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An analysis on how switching to a more balanced and naturally improved milk would affect consumer health and the environment

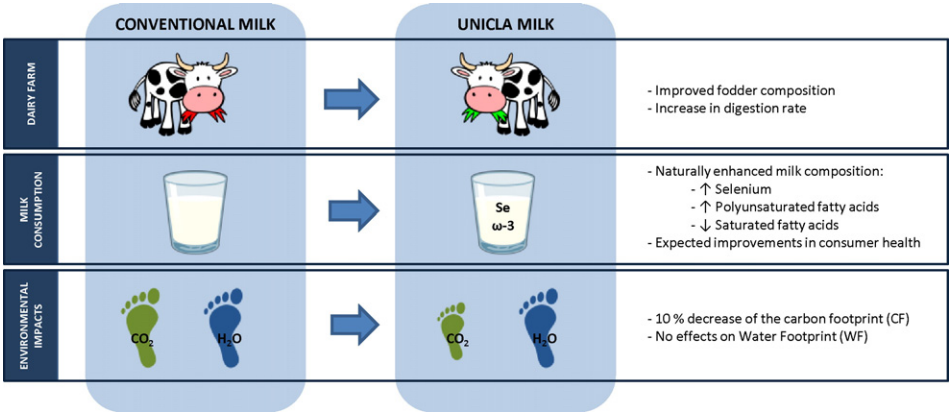
Laura Roibás [a,*], Ismael Martínez [b], Alfonso Goris [b], Rocío Barreiro [c], Almudena Hospido [a]

[a] Group of Environmental Engineering and Bioprocesses, Department of Chemical Engineering, Institute of Technology, Universidade de Santiago de Compostela, 15782 Santiago de Compostela, Spain
[b] Feiraco Sociedade Cooperativa Galega, Ponte Maceira s/n, 15864 Ames, Spain
[c] Laboratory of Food Hygiene, Inspection and Control (LHICA), Department of Analytical Chemistry, Nutrition and Bromatology, Universidade de Santiago de Compostela, Lugo, Spain

HIGHLIGHTS

- Unicla, a premium brand of milk, is naturally obtained by improving cows' diet.
- The brand was evaluated in terms of health effects, carbon, and water footprints.
- The enhanced fatty acid profile of Unicla is expected to improve consumer health.
- The carbon footprint of Unicla is 10% lower than that of conventional milk.
- No significant differences were found in the water footprint indicator.

GRAPHICAL ABSTRACT



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ABSTRACT

This study compares a premium brand of UHT milk, Unicla, characterised by an improved nutritional composition, to conventional milk, in terms of health effects and environmental impacts. Unlike enriched milks, in which nutrients are added to the final product, Unicla is obtained naturally by improving the diet of the dairy cows.

Health effects have been analysed based on literature findings, while the environmental analysis focused on those spheres of the environment where milk is expected to cause the higher impacts, and thus carbon (CF) and water footprints (WF) have been determined. Five final products have been compared: 3 conventional (skimmed, semi-skimmed, whole) and 2 Unicla (skimmed, semi-skimmed) milks. As a functional unit, one litre of packaged UHT milk entering the regional distribution centre has been chosen.

The improved composition of Unicla milk is expected to decrease the risk of cardiovascular disease and to protect consumers against oxidative damage, among other health benefits. Concerning the environmental aspect, CF of Unicla products are, on average, 10% lower than their conventional equivalents, mainly due to the lower enteric emissions of caused by the Unicla diet. No significant differences were found between the WF of Unicla and conventional milk. Raw milk is the main contributor to both footprints (on average, 83.2 and 84.3% of the total CF of

* Corresponding author.
E-mail address: laura.roibas.cela@usc.es (L. Roibás).

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Unicla and conventional milk, respectively, and 99.9% of WF). The results have been compared to those found in literature, and a sensitivity analysis has been performed to verify their robustness.
The study concludes that switching to healthier milk compositions can help slowing down global warming, without contributing to other environmental issues such as water scarcity. The results should encourage other milk companies to commit to the development of healthier, less environmentally damaging products, and also to stimulate consumers to bet on them.

1. Introduction

Cow milk has traditionally been a major component of the human diet, especially in developed countries, providing 19% of dietary protein supply in Europe (FAO, 2016a), where yearly dairy consumption reaches 219 kg per capita (FAO, 2011). The nutritional importance of milk in the human nourishment is widely accepted (Haug et al., 2007; Pereira, 2014), as demonstrated by its inclusion in the dietary recommendation patterns of the most recognised international health organisations (FAO, 2016b; HHS and USDA, 2015).

However, the suitability of the consumption of animal milk by humans has been questioned in recent years. The emergence of some studies linking milk consumption to some diseases, the contribution of milk farms to environmental degradation, and an increased social concern about the life quality of farm animals have led to some consumers to reduce or suppress milk intake (Haug et al., 2007).

The negative health effects to which milk consumption has been recently related include a higher incidence of cardiovascular diseases, due to its content of saturated fats (Hu et al., 1999), and a higher occurrence of prostate cancer (Qin et al., 2004; Song et al., 2013). Regarding the former, some recent studies found no clear evidence that dairy food consumption is associated with a higher risk of cardiovascular disease (German et al., 2009), while others have associated dairy intake with reductions in cardiovascular risk (Huth and Park, 2012). With respect to cancer, the topic is also controversial and no evidence of correlation has been found by several studies (Huncharek et al., 2008; Parodi, 2009), while other authors point out that milk can play a protective role in carcinogenesis (Pereira, 2014). The reason behind these apparent contradictions is that milk is a complex foodstuff, containing components that can be unadvisable in high amounts, such as saturated fats, but others that can play a protective role against several diseases. Among the latter, the following compounds stand out: calcium, magnesium, and potassium contained in milk have shown an antihypertensive effect (Pereira, 2014); vitamin D (when combined with calcium) contributes to bone density (Dawson-Hughes et al., 1997); polyunsaturated fatty acids such as omega-3 have important roles in the prevention of coronary heart disease (Connor, 2000); and selenium can play a protective role against the incidence of certain cancers (Shamberger and Frost, 1969).

Regarding its environmental burdens, livestock is one of the major contributors (14.5%) to anthropogenic greenhouse gas emissions (Gerber et al., 2013), mainly due to the methane arising from enteric fermentation (Moss et al., 2000), and it is also responsible for a major water consumption, since drinking water supplied to cattle represents 1.9% of all water withdrawals in Europe (Mubareka et al., 2013). Not only cattle breeding but crop cultivation for feed production is responsible of significant environmental degradation, as both manure and other nitrogen synthetic fertilisers are used to improve crop yields. Part of this nitrogen is released into the atmosphere as nitrous oxide (IPCC, 2006), contributing to global warming, and leached into surface water, increasing grey water footprint (Hoekstra et al., 2011). Water is also consumed for crop growth, either in the form of rainwater or freshwater from aquifers: the agricultural sector represents 92% of the total water footprint of anthropogenic activities (Hoekstra and Mekonnen, 2012).

The relevance of the greenhouse gas (GHG) emissions coming from milk production is evidenced by numerous studies aimed to evaluate the environmental effects of milk production from a life cycle perspective. Among them, some focus on Galicia (NW Spain) (Hospido et al., 2003b; Iribarren et al., 2011), and Portugal (Castanheira et al., 2010; González-García et al., 2013), the neighbouring country, with similar agricultural practices. On the other hand, studies determining the water footprint of milk production are rather scarce, and none of them focuses on Galicia or the Iberian Peninsula but on countries with different climatic conditions and management practices, such as Brazil (Palhares and Pezzopane, 2015), Chile (Osorio-Ulloa, 2013), and New Zealand (Zonderland-Thomassen and Ledgard, 2012). Mekonnen and Hoekstra (2010) determined the water footprint of milk production throughout the world, but their study is based on statistics instead of actual data coming from individual farms.

It can be concluded that, being milk a necessary foodstuff, its production can be improved to maximise its beneficial effects on consumer health, while trying to reduce its environmental impacts. Regarding the former, numerous brands of enriched milk (with calcium, omega-3, vitamins. . .) have been recently incorporated into the market by dairy companies. However, the improved composition of enriched milk is achieved through the addition of nutrient supplements to the final product, and therefore the potential improvements are not connected to the raw milk production, thus not affecting the major source of environmental damage.

An alternative way of producing healthier milk, by acting at the farm level, is evaluated here focusing on the latest innovative project developed by Feiraco.[1] Feiraco is a cooperative of stockbreeders located in Galicia and committed to the sustainable development of the region. As a result of this commitment to the area, the company only collects milk from its members' farms, to whom it offers permanent support and advice, and which are all located in Galicia. The company has an integrated food quality and safety system, based on ISO 9001 and ISO 22000, which covers the entire value chain, from livestock production to the packaging and marketing of the final products. They also manufacture their own animal feed, which they supply to the farmers and which is conceived to produce milk of the highest quality.

This study focuses on Feiraco's premium brand of UHT milk, Unicla. Unicla milk is characterised by an improved nutritional composition, obtained by modifying cow's diet by including high-quality forages and seeking greater digestibility, instead of artificially modifying the final product.

This paper reports the main results of a project funded by the autonomic government (FEADER, 2013), in which Unicla milk has been evaluated from a broad perspective, considering both its expected health effects and its environmental impacts, by focusing on those spheres of the environment where it is expected to cause the higher impacts. To conduct this assessment, Unicla milk has been compared to conventional milk, in terms of nutritional value, carbon (CF), and water footprints (WF). To the best of our knowledge, this is the first study that evaluates both the environmental and health performance of a naturally improved brand of milk, and the results will serve as a basis to guide future innovations leading to the development of healthier, environmentally friendly dairy products, and may also help stimulate consumers to bet on them.

[1] http://feiraco.es/en/.