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Analysis of Free Fatty acids, Organic Acids and Sugars in *Azolla filiculoides*-Supplemented Cow feed

Shilpa, P. Raikar[1], Sharadadevi Kallimani*[2]

[1,2]Department of Studies in Environmental Science, Davangere University, Shivagangothri, Davangere, Karnataka, India.

Abstract

The dairy industry in India plays a pivotal role in rural development, employment, and nutritional security, making the quality of milk produced a key factor for both consumer health and economic viability. Enhancing milk quality, particularly in terms of fat, protein, and casein content, is essential for the production of high-value dairy products. *Azolla filiculoides*, a nutrient-rich and sustainable feed supplement, has shown potential to significantly improve these milk quality parameters. In a study involving 20 lactating HF crossbreed cows, *Azolla* supplementation led to notable increases in milk yield, with improvements ranging from 13.70% to 30.89%. FFA levels increased from 0.20-0.48 mmol/100g to 0.29-0.59 mmol/100g. Lactic acid levels remained stable between 0.10% and 0.14% for most of the cows. Citric acid concentrations ranging from 0.139% to 0.147%. Most cows, exhibited decreases in ammonium sulfate, The minor variations in melamine suggest that *A. filiculoides* does not significantly affect the milk. While, *Azolla* enhances fat and protein content, it does not significantly alter milk sugars. The supplementation also maintained stable lactic and citric acid levels and had no significant impact on contaminants like ammonium sulfate and melamine, ensuring the safety and quality of milk. These results highlight *A. filiculoides*as an effective, sustainable feed supplement that enhances milk quality, supporting the dairy industry's objectives of improving nutritional outcomes and economic sustainability.

Keywords: *Azolla filiculoides*, Fatty acids in milk, Organic acid, Dairy cattle nutrition, Sustainable dairy farming.

Introduction

Milk, as a primary product of this industry, plays a crucial role in the daily lives of Indians. It serves as a major source of essential nutrients, particularly for a largely vegetarian population, and its per capita availability in India is significantly higher than the global average, ensuring nutritional security for many (Pandey et al., 2024; Ramani et al., 2023). Milk also holds cultural significance in India, being a key component of various culinary traditions and dietary practices, with products ranging from milk to cheese and yogurt contributing to a balanced diet (Brown et al., 2022; Balasubramanian, 2024).

Despite its benefits, the dairy industry faces challenges, particularly in ensuring milk quality. Issues such as adulteration and contamination pose health risks and affect consumer trust, while the lack of traceability in the supply chain, especially in rural areas, complicates quality control efforts (Miciński et al., 2012; Nayana et al., 2023; Rao, 2016). Only a fraction of milk is processed through organized channels, making it difficult to maintain consistent quality.

Feed supplements play a vital role in enhancing cattle nutrition, improving feed efficiency, productivity, and overall health. These supplements, ranging from probiotics to specific nutrient additives, are crucial in boosting milk yield and enhancing the nutritional value of milk (Hassen et al., 2022). However, normal feed often leads to nutritional imbalances, inefficiencies, and environmental impacts. Issues like low protein utilization and poor conversion rates contribute to reduced productivity and increased environmental pollution from nitrogen waste, highlighting the need for alternative, sustainable feed supplements (Kovalenko et al., 2024; Zhao, 2018). Addressing these challenges is essential for the continued growth and sustainability of India's dairy industry.

A. filiculoides, a species within the *Azolla* genus, is particularly noted for its versatile applications, including phytoremediation, biofuel production, and livestock feed supplementation. This species is highly effective in accumulating and degrading contaminants such as arsenic, heavy metals, and polycyclic aromatic hydrocarbons (PAHs). Studies have demonstrated up to 100% removal efficiency for copper and over 90% biodegradation rates for organic pollutants like naphthalene (Biswas and Ganesan, 2024; Abdulwahab et al., 2022; Zazouli et al., 2023; Kösesakal and Seyhan, 2022). In biofuel production, *A. filiculoides* serves as a promising feedstock, capable of being converted into bioethanol through optimized processes that achieve high alcohol yields, and it is also a potential source for biodiesel, meeting international standards through optimized transesterification processes (Christy et al., 2024; Ahmad et al., 2023; Sundararaman, et al., 2024).Additionally, *A. filiculoides*is a cost-effective feed resource, rich in amino acids, minerals, and vitamins, enhancing livestock productivity, particularly in regions facing feed shortages. Beyond its use in feeding, it contributes to soil fertility improvement and can be used in composting and biogas production, further expanding its agricultural benefits (Alebachew et al., 2024). The nutritional composition of *Azolla* includes a high protein content ranging from 21% to 30% dry matter, making it a valuable feed supplement comparable to conventional protein sources like soybeans and maize (Kumar et al., 2020; Nasir et al., 2022; Alebachew et al., 2024). In addition to its protein, *Azolla* contains essential fatty acids and active compounds such as phenolics and tannins, which enhance its nutritional profile (Nasir et al., 2022). When used as a supplementary feed, *Azolla's* high protein and nutrient content can significantly improve growth rates and productivity in livestock, including cattle (Nasir et al., 2022; Alebachew et al., 2024).

Azolla can be easily cultivated in water bodies, particularly in tropical and subtropical regions, providing a sustainable and low-cost feed resource for cattle (Kumar et al., 2020; Alebachew et al., 2024). It is commonly used as a supplementary feed alongside other feed resources to enhance feed intake, growth, and milk yield in dairy cattle (Alebachew et al., 2024). The use of *Azolla* as a feed supplement can reduce reliance on expensive commercial feeds, thereby lowering the cost of milk production and improving the economic viability of cattle farming (Kumar et al., 2020).Research has consistently shown that *Azolla* can be effectively incorporated into livestock diets, including cattle, to enhance nutritional intake and productivity. Studies have demonstrated that supplementing cattle diets with *Azolla* positively impacts milk yield and growth performance, confirming its potential as a valuable feed supplement (Kumar et al., 2020; Alebachew et al., 2024).

The aim of this study was to assess the impact of supplementing the diet of dairy cows with *A. filiculoides*on various milk quality parameters, including compositional elements such as FFA, lactic acid,citric acid and free fatty acids. Additionally, the study sought to evaluate the effects of *A.*

filiculoides on potential contaminants like ammonium sulfate and melamine in the milk. The need for this study arises from the growing demand for sustainable and cost-effective dietary supplements that can enhance milk production and improve its nutritional quality, while also ensuring the safety of dairy products. As *A. filiculoides* is known for its rapid growth, high nutritional content, and environmental benefits, this study aimed to explore its potential as a valuable addition to dairy cow diets, contributing to both the economic viability of dairy farming and the nutritional quality of milk.

Materials and Methods

Site Selection for *A. filiculoides* Cultivation

The cultivation of *A. filiculoides*was strategically established within Mr. Raghavendra Bhat's coconut plantation farm located in Mittlakatte, Davangere district. This site was deliberately chosen due to its convenient proximity to essential amenities such as the residence, water source, and road access, which facilitated regular maintenance and monitoring of the cultivation pond. To create an optimal environment for *A. filiculoides*growth, careful preparation was undertaken. The pond floor was meticulously leveled, with all potential obstacles such as stones, roots, and sharp objects removed to ensure a smooth and unobstructed surface. Consistent water levels were maintained throughout the pond to create an ideal habitat for *A. filiculoides*, promoting uniform growth. Additionally, shading was provided to minimize water evaporation, helping to conserve water and sustain the necessary conditions for the fern's healthy development.

Pond Construction and *A. filiculoides* Cultivation

For the cultivation of *A. filiculoides*, three carefully constructed cement concrete tanks were utilized, each measuring 6 feet in length, 3 feet in width, and 2 feet in depth. These tanks provided a stable and spacious environment conducive to the growth of *A. filiculoides*. A uniform layer of finely sifted fertile soil, about 10-15 centimeters thick, was mixed with cow dung and 5-6 kilograms of vermicompost, creating a nutrient-rich base. This mixture was then moistened to form a slurry, which was evenly spread across the pond floor. The water level in the pond was maintained at three-fourths capacity, with regular monitoring to ensure consistency. Following pond preparation, a pure culture of *A. filiculoides*sourced from Krishi Vigyan Kendra, Davangere, Karnataka, was introduced into the pond. Water temperature was carefully regulated between 20-30°C, and pH levels of both the organic matter at the bottom and the surface water were routinely tested to maintain optimal conditions. To control sunlight exposure and prevent contamination, a green net was installed over the pond. Systematic maintenance, including pest and disease management, was conducted to ensure the health of the *A. filiculoides*culture. Every six months, the pond was emptied, and a fresh culture was introduced to sustain optimal growth conditions.

Harvesting of *A. filiculoides*

Once inoculated under favorable environmental conditions, *A. filiculoides* typically completes its growth cycle within two weeks. Harvesting is conducted using a plastic tray equipped with a mesh sieve, which allows for efficient water drainage. After harvesting, the *A. filiculoides* undergoes thorough washing to eliminate any cow dung odor and to separate smaller plantlets that may pass through the sieve. The cleaned *A. filiculoides* is then weighed, sun-dried for 2-3 days, and stored in airtight bags to preserve its quality until needed.

Impact of *A. filiculoides* Supplementation on Milk Yield and Nutrient Utilization in Lactating Dairy Cows

The study involved 20 lactating HF crossbreed cows in their second to fourth lactation, sourced from Rajappa Naik, a farmer in Jarikatte, Davangere district. These cows were selected to assess the impact of *A. filiculoides* supplementation on milk production and nutrient efficiency. Each cow received a daily supplement of 1 kg of *A. filiculoides*, cultivated at Mr. Raghavendra Bhat's coconut plantation farm in Mittlakatte, Davangere district, along with 2 kg of standard cow feed. Prior to introducing the *A. filiculoides* supplementation, the cows were monitored as control subjects for two months to establish baseline data on key milk components, which are essential for evaluating cow health, milk production, and overall dairy quality. This control phase provided a foundation for comparing the effects of *A. filiculoides* supplementation on the cows' milk yield and nutrient efficiency.

The study will measure key milk components, including Lactic acid will be monitored as a marker of feed fermentation, supporting digestive health, while sucrose and lactose are important for energy balance and efficient milk synthesis. Milk density, influenced by fat and SNF, will be assessed to gauge richness and quality. Additional components such as galactose, urea, maltodextrin, maltose, casein, ammonium sulfate, citric acid, starch, sorbitol, free fatty acids (FFA), and melamine will also be evaluated to ensure milk safety and quality. These analyses will be conducted at Shivamogga Milk Union Limited (SHIMUL) in Harihara, Davangere district. During the two-month *Azolla* supplementation period, cows will be monitored daily for milk yield, housed in well-maintained shelters, and milked twice daily at 5 a.m. and 5 p.m. to ensure accurate data collection.

Results and Discussion

The various stages and components involved in the cultivation and supplementation of *A. filiculoides* in dairy cow feed trials is depicted in figure1 (A-G). The pond is prepared for *A. filiculoides* cultivation with a levelled soil base.This is followed by the application of a cow dung slurry, which provides essential nutrients for the growth of *A. filiculoides*. The robust proliferation of *A. filiculoides* is evident 15 days post-inoculation, demonstrating its rapid growth. The HF cow breeds selected for the study are also featured, highlighting their role in the feeding trials. The harvested *A. filiculoides* is shown, ready to be used as a supplementary feed, emphasizing its potential as a nutrient-rich addition to the cows' diet.

Milk Quality Indicators

The comparison of milk quality indicators after *A. filiculoides* supplementation aligns with existing literature, demonstrating both improvements and stability in key components of milk.

FFA Content

The FFAs are crucial for milk quality, affecting taste, shelf life, and nutritional value. In this study, FFA levels increased from 0.20-0.48 mmol/100g to 0.29-0.59 mmol/100g post-supplementation. Cows C1, C8, C9, A10, and A10 showed significant increases in FFA content, with cow C8's FFA rising from 0.39 mmol/100g to 0.58 mmol/100g. This aligns with findings by Nasir et al. (2022), which suggest that Azolla can enhance the fatty acid profile of milk, particularly by increasing the proportion of unsaturated fatty acids (MUFA and PUFA). However, the potential impact of higher FFA levels on casein and protein content should be managed carefully to avoid negative effects, as noted by Hanuš et al. (2018) and Chaudhary et al. (2017). Thus, the study found that *A. filiculoides* supplementation leads to modest improvements in SNF and TS percentages, as well as milk density, with more pronounced effects on milk fat content and FFA levels (Table 1). These findings are consistent with the existing literature, supporting *A. filiculoides* as a beneficial supplement for improving milk quality and production. The slight increases in SNF and TS, combined with stable urea levels and improved fatty acid composition, reinforce the potential of *A. filiculoides* to enhance the nutritional profile of dairy milk while maintaining essential milk quality components.

Organic Acid and Fermenters

Lactic Acid

Lactic acid plays a crucial role in dairy fermentation, especially in the production of products like cheese and yogurt. It is produced by lactic acid bacteria (LAB), such as Lactococcus lactis, during the fermentation of lactose, contributing to milk's acidity, flavor, and protein coagulation (Kondrotienė et al., 2023; Quiroz, 2022). The acidification process driven by LAB enhances the nutritional quality and shelf life of dairy products by lowering the pH, which inhibits spoilage organisms and serves as a natural preservative (Ağagündüz et al., 2022; Sharma et al., 2021).

In the study, *A. filiculoides* supplementation led to minimal changes in lactic acid levels, which remained stable between 0.10% and 0.14% for most cows. For example, cow C1's lactic acid content increased slightly from 0.10% to 0.11%, and cow C2's levels rose from 0.11% to 0.13%. However, cows like C4 and A2 experienced slight decreases in lactic acid from 0.15% to 0.13%. The majority of cows, such as C6, C7, and C8, maintained stable lactic acid levels between 0.13% and 0.14%. These findings suggest that *A. filiculoides* supplementation did not significantly affect lactic acid production, indicating stability in fermentation processes and overall milk acidity. This aligns with the literature, which indicates that dietary changes, including Azolla supplementation, do not significantly alter milk's lactic acid content or fermentation-related qualities (El-Naggar & El-Mesery, 2022; Mathur et al., 2013).

Citric Acid

Citric acid is essential for milk's flavor and biochemical stability, with typical concentrations ranging from 0.139% to 0.147%. It plays a critical role in the mineral balance and microbial stability of milk, influencing its quality, flavor, and resistance to spoilage (Yusa et al., 1969; Oshima& Fuse, 1981). Factors such as lactation stage and udder health can affect citric acid levels, with higher concentrations observed in early lactation and lower levels in cases of subclinical mastitis.

In this study, citric acid levels remained relatively stable following *A. filiculoides* supplementation, with only minor changes. Before supplementation, citric acid percentages ranged from 0.11% to 0.18%, and after supplementation, they ranged from 0.14% to 0.16%. For example, cow C2's citric acid content increased slightly from 0.11% to 0.16%, while cows C5 and C6 experienced slight decreases from 0.17% to 0.14% and 0.16% to 0.14%, respectively. Most cows, including C8, C9, and C10, maintained stable citric acid levels around 0.15%. These results suggest that *A. filiculoides* supplementation does not significantly affect citric acid levels, preserving the milk's flavor and stability. This finding is consistent with the literature, which indicates that citric acid levels are generally stable despite dietary changes (Celik, 2022). The stability of citric acid in milk is important for maintaining flavor and preventing microbial spoilage, particularly in protecting against spoilage bacteria like Pseudomonas fluorescens (Celik, 2022). Overall, this study found that *A. filiculoides* supplementation had a neutral effect on both lactic acid and citric acid levels in milk (Table 2), suggesting stability in these components and indicating that the supplement does not significantly alter the milk's acidity or flavor. This aligns with the broader literature, which supports the use of Azolla as a dietary supplement without compromising milk quality, particularly in terms of organic acids essential for dairy fermentation and stability (El-Naggar & El-Mesery, 2022; Yusa et al., 1969; Oshima& Fuse, 1981).

Sugars and Sweeteners

The integration of carbohydrates like sucrose, maltodextrin, maltose, sorbitol, and starch into dairy cow diets can significantly influence milk yield and composition, as well as the metabolic processes in cows.

Sucrose Levels

Sucrose plays an essential role in maintaining ruminal pH and supporting milk yield when used as a replacement for starch in cow diets. According to Ravelo et al. (2022) and Gao & Oba (2016), sucrose supplementation in dairy cows helps stabilize ruminal conditions without significantly affecting nutrient digestibility. In this study, A. filiculoides supplementation led to minimal changes in sucrose levels, with some cows showing slight increases (e.g., C2, C4, and A4), while others exhibited slight decreases (e.g., C6 and A5). Most cows showed no change, indicating a negligible impact of A. filiculoides on sucrose levels in milk. These findings align with literature indicating that sucrose in cow diets contributes to stable milk yield without major alterations in milk composition.

Maltodextrin Levels

Maltodextrin affects the carbohydrate profile of milk, influencing its texture and stability, particularly in processed dairy products (Fedorova et al., 2020). This study found slight variations in maltodextrin levels after *A. filiculoides* supplementation, with cows like C7 and A4 exhibiting increases and others, like C2, C6, and A6, showing minor decreases. This minimal change suggests that *A. filiculoides* does not significantly alter maltodextrin content, aligning with previous studies that highlight the relatively stable effect of dietary carbohydrates on maltodextrin in milk (Fedorova et al., 2020).

Maltose Levels

Maltose, another carbohydrate component in milk, generally increased in most cows after *A. filiculoides* supplementation. For instance, cows C9, A1, and A10 showed notable increases, suggesting a positive impact of *A. filiculoides* on maltose levels. This aligns with research showing that high-starch diets can enhance glucose absorption and potentially influence milk protein production, although they may also cause a depression in milk fat (Li et al., 2023). Conversely, cows C5 and C6 exhibited decreases in maltose levels, reflecting individual variation in response to the supplement.

Sorbitol Levels

Sorbitol levels, which are often associated with sweetness and stability in food products, generally decreased after *A. filiculoides* supplementation. For example, cows C5, A5, and A10 showed significant reductions, while others, like C3, C4, and A1, exhibited stable or slightly increased levels. This mixed response indicates that *A. filiculoides* may not have a uniform effect on sorbitol levels across all cows. This variability highlights the complexity of dietary interventions in cows, as sorbitol metabolism can be influenced by factors such as the cow's overall health and metabolic state.

Starch Levels

Starch, a key energy sthisce for dairy cows, typically improves glucose absorption and milk protein production but may also contribute to milk fat depression (Li et al., 2023). This study found that starch levels decreased notably in most cows after *A. filiculoides* supplementation, particularly in cows C5, C8, and C10. However, some cows, such as A5 and A10, showed increases, suggesting a complex interaction between *A. filiculoides* and starch metabolism. These results align with previous studies emphasizing the variable impact of high-starch diets on milk composition, depending on individual cow factors and overall diet composition (Li et al., 2023).

The supplementation of *A. filiculoides* resulted in varied effects on the sugar and carbohydrate components in milk (Table 3). Sucrose and maltodextrin levels showed minimal changes, indicating a limited impact of *A. filiculoides* on these parameters. In contrast, maltose levels generally increased, while sorbitol levels decreased, reflecting a complex response to the dietary change. Starch levels decreased in most cows but increased in a few, indicating individual variability in the response to the supplement. These findings align with the broader literature, which underscores the nuanced effects of dietary carbohydrates on milk composition. While *A. filiculoides* improves milk yield, its impact on specific carbohydrate components is less clear and warrants further investigation (Gao & Oba, 2016; Ravelo et al., 2022; Fedorova et al., 2020). This variability suggests that individual cows may respond differently to dietary supplementation, highlighting the complexity and multifaceted nature of *A. filiculoides*' impact on milk composition.

Contaminants

The fraudulent addition of ammonium sulfate and melamine to cow's milk has been a significant concern due to their ability to artificially boost protein content while posing serious health risks, particularly kidney damage in infants as a result of melamine contamination (Chu & Wang, 2013; Mansthis et al., 2017; Salman et al., 2012). This study, investigated the effects of *A. filiculoides* supplementation on ammonium sulfate and melamine levels in cow's milk.

Ammonium Sulfate

Ammonium sulfate is sometimes fraudulently added to milk to increase the nitrogen content, which is used to calculate protein levels using methods such as the Kjeldahl test. However, this practice can be dangerous and is considered food adulteration. In this study, the levels of ammonium sulfate showed slight changes after *A. filiculoides* supplementation. Most cows, such as C1, C2, and C6, exhibited decreases in ammonium sulfate, with levels dropping from 0.02 to 0.01, 0.09 to 0.01, and 0.02 to 0.01, respectively. In contrast, some cows, such as C4 and C9, showed slight increases from 0.01 to 0.02. Notably, cows like C3, C5, and A10 showed no presence of ammonium sulfate after supplementation. These findings suggest that *A. filiculoides* supplementation had only minor effects on ammonium sulfate levels, with slight decreases observed in most cows, indicating a positive trend in reducing the presence of this substance.

Melamine Levels

Melamine, known for its toxic effects, especially in the formation of insoluble melamine-cyanurate complexes that can cause kidney stones and renal failure (Salman et al., 2012; Rajpoot et al., 2020), is another harmful contaminant that can be used to falsely increase protein content in milk. This study found that melamine levels remained largely unchanged after *A. filiculoides* supplementation, with most cows maintaining stable levels. For instance, cows C1, C2, and C10 showed consistent melamine levels of 0.01 before and after supplementation, while cows like C3 and A4 maintained stable levels at 0.02. However, cow C5 exhibited a slight increase from 0.01 to 0.03, and cow C8 showed a decrease from 0.03 to 0.01. These minor variations suggest that *A. filiculoides* does not significantly affect melamine levels in milk.

Overall, the study results indicate that *A. filiculoides* supplementation had minimal impact on both ammonium sulfate and melamine levels in milk (Table 3). Ammonium sulfate levels showed slight decreases or were absent in some cows, while melamine levels remained largely unchanged, with only minor variations. These findings are consistent with the literature, which highlights the dangers of adding such substances to milk and the importance of ensuring milk safety. These results suggest that *A. filiculoides* is a safe dietary supplement that does not contribute to harmful adulterants like ammonium sulfate and melamine in milk. This supports the use of *A. filiculoides* as a natural, nutrient-rich feed that can enhance milk production without compromising milk safety or quality (Salman et al., 2012; Chu & Wang, 2013; Mansthis et al., 2017).

Conclusion

The findings from this study strongly support the efficacy of *A. filiculoides*as a sustainable and effective dietary supplement for dairy cows, significantly enhancing key milk quality parameters such as fat, protein, and casein content. The introduction of *A. filiculoides* led to notable improvements in milk yield, with increases ranging from 13.70% to 30.89%, and substantially enhanced the nutritional profile of the milk. FFA levels ranged from 0.20 to 0.59 mmol/100g. Lactic acid levels remained stable between 0.10% and 0.14% for most of the cows. Citric acid concentrations ranged from 0.139% to 0.147%. Most of the cows, exhibited decreases in ammonium sulfate, the minor variations in melamine content suggest that *A. filiculoides* does not significantly affect the milk. Furthermore, the stability observed in lactic and citric acid levels, as well as the minimal changes in contaminant levels such as ammonium sulfate and melamine, underscores the safety of *A. filiculoides* as a feed supplement. These findings align with existing literature and highlight the potential of *A. filiculoides* to improve both the nutritional quality and safety of milk, making it a viable alternative to conventional feed supplements. Overall, the study demonstrates that *A. filiculoides* supplementation can contribute to enhanced milk production and quality, supporting the economic sustainability of dairy farming while ensuring the production of safe, high-quality milk. Future research should explore the long-term impacts of *A. filiculoides* on dairy production and its potential application across different dairy farming systems. *A. filiculoides* offers a sustainable and safe option for dairy supplementation, preserving the nutritional and safety standards of milk. This aligns with efforts to provide safer alternatives to harmful adulterants in the dairy industry.

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Figure 1: A= The pond is prepared for cultivating *A. filiculoides*; B= A uniform distribution of cow dung slurry across the pond surface provides essential nutrients for the growth of *A. filiculoides*; C= Significant proliferation of *A. filiculoides* is observed 15 days post-inoculation; D: HF cow breeds selected for the study; E: *A. filiculoides* utilized as a supplementary feed for the cows; F: Standard cow feed is administered alongside *A. filiculoides* during the feeding trials.

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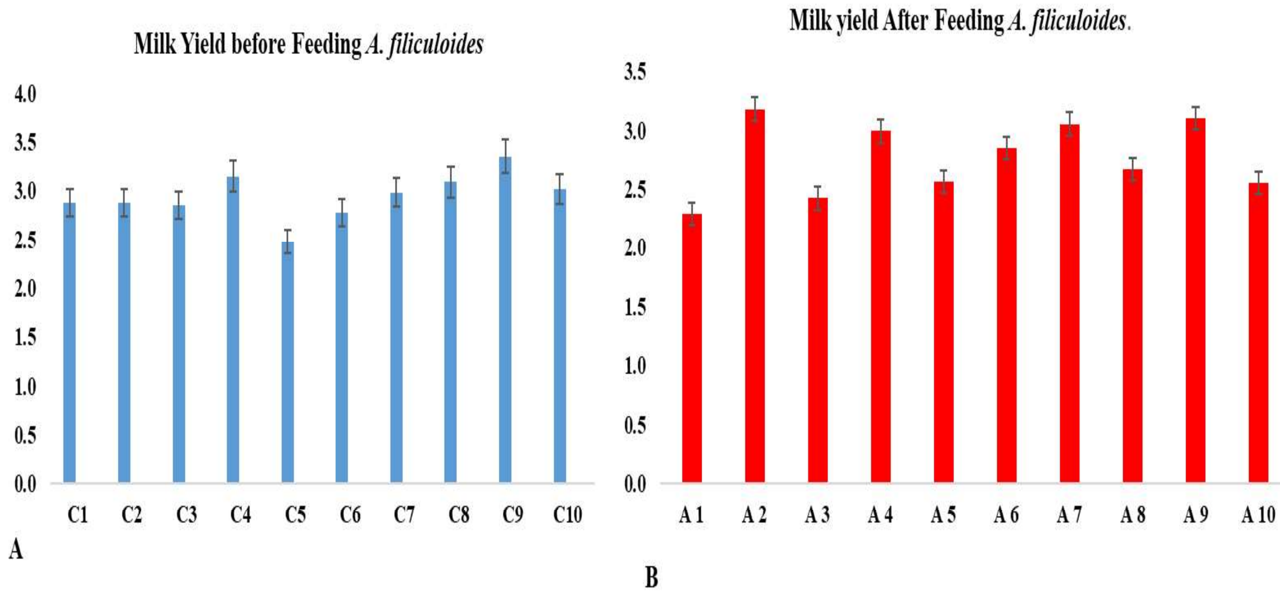

Figure 2: Effect of A. filiculoides supplementation on milk yield in 20 cows. A: Average milk yield (in liters) before feeding A. filiculoides, B: Average milk yield after feeding A. filiculoides. Each bar represents the mean value ± standard error of the mean (SEM), with data collected from three independent replicates per cow.

Table 3A: Comparison of lactic acid, citric acid percentages and FFA in cow milk before and after feeding *A. filiculoides* to 10 cows

Organic Acid and Fermenters			
	Lactic Acid %	**Citric Acid %**	**FFA mmol/100g**
Milk Samples	Before Intake	Before Intake	Before Intake
C1	0.10	0.16	0.2
C2	0.11	0.11	0.49
C3	0.14	0.16	0.38
C4	0.15	0.18	0.45
C5	0.14	0.17	0.4
C6	0.14	0.16	0.32
C7	0.13	0.16	0.4
C8	0.14	0.15	0.39
C9	0.14	0.15	0.43
C10	0.14	0.17	0.39

Table 3B: Lactic acid, citric acid percentages and FFA in cow milk after feeding *A. filiculoides* to 10 cows.

Organic Acid and Fermenters			
	Lactic Acid %	**Citric Acid %**	**FFA mmol/100g**
Milk Samples	After Intake	After Intake	After Intake
A1	0.13	0.15	0.41
A2	0.13	0.15	0.29
A3	0.11	0.15	0.39
A4	0.12	0.15	0.45
A5	0.12	0.14	0.42
A6	0.13	0.15	0.45
A7	0.14	0.15	0.49
A10	0.13	0.14	0.59
A10	0.14	0.15	0.58
A10	0.11	0.15	0.55