An "LCA" approach to Slow Food Presidia products: from agro-environmental and socio-cultural aspects to economic sustainability and nutritional evaluations

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ABSTRACT

Two approaches, nutritional and multi-criteria sustainability, were combined to define Life Cycle Assessment (LCA) of Slow Food Presidia in a new way. Chemical and bromatological evaluation of several plant and animal Presidia products were compared to traditional Italian bromatological references. To assess sustainability, producers were interviewed on four objective areas: environmental, economic, social and cultural. The gathered data were used to value Presidia.

Keywords: Food LCA, Sustainability, Slow Food Presidia Nutritional Value

1. Introduction

Slow Food is a global, grassroots organization, founded in 1989 to prevent the disappearance of local food cultures and traditions. It is also intended to counteract the fast pace of life and people's dwindling interest in the foods they consume, including their sources, production, and how their choices affect the world around us.

Since its inception, Slow Food has grown into a global movement involving millions through its activities:

- saving endangered foods and defending gastronomic traditions through biodiversity projects;
- teaching food pleasure and how to make good, clean, and fair choices through food and taste education;
- connecting young people passionate about changing the food system via the Slow Food Youth network;
- organizing countless daily activities for local Slow Food member groups (convivial) on food, the environment, and food-related sustainability;
- linking food producers, chefs, academics, and community representatives across the world through the Terra Madre network;
- creating the next generation of food and gastronomy professionals at the University of Gastronomic Sciences.

The Slow Food Foundation for Biodiversity was founded in 2003 to support Slow Food projects, defending food biodiversity and traditions. The Presidia project started in 1999 with a recording of hundreds of products facing extinction through the Ark of Taste. Thereafter, Slow Food engaged the production side of the foods (the where, how, and who) to promote the products, work, and wisdom.

The Presidia sustain their production quality while risking extinction of their unique regions and ecosystems, traditional processing methods, native breeds and local plant varieties. There are more than 200 Presidia in Italy and more than 170 International Presidia, involving 2500 small-scale fishers, butchers, shepherds, cheese makers, bakers, and pastry chefs.

2. Methods

2.1. The project

Since 2009, the Slow Food Foundation for Biodiversity (SFFB) in collaboration with Turin and Pollenzo Universities and the Chemical Laboratory of the Chamber of Commerce of Turin, has started a process of chem-

ical and bromatological evaluation of some plant and animal Presidia products. They were compared to usual Italian bromatological references in IEO and INRAN tables.

In 2012, a collaboration of the SFFB, University of Turin, and University of Palermo studied the sustainability of a significant sample of European Presidia from three points of view: agri-environmental, socio-cultural, and economic. Four areas were investigated: environmental (biodiversity preservation, food production sustainability increase, economic (producer income rise, locally-driven activity development, employment increment), social (producer social role improvement, organizational skill consolidation, self-esteem increase), cultural (producer cultural identity consolidation, production area promotion).

Life Cycle Assessment of Presidia food products to determine their value utilized an approach that considered the entire supply chain: before, during, and after food production. To this end, Presidia products were evaluated from two different perspectives: nutritional and multi-criteria sustainability.

Four Italian Presidia were selected for analysis based on food category and available comparative literature: 'Lenticchia di Ustica', a lentil (legume) grown on an island of Sicily; 'Ramasin di Pagno della Val Bronda', a plum grown in southwest Piedmont; 'Manna delle Madonie', natural sweetener harvested from the bark of tree Fraxinus tree in Sicily; and 'Culatello di Zibello,' a crude ham from Parma.

2.2. A model of sustainability

The assessment of the socio-cultural, agri-environmental, and economic aspects of 47 of the 269 European Presidia was performed between 2000 and 2012. Presidia were selected according to risk of extinction, social sustainability, small-scale production, history, and culture.

Four areas were analyzed: environmental (biodiversity defense, food production sustainability improvement), economic (producers' income, locally driven activities development, employment increase), social (producers' role, organizational skills and self-esteem) and cultural (strengthening producers' cultural identity and promoting production areas).

They were clustered into three scales (socio-cultural, agri-anvironmental, and economic) on the basis of an assessment grid discussed and formulated by agronomists, sustainability experts, and producers. Each scale had 10 indicators that, when maximized, reached a score of 100. As an example, biodiversity was analyzed according to variety, processing tecnhnique, landscapes, seeds and intercropping. Soil and water analysis was based on rotation, irrigation, fertilization, organic fertilization; crop protection included pest and disease protection, natural pest and disease protection, weed control, natural weed control, post-harvest treatments, natural post-harvest treatments, certification; energy took into consideration renewable energy and packaging. Each indicator had a different measurement unit (yes/no - % of farms, % producers)

The Slow Food motto of "good, clean and fair" food, formed the basis of each scale. "Good and fair" parameters were mainly considered by the socio-cultural scale (taste, sustainability, link to local culture), "clean" parameters were included in the agri-environmental scale (risk of extinction, soil and water, energy, crop protection), and "fair" was also used by the economic scale (development, efficiency).

Total sustainability was analyzed over time, where T_0 represented the initial status of the Presidium and T_1 represented their status in 2012.

2.3. Nutritional evaluations

The main purpose of this part of the study was chemical analysis of Slow Food Presidia to understand if different production methods, both for animal and plant foods, could lead to different nutrient profiles. A few papers have, in fact, shown preliminary data as to the influence of seeds (native versus traditionally or genetically-modified), space (open versus greenhouses), and production type (small-scale versus intensive) on the final food.

Many of the nutritional components analyzed for each Presidium were common among the foods, but others differed according to food category. Table 1 lists the products and analyses performed for each.

Table 1. Components analyzed for each Presidium product considered.

Component	Lentil	Plum	Sweetener	Ham
Proteins	✓	✓	✓	✓
Carbohydrates	✓	✓	✓	✓
Sugars	✓	✓	✓	✓
Starch	✓	✓		
Polyalcohol (mannitol)			✓	
Dietary fibre	✓	✓		
Fats	✓	✓	✓	✓
Saturated fatty acids				✓
Monounsaturated fatty acids				✓
Polyunsaturated fatty acids				✓
Cholesterol				✓
Calcium	✓	✓		✓
Iron	✓	✓		✓
Phosphorous	✓	✓		✓
Magnesium	✓	✓		✓
Potassium	✓	✓		✓
Sodium	✓	✓		✓
Vitamin C		✓		
Flavouring		✓		

All nutritional analyses were performed in the Chemical Laboratory of the Chamber of Commerce in Torino, Italy over a four-year period (from 2008 till 2012). Table 2 displays the methods used for each analysis.

Table 2. Analytical method used for component analysis of Presidia tested.

Component	Analytical method
Proteins	Kjeldahl Method (ISO 1871:2009)
Sugars	HPLC (high performance liquid chromatography) Electrochemical Detection
Starch	Enzymatic-Spectrophotometric Method
Dietary fibre	Enzymatic-Gravimetric Method (AOAC 985.29)
Fats	Official methods such as Soxhlet Extraction after Acid Hydrolysis
Fatty acids*	Gas-chromatography of methyl esters of fatty acids (ISO 5508:1990 (E) + UNI EN ISO 12966-2:2011)
Cholesterol	HPLC (high performance liquid chromatography)
Minerals**	ICP-AES (Inductively coupled plasma -Atomic Emission Spectroscopy)
Vitamin C	Spectrophotometric method
Flavoring	HS-GC-MS (Head Space Gas Chromatography Mass Spectrophotometry)

* Fatty acids including saturated, monounsaturated, and polyunsaturated fatty acids.
**Minerals including calcium, iron, phosphorous, magnesium, potassium and sodium.

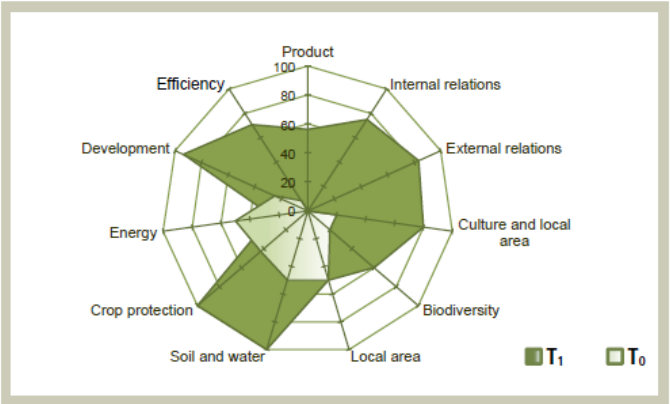
Following the analyses, study results were compared to bromatological values of similar foods reported in IEO and INRAN literature. The comparison was not possible for 'Manna delle Madonie' as its traits are not available in the literature.

3. Results.

3.1. 'Lenticchia di Ustica'

These tiny, dark brown, tender and flavorful lentils grow on the fertile volcanic soil of the island of Ustica. They must be soaked and then cooked for 45 minutes.

The Presidium was launched in 2000 from a point of very good performance. Nevertheless, it attained excellent scores due to the impressive interest and involvement it attracted by young people, as well as its good defense of cultivation, soil, and water. By T_1, post-harvest chemical soil treatments against weevils had been replaced with cold treatments and all producers were adopting organic practices (Figure 1).



The components of all three scales are growing considerably, particularly the *defense of cultivations*, *soil and water* (agri-environmental scale) and *development* and *internal* and *external relations* (sociocultural scale).

Figure 1. Sustainability performances of 'Lenticchia di Ustica': T_0 = initial status of Presidium, T_1 = 2012 status

The results describing the nutritional quality of the lenticchia are displayed in Figure 3. The dietary fiber of 'Lenticchia di Ustica' is more than double that of other lentils, which led to a reduced energy value and carbohydrate content. Furthermore, the high Iron content in the Presidium results in a single serving (about 60 g) providing 5.4 mg of iron, or almost 50% of the RDA.

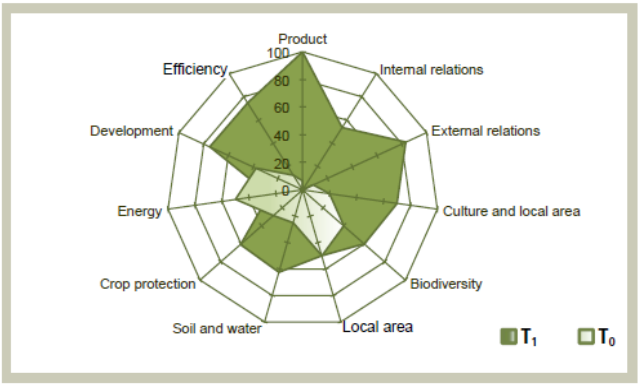
Table 3. Summary of results comparing 'Lenticchia di Ustica' and standard lentils (per 100 grams)

	Lenticchia di Ustica	**Lentils**
Energy value (kcal)	252	291
Proteins (N x 6,25) (g)	27,7	22,7
Carbohydrates (g)	32,6	51,1
Fats (g)	1,2	1,0
Starch (g)	29,82	44,8
Sugars (g)	2,78	1,8
Dietary fiber (g)	30,22	13,8
Iron (mg)	9	5

3.2. 'Ramasin della val Bronda'

The small, dark, and very sweet 'Ramasin della val Bronda' plum is familiar to many in the Piedmont (region in northwest Italy), but it is relatively unknown in the other Italian regions. It is a traditional fruit that was typically found along the borders of family orchards.

The Presidium started its activity in 2007 with a very low initial score, but the 2012 evaluations found interesting levels of efficiency and sustainability. The producers now sell their products both fresh and processed (in jam and spirits), promote them collectively, and two producers among the six are women. Organic agriculture has been only partially adopted to-date, and the packaging still requires improvement (Figure 2).



The most significant improvements are found in the components of *development*, *efficiency* (economic scale), *product* (sociocultural scale).

Figure 2. Sustainability performances of 'Ramassin della Val Bronda:' T_0 = initial status of Presidium, T_1 = 2012 status

The results of the nutritional quality analysis of the Ramasin are summarized in Table 4. The 'Ramasin di Pagno della Val Bronda' plum is richer in dietary fiber (seven-fold higher) and vitamin C (more than two-fold) compared to the reported standard values for plums. The measured flavoring components explain the organoleptic character that improves the consumption of this fruit.

Table 4. Summary of results comparing 'Ramasin della Val Bronda' and standard plum (per 100 grams)

	Ramasin della Val Bronda	**Plum**
Energy value (kcal)	41	42
Proteins (N x 6,25) (g)	0,7	0,5
Carbohydrates (g)	9,6	10,5
Fats (g)	< 0,10	0,10
Starch (g)	< 0,10	< 0,10
Sugars (g)	2,8	1,8
Dietary fiber (g)	7	1
Phorsphorus (mg)	19	14
Vitamin C (mg)	9,4	5

3.3. 'Manna delle Madonie'

'Manna' is obtained from a resinous substance extracted from the bark of ash trees in Castelbuono and Pollina (Madonie mountains, Sicily), which dries rapidly to form white tubes. It is used as a natural sweetener and has very low glucose and fructose content.

The Presidium, launched in 2002, has improved in its harvest technique. Purity and quality are now continuously monitored and the use of metal wires hung on branches to collect the manna (*versus* manna flowing down the bark) has reduced impurity levels.

Many producers are very young (seven among the 10 are under 35 years). Sustainability, already very high, has remained unchanged even with improved harvest techniques. The quantity of 'manna' produced has increased from 100 to 450 kg/year (Figure 3).

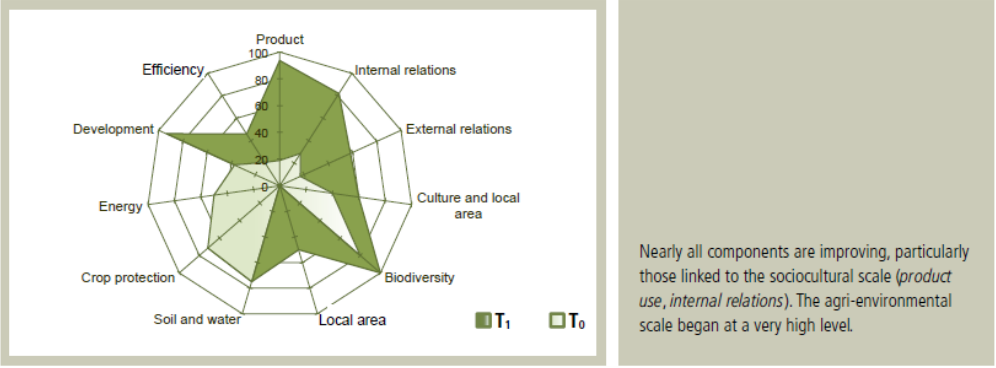


Figure 3. Sustainability performances of 'Manna delle Madonie:' T_0 = initial status of Presidium, T_1= 2012 status

The results describing nutritional quality of manna are mentioned in the Table 5. The 'Manna delle Madonie' main characteristic is its high mannitol and low soluble sugar contents which result in a reduced energy value, but conserved sweetening power.

Table 5. Summary of results 'Manna delle Madonie' (per 100 grams)

Energy value (kcal)	**176**
Proteins (N x 6,25) (g)	< 0,10
Carbohydrates (g)	64
Fats (g)	0,3
Polyalcohol (D-mannitol) (g)	53
Sugars (g)	11

3.4. 'Culatello di Zibello'

'Culatello di Zibello' is among the most highly regarded Italian cured meats due to its long and delicate processing and prized cut of pork. The heritage and richness of the cured ham is amplified by the peculiar climate of the foggy flatland from which it comes near the Po River. The right aging is a key element that has been passed on for generations. The ham embodies the history of a land, a people's tradition, and the particular climate.

In the Protected Designation of Origin (PDO) production, which is mainly industrial one, great efforts have been made in recent years to differentiate traditional producers. In the case of 'Culatello di Zibello,' it has been improved in several ways: it is GM-free, it has shown strong growth on the sociocultural scale, and it has maximized its local area score (agri-environmental) (Figure 4).

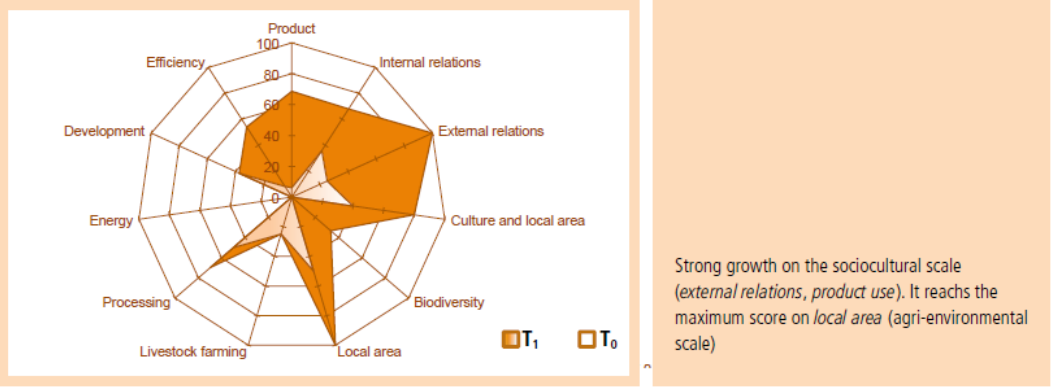


Figure 4. Sustainability performances of 'Culatello di Zibello:' T_0 = initial status of Presidium, T_1 = 2012 status

The analysis of the nutritional components of 'Culatello di Zibello' compared to other cured hams as displayed in Table 6 shows that is a protein-rich animal product. Its monounsaturated fatty acid content is higher than in other crude hams, and its cholesterol value is lower. These characteristics make 'Culatello di Zibello' very similar to low-fat bovine and ovine meat. Other positive qualities are its low sodium content and high phosphorous and potassium contents.

Table 6. Summary of results comparing 'Culatello di Zibello' and standard crude ham (per 100 grams)

	Culatello di Zibello	**Crude ham**
Energy value (kcal)	404	370
Proteins (N x 6,25) (g)	29	22
Carbohydrates (g)	< 0,10	< 0,10
Fats (g)	32	31
Saturated fatty acids (g)	11	10
Monounsaturated fatty acids (g)	16,2	13,9
Polyunsaturated fatty acids (g)	4,4	3,8
Sugars (g)	< 0,10	< 0,10
Cholesterol (mg)	72	92
Sodium (mg)	1544	2378
Phosphorous (mg)	320	177
Potassium (mg)	646	281

4. Discussion

Lifestyle and nutrition health indicators show a pandemic of obesity, type-2 diabetes, some cancers, and many chronic degenerative diseases, including Parkinson's and dementia. Given these data, it is no surprise that there is an increased consumer demand for healthier food choices. While fortified and deeply transformed foods can augment the intake of protective nutrients (fibers, antioxidants, chemo-protective substances, healthy fats, and more), their taste and other aspects often take them far from natural, traditional, and local food products. On the other hand, local and traditional certified foods often suffer from a lack nutritional and bromatological data. Furthermore, there is an increasing concern about the ecological footprint of food. How best to combine sustain-

ability, health, and pleasure deserves consideration. Slow Food Presidia responds to this issue through its focus on several crucial sustainability issues of local communities: small-scale agriculture and farming, mountain pasture protection and pastoral farming, traditional landscape defense, traditional seed selection and propagation by communities, animal welfare, transparent labeling and ecologically sustainable packaging.

Nutritional quality analysis of Presidia confirms a strong consumer health orientation and suggests a new global 'health-oriented LCA' approach. Understandably, the approach is limited to small productions that represent a very small percentage of world food production. However, Presidia present an interesting paradigm that can be applied to other small-scale productions in order to promote LCA analysis in less-industrial settings while taking into account holistic gastronomic aspects that are sometimes forgotten in such studies.

5. Conclusions

The combined approaches represent an interesting example of Life Cycle Assessment (LCA) of food. In order to consider the global impact on the well being of both land and people, the nutritional aspect must be included alongside the usual sustainability markers.

Slow Food Presidia products (both plant and animal foods) performed at high levels of global sustainability and demonstrated extra nutritional value. Our work suggests that when a nutritional evaluation is combined with traditional LCA social, agri-environmental, and economic aspects, an innovative tool emerges that help small scale producers improve product characteristics, as well as support and promote traditional gastronomic activities. Furthermore, the food—health relationship must be considered with a multifactorial approach that encompasses producers, consumers, communities, and environment.

6. References

Chrzan J (2004). Slow Food: What, Why, and to Where? Food, Culture and Society: An International Journal of Multidisciplinary Research 7 (2): 117-132

Frighi Z, Pezzana A (2011). Analisi bromatologica e valutazione dietetico-nutrizionale di prodotti industriali di largo consumo in confronto con i prodotti dei Presidi Slow Food. Atti del 23° Congresso Nazionale ANDID, Milano

Hamm MW (2009). Principles for Framing a Healthy Food System. Journal of Hunger & Environmental Nutrition, 4:241–250

Horrigan S, Lawrence RS, Walker P (2002). How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture. Environmental Health Perspectives 110 (5): 446-455

Lotti A (2010). The commoditization of products and taste: Slow Food and the conservation of agrobiodiversity. Agriculture and Human Values 27: 71-83

Nosi C, Zanni L (2004). Moving from "typical products" to "food-related services": The Slow Food case as a new business paradigm. British food Journal 106 (10/11): 779 - 792

Peano C, Sottile F (2012). Slow Food Presidia in Europe: a model of sustainability. http://www.slowfood.com/sloweurope/filemanager/position_docs/biodiversity/Ricerca_presidi_ENG.pdf

Petrini C (2001). Slow Food: The case for taste. Columbia University Press

Pezzana A, Bersani L, Zanardi M, Baldereschi F, Ponzio R, Frighi Z, Durelli PC, Vassallo D, Petrini C (2014) The role of traditional foods, legumes in particolar, in the Mediterranean diet and the Slow Food Presidia products. X Barcelona International Conference on the Mediterranean Diet

Van Dieren S (1981). The global burden of diabetes and its complications: an emerging pandemic. In : Management of Type 2 Diabetes Mellitus and Prediction of Cardiovascular Complications. Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht

VV.AA. Food composition database for epidemiological studies in Italy, IEO European Institute of Oncology, http://www.ieo.it/bda2008/uk/diritti.aspx

VV.AA. Tabelle di composizione degli alimenti, Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione (INRAN), http://nut.entecra.it/646/tabelle_di_composizione_degli_alimenti.html

VV.AA (2010): La Pêche Durable - Dialogue international, pour une restauration durable. pp. 30-33, http://www.ecomeal.info/documents/peche_durable.pdf

Waters A (2006). Slow Food Nation. http://www.thenation.com/doc/20060911/waters

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