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Review

The "Noble Method®": A One Health Approach for a Sustainable Improvement in Dairy Farming

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Abstract: The Noble Method® has been successfully introduced in the last few years in Italy and in some foreign countries. This novel livestock management provides, among other rules, a high forage/concentrate ratio, no use of silage and supplements, no GMOs and the availability of outdoor paddocks. One of the goals is to achieve high-quality milk in terms of nutritional properties. Other benefits have been reported; amongst them, the forage/concentrate ratio of the diet was shown to reduce the amount of methane produced by animals, also, the system provides economic benefits, mainly for small breeders, in terms of the sustainability and market placement of milk. Thus, the method represents a sustainable approach to improve the production and the supply chain, from the land to the final product. In this review, the most recent studies on Noble Method® are depicted, showing that, besides the nutritional proprieties of dairy products, the method is able to improve animal welfare, human health and environmental sustainability, thus falling within a "One Health" approach.

Keywords: Noble Method®; Noble Milk®; dairy cow; behavior; milk quality; environment

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1. Introduction

A balanced diet containing all the necessary nutrients is crucial in livestock breeding; ruminants are herbivorous, herd and social animals, thus grass represents the ideal environment to express their natural behavior. In view of this, a nutritional approach, the Noble Milk Method (NMM), has been successfully introduced in Italy in recent years and is now being applied in other countries in the world as well. The original idea was to achieve more natural feeding by following some rules [1]:

The "Noble Milk®" Guidelines [2]

- Animals must have free access to outdoor paddocks;
- Diet forage/concentrate ratio 70:30;
- Silage and GMOs prohibited;
- Fresh and/or preserved forages (hay) with five different essences (with at least 10% of each);
- Mineral nitrogen fertilization of meadows may not exceed 50 kg of N/ha in order to not imbalance meadow vegetation. The total nitrogen input (organic + mineral) should not exceed 120 kg of N/ha to allow sufficient development of legumes. Manure input should be made with mature product (8–12 months of maturation in heap covered with breathable plastic sheeting); in the case of pastures, the maximum dose of mineral nitrogen cannot exceed 30 kg of N/ha.
- Preference should be given to autochthon breeds for the best adaptation to the area. However, the "Noble Method®" model aims to encourage the breeding of native breeds that are well adapted to their production area.

- The levels of animal welfare required by the Welfare Quality® standard must be ensured.
- The hay must achieve a score of at least 70 points out of 100. This score is obtained through a sensory evaluation system, used to identify hay quality. It is scored on a scale from 1 to 100 (Table 1). At the end of the evaluation, the partial value of each characteristic is summed to obtain the final score.

Table 1. Hay sensorial evaluation.

Parameters	Evaluation	Lowest Score (0)	Highest Score (100)
Color	It ranges from green to brown. Is indicative of the good quality of the forage. A brown color may suggest rotting during drying.	Dark brown	Dark green
Number of essences	More essences correspond to higher quality forage.	Few essences	More than 5 essences
Presence of dust	Indicative of correct forage harvesting and storage.	Presence of dust	Absence of dust
Tactile evaluation	Woody forage presents a high lignin content, it corresponds a lower nutritive value.	Woody	Soft
Odor evaluation	The animals eat more willingly a fragrant forage than a less aromatic forage.	Old, mold	Persistent, aromatic and floral
Leafiness	The leaves are the part of the plant representative of the protein content.	Absence of leaves	Presence of leaves

Farmers who decide to join the consortium gain an extra 50% if compared to common milk farms. The evolution of the "Noble Milk®" circuit was the creation of the ME.NO (Method Noble) consortium also involving producers of other foods, either of animal origin (i.e., meat), recognizing the fundamental role of animal feeding to improve product quality [3], or of plant origin. This system proposes the application of a more sustainable approach in relation to animal welfare, respect for the environment and human health.

The aim was to achieve an improvement in milk quality by reducing the ω6:ω3 ratio and by increasing conjugated linoleic acid (CLA) content [4] without negatively affecting cow metabolic homeostasis. In the frame of the increasing demand of consumers for foods with beneficial properties for human health, obtaining food with favorable nutritional characteristics should represent one of the main goals of a farm. One of the primary aspects to be considered is the fatty acid profile, as it is known to be, probably, the most important factor to assess the health properties of food. The first parameter concerns ω6:ω3 fatty acids, whose intake through the diet is essential for humans, with ω6:ω3 ratios within 2.1 to 4.1 [5]. According to nutritionists, in fact, this range represents the optimum intake of these organic acids as it considers the balanced effects between pro-inflammatory compounds (ω6) and anti-inflammatory ones (ω3). The second one, due to its immune-modulating, anticarcinogenic and antiatherosclerosis properties, is the milk CLA content [6], for which dosages varying from 0.7 g/day to 6.8 g/day have been reported to be beneficial [7]. The diet is the main factor determining the fatty acid profile of cow milk, and, when cows are fed a high percentage of forage, the ω6:ω3 ratio in milk has shown to be near the one recommended for human health [8]. For instance, this ratio is at least two times higher [5] in milk from other breeding strategies that generally use a low forage/ concentrate ratio in order to increase yield [9]. Similar results have also been reported for CLA levels [10] in the milk of other domesticated ruminants (i.e., small ruminants, sheep [11]), for which significantly higher milk CLAs were obtained from feeding fresh forage instead of TMR (total mixed ration).

Once the Noble Milk® gained success due to the economic advantages for breeders and the benefits for human health [12,13], some researchers explored the effects of the

Noble Milk® method on animal welfare [14] by assessing other parameters such as cows' blood metabolic profiles, the evaluation of oxidative stress and behavioral patterns [15]. Thus, the second step of research was focused on the possible effects of the breeding system on animal welfare. Assessing animal welfare using animal-based, resource-based and management-based assessment tools provided a holistic view of the welfare state of facilities [16,17].

Animal welfare is an objective that can be exploited to advance sustainable development goals and vice versa. Pasture is frequently thought to be more beneficial to animal health because it can provide a positive experience for the animals. However, the welfare of ruminants may be different; it depends on management practices and environmental conditions affecting the different habits of the animals, such as nutrition-, environment- and healthcare-related, which, when more "controlled", may be decisive [18].

Given all the above-mentioned field of interests involved in the application of Noble Method specifications, it seemed important to give a global and comprehensive view of this farming system, analyzing in detail all the aspects that it concerns, as it is becoming increasingly adopted by farmers and highly demanded by consumers.

This review is aimed at highlighting the positive effects of NMM application in dairy farms, focusing on animal, environmental and human health. In Table 2, the main "Noble Milk®" rules are presented.

Table 2. "Noble Milk®" guidelines [2].

ANIMAL NUTRITION	MANAGEMENT SYSTEM
Prohibited	
Chemical weeding	Breeding without grazing
GMOs	Mineral nitrogen fertilization $\geq$ 50 kg of N/ha
Silage and bandages	
Synthetic vitamin and mineral supplements	
Required	
$\geq$five dominant forage species	Dairy livestock load of the farm $\leq$ 1.3 livestock units (LSAs) per hectare of forage area
Forage/concentrate ratio $\geq$ 70:30	Ensuring free access to outdoor paddocks
Fresh and/or preserved forage (hay)	Ensuring the levels of animal welfare required by the Welfare Quality® standard
Hay score $\geq$ 70/100	
Preferable	
	Raising native breeds

2. Animal Welfare

Protecting animal welfare can turn into profit, in terms of reducing veterinary costs, increasing animal performance, improving product quality and maintaining hygiene standards in food production. Wellbeing is closely linked to the health and production efficiency of farmed animals and supporting animal welfare can also increase the commercial value of animal products. Thus, the demand for high-quality food is increasing and an increasing number of consumers expect animal products to be obtained and processed with greater respect for animal welfare. Rumen micro-organisms play a significant role in fiber breakdown because the rumen is a natural bioreactor for very efficient fiber degradation [19]. A high proportion of concentrates in livestock farms has resulted in increases in dry matter and digestible carbohydrate intake with a consequent reduction in fiber digestibility, altering volatile fatty acid patterns [20]. Kljak et al. [21] showed that a forage/concentrate ratio of 65:35 presents the most optimal balance of available ammonia-N and readily fermentable carbohydrates.

This ratio is very similar to the NMM one (70:30). In addition, a decrease in chewing activity caused by the inclusion of concentrates reduces saliva production, lowering rumen pH [22] and VFA concentration [23], and leading to a risk of rumen acidosis [24]. Moreover, it has been shown that by lowering the ω6:ω3 ratio in the diet and by increasing conjugated linoleic acids (CLAs), produced through the dehydrogenation of linoleic acid in the rumen due to the presence of volatile fatty acids (VFAs), the main products of degradation that occur at the ruminal level as a result of the microbial population could improve milk nutritional value [4]. CLA levels in sheep [11], cow [10] and goat [13] milk is demonstrated to be significantly higher when animals are fed fresh forage than when using the TMR technique. The major isomer of CLA, cis-9, trans-11 (rumenic acid), accounts for up to 80% of total CLA and is localized in the rumen, mammary gland and muscle. Linoleic acid ω6 (C18:2) and alfa-linolenic acid ω3 (C18:3), if correctly balanced in the diet, have beneficial effects. Linoleic acid shows pro-inflammatory, pro-aggregant and immunosuppressive activities, while alfa-linolenic acid has anti-inflammatory, antiaggregant and non-immunosuppressive activities. Hay and silages are able to decrease PUFA content, compared to fresh forages, due to oxidative processes during storage [25]. Therefore, the improved forage/concentrate ratio influences rumen activities and metabolic state (i.e., increased pH in the rumen) [26] and, consequently, the nutrient supply used for the synthesis of milk components, improving the activity of the ruminal microbiome [27–29]. This kind of diet aims at preserving the metabolic homeostasis of the animals, avoiding abrupt changes in pH and the onset of dysmetabolism, such as acidosis, thus improving the nutritional quality of the milk [4]. Unbalanced diets could cause an alteration in mitochondria activity, leading to an accumulation of free radicals and therefore oxidative stress. Blood metabolites, indeed, are highly indicative of animal nutritional and physiological condition [30] as well as oxidative stress, which is a parameter gaining more and more importance in evaluating animal welfare status [14]. A high level of reactive oxygen species can lead to oxidative stress, an emerging health risk factor implicated in many diseases, including inflammatory, infectious and degenerative disorders in both humans and animals [31–35]. Several authors examined in depth the impact of nutrition on regulating oxidative stress. In the work of Bernabucci et al. [36], the authors examined the link between body condition scores and oxidative status and suggested that nutrition plays an important role in this modulation due to its involvement in the rate of free-radical-mediated lipid peroxidation, which is critical in high-producing dairy cows due to their greater susceptibility to oxidative stress conditions. Musco et al. [14] demonstrated that animals with a high forage/concentration ratio in their diet showed an improvement in oxidative status.

Feeding with higher forage content turns out to be efficient for several reasons (Table 3):

- The hay acts as a filter for the passage of grain, thus preventing the onset of acidosis. Propionic acid, which is formed from starch, thanks to the amilolytic bacteria that are activated by the concentrate, gives an energy boost by becoming glucose, which if present in excess can also become lactic acid and create acidosis [37].
- Fiber promotes the function of cellulosolytic bacteria and is responsible for the formation of acetic acid in the rumen, important for the milk fat content [38].
- Increases salivation by lowering ruminal pH due to the presence of bicarbonate in saliva, which has a buffering effect [39].

However, the metabolic requirements of the ruminants in production are not satisfied with only the use of fresh forages. For this reason, "Noble Milk®" suggests a moderate use of concentrates without completely abolishing them. Otherwise, a reduction in production and animal welfare could be observed [40]. This must be avoided, because animal welfare is considered a critical pillar of sustainability in livestock systems.

The pasture, with incorrect management, could also affect animal health and longevity, milk quality and reproductive efficiency. As reported by [41], an association of animal density with stress in lactating ruminants has been observed in intensive farms. In particular, injuries or nutritional deficiencies can occur and contribute to reduced animal welfare [42]. A benefit of a high forage/concentrate ratio is also the possibility for ruminants to accumulate carotenoids in milk, which will then be transferred to dairy products, contributing to their nutritional and sensory properties [43]. The modulation of feeding systems can enhance the quality of dairy products in terms of the presence of antioxidant compounds (i.e., tocopherols, carotenoids, phenolic compounds) [44–46].

Table 3. Physiological effects of two different feeding systems on animal welfare.

PHYSIOLOGICAL EFFECTS	
Forage/Concentrate Ratio ≥ 70:30 (Noble Milk® Method)	**Forage/Concentrate Ratio < 70:30 (Intensive Farming Method)**
Optimal balance of available ammonia-N and readily fermentable carbohydrates [21].	Reduction in fiber digestibility, altering volatile fatty acid patterns [20].
Higher CLA levels in sheep milk [11], cow [10], and goat [13] milk for animals fed with fresh forage than with total mixed ration (TMR) technique.	Decrease in saliva production, decrease in rumen pH [22] and VFA concentration [23].
Improvement in oxidative status [14].	Accumulation of free radicals caused by altered action of the mitochondria.

Mastellone et al. [15] also showed that the NMM is able to favor positive behaviors in dairy cows. These authors observed a modification in the behavioral repertoire of a group of dairy cows bred with the Rubino system [1] compared to traditional livestock breeding. Animals bred with the NMM were more dynamic, with an increase in walking and a decrease in all stationary behaviors such as lying down, standing and sleeping. Such a result was attributed to access to outdoor paddocks which, by allowing cows to move freely, is able to increase leg health, improving cows' locomotory ability [47,48]. This is in accordance with Crump et al. [49], who noted a positive effect of exercise on dairy cattle welfare.

The NMM also affected feeding behaviors. Cows showed longer rumination and a decreased drinking time. Obviously, a diet with high forage content requires more time to eat [50], while the concentrate content has been shown to be positively correlated with water intake [51]. Also, improving rumination increases salivary secretion [52,53], which is associated with higher intake of forages [39]. As a consequence, the NMM, by promoting rumination, may reduce the risk of subacute ruminal acidosis [39]. Interestingly, the NMM also affects some social behaviors, increasing allogrooming and social rubbing times. A similar study has been performed in dairy heifers allowed to access pastures showing different social interactions in pastures [54]. In particular, a larger space availability was considered responsible for both an increase in allogrooming and a decrease in agonistic interactions.

Mastellone et al. [15] reported that the larger space availability provided for the NMM should give less opportunity for social contact but positive social interactions are longer lasting. The authors underlined that allogrooming is an important behavioral pattern that, reflecting positive interactions between ruminants, is involved in the formation and maintenance of social bonds [55]. In general, social grooming is also believed to reduce social tension and to balance positive and negative social interactions [56]. Therefore, it seems that the NMM improves social interaction in dairy cows and that this effect is more likely related to the diet.

Importantly, breeding systems are always designed to improve production, ignoring the behavioral patterns that may be signs of animal welfare. Mastellone et al. [15] showed that the NMM significantly influenced the behavior of dairy cows, including locomotor activity and affiliative social behaviors (Table 4).

Table 4. Effects of Noble Milk® feeding systems on animal behavior and eating behavior.

"Noble Milk®"	
EFFECTS ON ANIMAL BEHAVIOR	**EFFECTS ON EATING BEHAVIOR**
Increase in ambulation and decrease in all stationary behaviors.	Risk of subacute ruminal acidosis reduction by promoting rumination [39].
Increase in leg health, which improves locomotor capacity of cows [47,48], resulting in a positive effect on the welfare of dairy cattle.	Increase in allogrooming and social rubbing times, which are involved in the formation and maintenance of social bonds [55].
Increase in duration of positive social interactions [15].	Decrease in social tension among dairy cows [56].

Using proper animal welfare practices, it is possible to achieve a balance between sustainable agricultural practices, which reduce biodiversity decline, and overdependence on human edible food items, which will in turn enhance food security.

3. Environmental Mitigation Strategies

3.1. Animal Nutrition

The efficiency of nutrients fed to animals would also lead to significant benefits in terms of sustainability; in fact, it could decrease pollution due to the waste nutrients excreted and could improve the relationship between unit production and unit pollution [57]. Furthermore, the benefits may also come in economic terms because there would be a reduction in direct (both financial and environmental) and indirect costs (transport of feed to the animal). Milk production, like all human activities, is known to have a certain effect on the environment. Dietary manipulation represents a simplistic and pragmatic approach to mitigate CH4 production, while improving farm productivity. This approach is based on the alteration in rumen fermentation, which can lead to up to 40% reductions in CH4 emissions [58,59]. There are many dietary strategies, but they can be divided into two main categories: (i) alteration in the forage content in the diet and the quality of the forage itself and (ii) use of additives in the diet that inhibit the action of methanogenic bacteria [58]. As reported above, the Noble Milk® guidelines require that forage makes up at least 70% of the ratio.

The assessment of the impact of ruminant production on the environment is fundamental for the development and adoption of adequate mitigation strategies. Through the use of the LCA (Life Cycle Assessment) index, it is possible to estimate the environmental impact deriving from animal production [60]. Such estimation is based on the environmental impact of a given product considering the outputs and inputs of its production system. Animal carbon and water footprint are the main impacts deriving from ruminant production. The environmental impact that the "Noble Milk®" type of breeding has should be certainly considered as multifactorial and depends on many characteristics and management strategies [59], especially starting with feeding: nutrition is an important factor influencing the excretion of nitrogen (N) by animals [61]. Animal nutrition is a critical issue for the livestock sector, both in terms of production efficiency and its impact on the environment; in the dairy sector in particular, the production of feed for livestock is a major contributor to potential global warming, acidification and eutrophication. Interestingly, the interest in alternative feeds to improve soil fertility and reduce the need for chemical fertilization is progressively increasing [62]. The synergy of several production factors must be considered. Emissions, particularly those of methane, are linked to enteric fermentation, as ruminants produce methane themselves during digestive processes (which is then eliminated by belching). In the rumen, microbial fermentations transform carbohydrates into simpler molecules that can be utilized by the animals. Methane (CH4) is a byproduct of this process [63] and is considered the main greenhouse gas produced through enteric fermentation during the normal digestive process of ruminants [64].

Forage quality is a key factor in modulating ruminal CH4 production [65]. Young plants lead to a reduction in CH4, thanks to the lower NDF content and more fermentable carbohydrates, leading to a greater digestibility and passage speed [66,67].

In contrast, old forages are less digestible and increase CH4 production, mainly due to an increase in the C:N ratio [68]. The chemical composition of forages can also be responsible for a greater or lesser production of CH4 [69].

The presence of antinutritional factors (mainly represented by condensed tannins), low fiber content and high dry matter intake in legume forages are responsible for lower CH4 yield [70]. Processing techniques and forage conservation also influence CH4 emissions [71]. As reported by Boadi et al. [72], chopped or pelleted forage leads to a reduction in CH4 production because the smaller particle size of the particles requires less degradation in the rumen.

Serra et al. [73] conducted an analysis on dairy cattle farms in Italy based on the calculation of average emissions, and found a value of 1.3 kg CO_2eq/L of milk produced, with a strong tendency towards reducing the impact, when going from less productive to more productive farms. As proof of this, in a comparative study on the carbon footprint of dairy herds in Northeast Italy and Slovenia [74], the kg CO_2eq/L of milk corrected for fat and protein estimates was significantly higher for Brown Swiss cows (1.61 kg CO_2eq) compared to Friesian Simmental and Holstein cows (1.15 and 1.04 kg CO_2eq, respectively), thus providing an important insight concerning milk quality. This study was based on an LCA approach to estimate potential emissions as well as consumption of renewable sources. The differences between the breeds were attributable to the quantity of milk produced, which was lower for the Brown cows, and the animals were fed a diet richer in forages when compared to the Friesian Simmental and Holstein breed herds. According to Serra et al. [73] and Bava et al. [75], intensive livestock and increased milk yield/cow, dairy efficiency and stocking density were negatively related to emissions/kg of product. This last suggests a positive effect of these factors on mitigating greenhouse gases. In conclusion, the use of a ratio of young forage, characterized by low fiber content and a higher soluble carbohydrate content, could be useful to contain methane emissions. Supplementing the diet with a small amount of concentrates, preferably cereals, is also a promising mitigation approach. Increasing the dietary level of concentrate reduces CH4 production since the energy share is mainly used for animal products, such as milk and meat [71]. In contrast, the concentrates are associated with increased DMI, ruminal fermentation rate and feed turnover rate and can change the rumen environment and microbial composition [71]. Indeed, it is not necessary to exceed the amount of concentrate because diets with a high-concentration content are poor in structural fibers and, in the long term, can negatively affect ruminal function, leading to acidosis; therefore, these ratios are not sustainable for ruminant production.

The use of smaller quantities of concentrates drastically reduces the pollution attributed to ruminant farming. In particular, concentrates represent the foods with the greatest impact on the livestock sector, firstly because many are produced in overseas countries, using cultivation techniques that are sometimes not respectful of the wellbeing of the soil and are the result of significant deforestation. Furthermore, the transport of these concentrates leads to further emissions of harmful gases into the atmosphere. By using better quality forages, it is possible to significantly reduce the inclusion of concentrates in ruminants' diet, thus improving the sustainability and welfare status of the animals.

3.2. Forage/Concentrate Ratio

The forage/concentrate ratio in the diet can affect the amount of methane produced by animals [27]. In the rumen, microbial fermentations convert carbohydrates into simpler molecules that can be used by animals. Methane is a byproduct of this process: reactions with high fiber content cause higher methane emissions per unit of energy ingested [76].

Ruminal micro-organisms produce acetic acid (acetate) and propionic acid (propionate) from fodder and concentrate intake, respectively.

The production of a low acetate/propionate ratio by the rumen results in a reduction in ruminal pH and in the number of protozoa [77], which have been found to reduce methanogens in terms of growth and/or activity [27,78] and cellulolytic bacteria [79].

Therefore, the forage/concentrate ratio adopted by the "Noble Milk®" specification does not cause higher animal emissions. Shiddieqy et al. [80] evaluated the environmental impact of different Indonesian cattle breeds fed with different forage/concentrate ratios, concluding that the highest amount of CH4 emissions occurred in the feces of Bali cattle with a forage-to-concentrate ratio of 30:70 on the first day of observation. According to Fadaee et al. [81], methane emissions may vary when the buffering capacity of the diet is modified using inorganic buffers. However, various strategies have being studied to reduce methane emissions from ruminants, for instance by adding *Lotus pedunculatus* to animals' diet [82] or through genetic selection [83] of the breeds chosen for milk production. Aemiro et al. [84] conducted a study to investigate the effect of different concentrations of Euglena (*Euglena gracilis*) on CH4 production and it turned out that the addition of Euglena to the diet has the potential to mitigate methane emissions.

3.3. The Use of Pasture

Grazing is one of the most competitive and sustainable feeding systems for dairy cows due to its low environmental impact, benefit for animal welfare and relatively low cost in the production and use of concentrate [85]. Indeed, grazing is not always possible due to seasonal variations in grass production and adverse weather conditions [86]. In addition, grazing livestock is the focus of many rural communities, using land that is difficult to use for other activities, providing jobs and enriching the landscape. Furthermore, highly productive dairy cows, resulting from genetic improvements, can no longer rely exclusivelyT on grazing to provide the nutrient supply needed to satisfy milk production [87]. If the pasture is of high quality, the proportion of additional feed decreases, while productivity remains unchanged [88], with the additional benefit of obtaining an improvement in the chemical and nutritional composition of milk [89]. Grazing protects the soil from erosion thanks to the strong root system, so there is a benefit of preserving the eco-systems of permanent meadows and pastures [90]. The presence of ruminants can positively modify nutrient pathways and soil aggregation, increasing soil quality [91]. With grazing, there is a return of organic matter and nutrients to the soil through manure [92].

Therefore, nutrients ingested by animals are excreted and return to the system, bringing an advantage to the crop and increasing its yield. This technique limits the use of synthetic fertilizers for the cultivation of plant species that also enter into the human food chain [93]. With this type of feeding, animals do not compete with humans for food [94]. In addition, eutrophication, which is the uncontrolled increase in nutrients in water, is lower in grazing farms than in non-grazing ones due to the lower use of nitrogen fertilizers for feed production [95]. In some pastures, legumes forages (i.e., clover, common vetch, purple clover, sainfoin and sulla) are largely present. According to Aboagye et al. [96], legume fodder could reduce enteric methane emissions by ruminants, as well as tannins, the secondary metabolites particularly abundant in legumes plants, which help control enteric methane emissions [97,98]. Grazing allows for offsetting, at least partially, the greenhouse gas emissions produced by cattle breeding, because it captures organic carbon in the soil for a few years [99–101].

Furthermore, in terms of grazing, it must also be taken into account that the supply of feed is one of the main input costs in dairy cattle breeding. The environmental impact, considered as the carbon footprint (CF) used as an indicator of the sustainability of livestock farming, is lower in grazing farms than in semi-intensive or intensive farms [102]. A sustainable form of agriculture is supposed to respect the environment in order to allow long-term practice. In general, the goal is to maximize the use of grazed grass. This is achieved by ensuring that the duration of the grazing season is as long as possible. Previous research has shown that increasing the length of the grazing season is associated with a reduction in greenhouse gas emissions per unit of produce [103].

Overgrazing on a given area causes erosive problems in the soil, leading to economic disadvantages [104]. Soil damage is linked to two factors: animal load and soil characteristics [105].

3.4. Livestock Units

According to "Noble Milk®" procedural guidelines, the dairy livestock load of the farm may not exceed 1.3 livestock units (LSAs) per hectare of forage area. LSA is the unit of measurement of the size of a herd. The Ministry of Agriculture and Food Sovereignty does not provide a maximum density for livestock loading, but the ministerial decree will be increased to provide for a maximum livestock loading of 2 LSAs per hectare in vulnerable areas (NVs) and 4 LSAs per hectare for the other non-vulnerable areas (NVZs) [106]. Animal load is one of the main factors that can change the amount of N excreted by a herd. Increasing the number of animals per ha risks compromising the sustainability and productivity of resources [107].

The environmental sustainability of livestock farming has become a major issue. In recent years, consumers have recognized and required a high quality in animal products. In addition, consumers are increasingly interested in ethical aspects such as the production process, environmental sustainability and animal welfare.

4. Human Health

Milk and dairy products are considered essential sources of micronutrients like minerals (Ca, Mg, Na, K) and vitamins, which support a variety of essential body functions [108]. Vitamins have an important role in physiological processes such as the visual process (vitamin A), as antioxidants (carotenoids, vitamins E, C, and riboflavin), in modulating calcium metabolism (vitamin D) and in hematopoiesis (vitamin B12, folates and vitamin B6) [109]. The epidemiological data currently available also indicate that milk consumption helps to protect from allergies, asthma and respiratory tract infections, with bovine IgG being able to destroy pathogenic micro-organisms [110]. Vitamins and minerals found in cows' milk can also have positive and significant effects on strengthening the immune system [111].

In addition, regarding the thermal processes to which milk is subjected before sale, pasteurization does not cause a loss of vitamins while UHT sterilization causes a limited loss of vitamins [112]. Cows' milk is also recognized as an excellent source of proteins, characterized by high biological value and high digestibility [113]. It was shown by McGregor et al. [114] that the consumption of milk protein reduces the incidence of metabolic risk factors, such as hypertension, dyslipidemia and hyperglycemia. Gastric, pancreatic and microbial proteases can hydrolyze whey proteins to produce peptides that have physiological functions [115]. These bioactive peptides are efficient in preventing parasitic, bacterial and viral infections as well as autoimmune inflammatory processes in the body [111].

With regard to the function of calcium, this mineral is essential for the contraction of muscles, including the heart muscle, the release of neurotransmitters, digestion and blood clotting [116]. Heaney et al. [117] showed that calcium intake from dairy products promotes bone health in humans. Indeed, calcium deficiency is related to the development of osteoporosis or other disorders, and for that reason it is crucial to integrate this mineral into the diet through milk and other dairy products [118]. In this regard, Black et al. [119] showed that kids who had avoided cow milk for a long time had low calcium level and had poor bone strength and density when compared to kids who consumed milk, [120].

Balivo et al. [89] reported the health implications of Noble Milk® consumption for humans. In particular, in this review the importance of the conjugated linoleic acids (CLAs) that are principally present in milk and meat of ruminant is analyzed. The primary geometric isomer of CLAs found in nature is cis9 trans11-CLA (c9t11), which is created as a byproduct of ruminant microbes' biohydrogenation of dietary linoleic acid to stearic acid (C18:0) [120]. Milk CLA results from the activity of stearoyl-CoA desaturase (SCD) in the mammary gland on trans-11C18:1 (TVA, trans vaccenic acid), an intermediate product of several polyunsaturated fatty acids biohydrogenation [121].

CLAs have been demonstrated to have physiologically beneficial effects, including anticarcinogenic, antiobesity, antidiabetic and antihypertensive characteristics [122] (Table 5). Ip et al. [123] showed that CLAs are more effective than any other fatty acid in controlling the growth of tumors. The effects of physiological concentrations of CLAs on humans were tested. According to the evidence reported by Shultz et al. [124], the results from in vitro experiments showed that CLAs might be cytotoxic to human cancer cells. In particular, physiologic levels of CLAs can inhibit the proliferation of human melanoma, colorectal and breast cancer cells in vitro [124]. More recent research has shown that using CLA supplements helps patients to lose weight, have lower leptin levels and have less body fat. CLAs were demonstrated to decrease body fat mass (BFM) in healthy human volunteers who were overweight or moderately obese [125]. Cavaliere et al. [12] studied the effects of milk obtained from cows fed a high forage diet on lipid metabolism, inflammation, mitochondrial function and oxidative stress using a rat model. The experiment lasted 4 weeks; the rats were fed with an isoenergetic diet supplemented with milk obtained from cows fed with a high forage/concentrate diet or a high concentrate/forage diet. The results showed a positive effect on lipid metabolism, mitochondrial function and oxidative stress in the experimental group, providing first evidence of the beneficial effects of milk obtained from cows fed a high-forage diet. Furthermore, Trinchese et al. [13] showed reduced lipid content and inflammation levels and improved mitochondrial lipid oxidation and redox status when supplementing rats' diet with milk obtained from cows fed a high-forage diet.

Thanks to the presence of bioactive fatty acids, dairy products can promote human health. Gomez et al. [126] illustrated the essential role of vaccenic and rumenic acids in the preservation of gut microbiota, weight control and the prevention of chronic inflammatory diseases. Rubino et al. [1] examined the metabolic effects of different isomers of CLAs, specifically highlighting the beneficial action of the c9t11 isomer on the improvement in insulin sensitivity in young, sedentary humans. In general, studies concerning the effects of CLAs on humans are fewer than those on animals. In developed nations, cardiovascular disease (CVD) is a leading cause of death, and atherosclerosis is the secondary cause of the majority of cardiovascular events [127]. For example, Toomey et al. [128] tested the effect of c9t11 on the reduction in atherosclerosis in mice. It was shown that CLA supplementation reduced atherosclerosis by suppressing the expression of pro-inflammatory genes and inducing apoptosis in the atherosclerotic lesion [128]. Moreover, Lee et al. [129] investigated the effects of diets supplemented with CLAs in rabbits on atherosclerosis and found significantly lower LDL cholesterol and triglycerides in the CLA-fed group compared to the control one. Additionally, CLA-fed rabbits had less atherosclerosis as seen via an aorta examination. It is clear that additional research, particularly on human subjects, will be required to further investigate the potential health advantages of consuming CLAs.

Dairy products can be identified as functional foods as they naturally contain high levels of vitamins, minerals and CLAs [129], thus constituting an essential element of a healthy diet.

Table 5. Health effects from dietary ingestion of CLA isomer cis9 trans 11.

BENEFICAL EFFECTS	MECHANISM OF ACTION
anticarcinogenic	Cytotoxic activity against human cancer cells, in particular toward malignant melanoma and breast cancer [123]
antiobesity	Reduction in body fat mass [124]
antidiabetic	Normalization of glucose metabolism and improved insulin sensitivity [120]

Table 5. *Cont.*

BENEFICAL EFFECTS	MECHANISM OF ACTION
prevention of chronic inflammatory diseases	Reduction in inflammatory markers in human cells, and prevention of subsequent related disease [125]
prevention of cardiovascular disease	Resolution of atherosclerosis by inhibiting the expression of genes that promote inflammation and cause apoptosis in the atherosclerotic lesion [127]

Public awareness of quality food production related to organoleptic and nutritional properties, cultural enhancement, environmental protection and animal welfare protection is constantly growing and is leading to individuals searching for healthy food. The implementation of NMM could increase the market of sustainable and better quality products with benefits for human health.

5. Conclusions

The "Noble Method®", applied to the dairy sector (Noble Milk®), represents a novel livestock management system for a sustainable approach in terms of improvements in animal welfare, milk nutritional quality, human health and environmental factors. The increasing diffusion of the concept of One Health is an acknowledgement that the health and welfare of humans, animals and ecosystems are interconnected. In terms of human health, improved milk quality with an increase in CLA content improves immune functions and could have protective effects against cancer, obesity, diabetes and atherosclerosis. In terms of animal health, some studies have shown an improvement in oxidative status. The latter result could also be interesting in terms of a prolongation of productive life. Moreover, with the "Noble Method®", the environmental impact of livestock farming could decrease. However, further studies are required to investigate the potential benefits of these productions in different fields.

The "Noble Method®" farming system reminds the consumer of a farm concept back to the origin. In fact, it includes all the expectations of the modern consumer: wholesomeness and respect for biodiversity and the ecosystem in general. At a time when multinational corporations are imposing the same foods and drinks on the world, the diversity of taste and local identities are felt to be values that need to be defended and encouraged.

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