1. **Fatty Acid Analysis of Moringa-Enriched Cattle Feed Milk**

From the total fatty acid composition analyzed in the milk samples of the cattle considered in the experiment, more than 85% of the compositions are contributed by 20 compounds. The major three ones are Methyl butyrate (26.13%), Palmitic acid, methyl ester (20.97%), and Octadecanoic acid, methyl ester (Stearic acid, methyl ester) (11.87%) (Table 1).

**Table 1.** General fatty acid composition of milk samples in the experiment

|  |  |
| --- | --- |
| **Compound name** | **%com** |
| Elaidic acid, methyl ester | 7.75 |
| Methyl palmitoleate (cis-9-Hexadecenoic acid, methyl ester) | 0.75 |
| Palmitic acid, methyl ester | 20.97 |
| Pentadecanoic acid methyl ester | 1.07 |
| Octadecanoic acid, methyl ester (Stearic acid, methyl ester) | 11.87 |
| Linoleic acid, methyl ester (9,12-Octadecadienoic acid (Z,Z)-, methyl ester) | 1.51 |
| Capric acid methyl ester | 1.21 |
| cis-9-Tetradecenoic acid, methyl ester (methyl myristoleate) | 0.67 |
| Methyl butyrate | 26.13 |
| Myristic acid, methyl ester | 6.66 |
| Lauric acid, methyl ester | 1.65 |
| Caprylic acid methyl ester | 0.46 |
| Methyl caproate | 0.45 |
| Eicosanoic acid, methyl ester (Arachidic acid methyl ester) | 1.24 |
| Margaric acid methyl ester (Heptadecanoic acid methyl ester) | 0.7 |
| Linolenic acid, methyl ester | 0.95 |
| Oleic acid, methyl ester | 0.24 |
| cis-10-Heptadecenoic acid, methyl ester | 0.34 |
| γ-Linolenic acid, methyl ester | 0.46 |
| Methyl tridecanoate | 0.19 |

1. **Comparison of Fatty Acid Composition in Milk Samples from Cattle Fed Moringa-Enriched Feed and a Control Group**

The inclusion of moringa as a feed supplement for cattle led to a consistent increase in the fatty acid composition of milk samples in this experiment. Over 85% of the fatty acid composition in milk samples was derived from 20 different compounds (Table 2), with 20% belonging to monounsaturated fatty acids (MUFA), 15% to polyunsaturated fatty acids (PUFA), and 55% to saturated fatty acids (SFA).

Table 2 displays an increase in 80% of the fatty acid composition of milk samples collected from cattle supplied with moringa leaf. The largest increase (56.3%) was observed for cis-9-tetradecenoic acid methyl ester (methyl myristoleate), a MUFA, followed by the PUFA compound omega-3 fatty acid (linolenic acid methyl ester) with a 45.5% increase. The third most increased compound due to moringa feed was methyl tridecanoate, showing a 41.7% increase.

There existed a 5 to 38% increase in the other 13 fatty acid components of milk samples due to the inclusion of moringa as a feed supplement.

The results of this experiment demonstrate that the inclusion of moringa as a feed supplement for cattle consistently increased the fatty acid composition of milk samples. The significant increase in MUFA and PUFA content suggests that moringa supplementation could potentially enhance the nutritional quality of milk. The substantial increase in cis-9-tetradecenoic acid methyl ester (methyl myristoleate) and linolenic acid methyl ester highlights the impact of moringa on specific beneficial fatty acids. Additionally, the observed increase in other fatty acid components indicates a broad-ranging effect of moringa supplementation on the fatty acid profile of milk. These findings suggest that moringa could be a valuable supplement for improving the fatty acid composition of milk, which may have implications for human health and nutrition. However, further studies are required to explore the mechanisms underlying these effects and to evaluate the overall impact of moringa supplementation on milk quality and nutritional value.

**Table 2**. Variation in fatty acid composition between treatment and control group

| **Cpd No** | **Compound name** | **Chemical formula** | **Fatty acid category** | **% composition** | | **% change** | **Activity** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment group** | **Control group** |
| 1 | Methyl butyrate | C5H10O2 |  | 22.38 | 31.02 | 🡫 27.85 | Contribute to the overall flavor and aroma profile of milk |
| 2 | Palmitic acid, methyl ester | C17H34O2 | SFA | 21.45 | 19.70 | 8.84 | Provides energy and is involved in the formation of milk fat globules, which are essential for the digestion and absorption of fat-soluble vitamins |
| 3 | Octadecanoic acid, methyl ester (Stearic acid, methyl ester) | C19H38O2 | SFA | 11.89 | 11.31 | 5.15 | Contributes to the creamy texture of milk and it helps stabilize the fat globules in milk, preventing them from coalescing and separating from the liquid |
| 4 | Elaidic acid, methyl ester | C19H36O2 | Trans fatty acid | 9.63 | 6.99 | 37.81 |  |
| 5 | Myristic acid, methyl ester | C15H30O2 | SFA | 6.72 | 6.20 | 8.30 | Provides a creamy texture to dairy products |
| 6 | Lauric acid, methyl ester | C13H26O2 | SFA | 1.58 | 1.48 | 6.79 | Antimicrobial properties |
| 7 | Linoleic acid, methyl ester (9,12-Octadecadienoic acid (Z,Z)-, methyl ester) | C19H34O2 | PUFA | 1.57 | 1.34 | 17.16 | Omega-6 fatty acid. Important for maintaining the structure and function of cell membranes and is a precursor for the synthesis of other important compounds in the body, such as prostaglandins. |
| 8 | Eicosanoic acid, methyl ester (Arachidic acid methyl ester) | C21H42O2 | SFA | 1.27 | 1.08 | 17.41 |  |
| 9 | Capric acid methyl ester | C11H22O2 | SFA | 1.15 | 1.07 | 7.48 |  |
| 10 | Pentadecanoic acid methyl ester | C17H34O2 | SFA | 1.05 | 1.13 | 🡫 6.80 |  |
| 11 | Linolenic acid, methyl ester | C19H32O2 | PUFA | 1.00 | 0.69 | 45.51 | Omega-3 fatty acid. Plays a crucial role in maintaining the structure and function of cell membranes and is a precursor for the synthesis of other important compounds in the body, such as eicosanoids |
| 12 | Methyl palmitoleate (cis-9-Hexadecenoic acid, methyl ester) | C17H32O2 | MUFA | 0.83 | 0.69 | 20.29 | Has anti-inflammatory properties and a role in skin health |
| 13 | cis-9-Tetradecenoic acid, methyl ester (methyl myristoleate) | C15H28O2 | MUFA | 0.75 | 0.48 | 56.25 | Has anti-inflammatory properties |
| 14 | Margaric acid methyl ester (Heptadecanoic acid methyl ester) | C18H36O2 | SFA | 0.72 | 0.62 | 16.15 |  |
| 15 | Methyl caproate | C7H14O2 | SFA | 0.45 | 0.35 | 28.49 | Components of volatile fatty acids responsible for contributing to the flavor and aroma of dairy products |
| 16 | ?-Linolenic acid, methyl ester | C19H32O2 | PUFA | 0.45 | 0.56 | 🡫 19.82 | Omega-3 fatty acid. It is important for human nutrition as it is a precursor for the synthesis of other omega-3 fatty acids, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which have been associated with various health benefits. |
| 17 | Caprylic acid methyl ester | C9H18O2 | SFA | 0.44 | 0.39 | 13.28 |  |
| 18 | cis-10-Heptadecenoic acid, methyl ester | C18H34O2 | MUFA | 0.34 | 0.26 | 33.25 |  |
| 19 | Oleic acid, methyl ester | C19H36O2 | MUFA | 0.22 | 0.23 | 🡫 2.61 |  |
| 20 | Methyl tridecanoate | C14H28O2 | SFA | 0.09 | 0.06 | 41.67 |  |

NB: Cpd No, Compound number; PUFA, Polyunsaturated fatty acid; MUFA, Monounsaturated fatty acid; SFA, Saturated fatty acid