handle.net/10568/76187

Salamon, R., Varga-Visi, É., Sára, P., Csapó-Kiss Zs. and Csapó, J. East African Standard Pasteurized milk Specification. 2006. 1-5.

Schingoethe, D. J. Dietary influence on protein level in milk and milk yield in dairy cows. Anim. Feed Sci. Tech. 1996; 60:181-190.

Schlecht, E., Plagemann, J., Mpouam, S. E., Sanon, H. O., Sangaré, M. and Roessler, R., Input and output of nutrients and energy in urban and peri-urban livestock holdings of Ouagadougou, BurkinaFaso.

Nutrient Cycling in Agro ecosystems. 2019; *115*(2), pp.201-230

Schroeder, J. W. Dairy cow nutrition affects milk composition. NDSU Extension Service.2012.

Senbeta K, Taffa G Effect of Concentrate Feeding Levels and Frequency on Performance of Crossbred Dairy Cows. J Vet Sci Technol. 2019; 10: 582

Sorensen, A., Muir, D. D. and Knight, C. H. Extended lactation in dairy cows: effects of milking frequency, calving season and nutrition on lactation persistency and milk quality. *Journal of Dairy Research.*2008; 75(1):90-97.

Stojanovic, B., Grubic, G., Dordevic, N., Božickovic, A. Ivetic, A. Supplementary feeding of grazing dairy cows. Proceedings of the International Symposium on Animal Science 2014, September, Belgrade-Zemun.

Suharyono S. N. WHardani, P. D Sitoresmi, adiarto Effects of Feed Supplementation in Friesien Holstein Crossbreed Cows at the First Quarter on the Production and Quality of Milk, IOP Conference Series: Earth and Environmental Science.2018.doi :10.1088/1755-1315/119/1/012044

Susanti S. and Marhaeniyanto, E. "Correlation between Nitrogen digestibility and retention with milk production in crossbreed friessianholstein with pollard and rice brand," Jurnal Protein. 2007; vol. 15, no. 2, pp. 130-135,

Syarwani, M. Single cell protein production from *Aspergillus oryzae* enriched with minerals Ca and P," JurnalTeknologiSeparasi, 2008. vol. 1

Tonamo, A. A review on cattle husbandry practices in Ethiopia. *International Journal of Livestock.*2016; *Production*, *7*(2), pp.5-11.

Tripathi, M. K., Effect of nutrition on production, composition, fatty acids and nutraceutical properties of milk. *Advances in Dairy Research*.2014; pp.1-11.

Uhi, H. T. Catalytic supplement based on gelatinized sago, NPN, and micro minerals for ruminant in marginal areas, Doctoral program dissertation, Post Graduate Scholl Bogor Agricultural Institute, Bogor, 2005.

Wayu, S., Gebremariam, T. and Tesfay, Z., Effect of supplements on feed utilization of Tigray Highland sheep fed a basal diet of barley straw. *Tropical Animal Health and Production*. 2021; *53*(1), pp.1-11.

Wu, Z., and Huber. J. T. Relationship between dietary fat supplementation and milk protein concentration in lactating cows: a review. Livest. Prod. Sci. 1994;.39:141-155

Xie, Z. L., Zhang J., Zhang, D. M, Li, J. F. and Lin, Y. H. Effect of a high concentrate diet on milk components and mammary health in Holstein dairy cows. Genetics and Molecular Research.2017;.16(1).

Xue, B., Yan, T., Ferris, C. F. and Mayne, C. S., Milk production and energy efficiency of Holstein and Jersey-Holstein crossbred dairy cows offered diets containing grass silage. *Journal of dairy science*, 2011; *94*(3), pp.1455-1464

Yadessa, E. Assessment of feed resources and determination of mineral status of livestock feed in Meta RobiDistrict, WestShewa zone, Oromia Regional State, Ethiopia. MSc thesis in Animal Production. Ambo, Ethiopia: Ambo University. 2015; https://hdl.handle.net/10568/61854

Yator, M. J. Evaluation of compounded supplementary concentrate on milk yield and quality among holsteinfriesian cattle (Doctoral dissertation, University of Eldoret). 2018.

Yilma, Z., Guernebleich, E., Sebsibe, A. and Fombad, R., A review of the Ethiopian dairy sector. Addis Ababa, Ethiopia: FAO Sub Regional Office for Eastern Africa (FAO/SFE).2011.

Zegeye Y Challenges and opportunities of livestock marketing in Ethiopian: Proceedings of the 10th annual conference of Ethiopian society of animal production (ESAP), 22–24 August 2002 held in Addis Ababa, Ethiopia. 2003; pp. 47–54.

How to cite this article:

Abdi Hassen, Petros chavula, SirajShek Mohammed and Abrahim Dawid. 2022. The Effect of Feed Supplementation for Cow Milk Productivity and Milk Quality in Ethiopia. *Int.J.Curr.Res.Aca.Rev.* 10(03), 67-78. doi: https://doi.org/10.20546/ijcrar.2022.1003.007