Agribalyse 3.0.1 – Data variability study

Carried out by

Analysis of data structure parameters to develop environmental information for consumer display

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RÉSUMÉ

Agribalyse « version 3 » est une base de données d'Analyse de Cycle de Vie regroupant 2 500 aliments, publiée en 2020. C'est la première base environnementale publique de ce type, publiée avec un tel niveau de détail et contenant les principales « catégories d'aliments » consommées par les français.

L'objectif de cette étude est de mieux cerner le domaine de validité des données et d'identifier les paramètres structurants de l'impact environnemental des produits, en particulier dans une perspective d'affichage environnemental destiné à informer les consommateurs. Cette étude se concentre uniquement sur les indicateurs ACV fournis par Agribalyse. Il est admis que ceux-ci ne couvrent pas pleinement à ce stade l'ensemble des enjeux environnementaux (par exemple la préservation de la biodiversité) pour le secteur alimentaire, et qu'il est nécessaire de tenir compte de ces limites, et éventuellement de compléter les analyses avec des indicateurs complémentaires pour réaliser des évaluations environnementales « complètes » (cf « limites de l'ACV », site Agribalyse).

Sur l'analyse des produits alimentaires, les résultats de l'étude montrent que l'indicateur agrégé «score unique EF3» est corrélé avec celui du changement climatique, qu'il enrichi sur des dimensions complémentaires (eau, air etc.), d'une manière qui semble pertinente dans la perspective d'un affichage environnemental.

L'analyse des étapes du cycle de vie montre que l'amont agricole est le plus gros contributeur de l'impact final (78%) devant la transformation (8%), l'emballage (5%), le transport (5%). Les étapes de distribution et de consommation comptent peu.

L'étude a permis d'identifier les paramètres structurants de l'impact environnemental par catégorie de produits : selon les produits observés, le transport, l'emballage, les modes de production et la composition des recettes sont des paramètres qui influent plus ou moins fortement sur le «score unique EF3» final. Toutefois, et mis à part quelques catégories de produits spécifiques comme la viande rouge, le poisson, le chocolat ou le café, ces paramètres provoquent globalement de faibles variations sur le «score unique EF3» final des produits par rapport à l'ensemble de l'impact de l'alimentation et changent peu les hiérarchies entre catégories de produits.

Cette étude fournit également des pistes d'amélioration pour la base de données, pour une meilleure représentativité des recettes notamment. Cette étude tend à valider la pertinence des valeurs moyennes de la base Agribalyse et sa pertinence dans le cadre d'un affichage environnemental prenant en compte l'analyse de cycle de vie.

ABSTRACT

Agribalyse version 3.0.1 is a LCA database of 2,500 food products, published in 2020. This is the first public environmental database with this level of detail and containing the main "food products categories" consumed by the French.

The goal of this study is to get a better understanding of the data's validity domain and to identify the structuring parameters of the products' environmental impact, particularly in an environmental display perspective intended to inform consumers. This study focuses only on the LCA indicators provided by Agribalyse. The authors recognize that these do not yet fully cover fully the environmental stakes (for example preserving biodiversity) within the food industry, and that it is necessary to keep these limits in mind, eventually completing analysis with complementary indicators in order to carry out a full environmental assessment. (cf. LCA methodology limits in the Agribalyse website).

On the food products analysis, the results of the study show that the aggregated indicator "EF3 single score" is correlated with the climate change indicator but enriches the latter with additional dimensions such as water use, air quality, in ways that are relevant for environmental information display.

The life cycle stage analysis shows that the agricultural upstream stage is the main contributor to the final impact (78%), before processing (8%), packaging (5%), and transport (5%). The distribution and consumption stages are of little importance.

The study highlights the structuring parameters of environmental impact by food product category : depending on the product, transport, packaging, production methods and composition parameters have a greater or lesser effect on the final EF3 single score. However, aside from specific categories such as red meat, fish, chocolate and coffee, these parameters have a relatively low impact on the final EF3 single score of the products in relation to the overall impact of food products, and do not significantly change the ranking of food product categories.

This study also suggests ways to improve the database, in particular by including more representative food ingredients and recipes. The study tends to validate the relevance of the mean values of the Agribalyse database and its relevance for environmental display based on life cycle analysis.

INTRODUCTORY REMARKS

The environmental impacts of agriculture and food processing are well documented, and much research has been done to quantify these impacts. This work includes life cycle analyses (LCA) that cover all stages of product manufacture. A number of levers have been identified to limit the environmental impacts of food, including: more efficient use of agricultural inputs and energy consumption; less wastage; relocalization of farm production in wealthy countries; agriculture less dependent on fossil resources; revised distribution modes, and changes in food habits (Les Greniers d'Abondance, 2020).

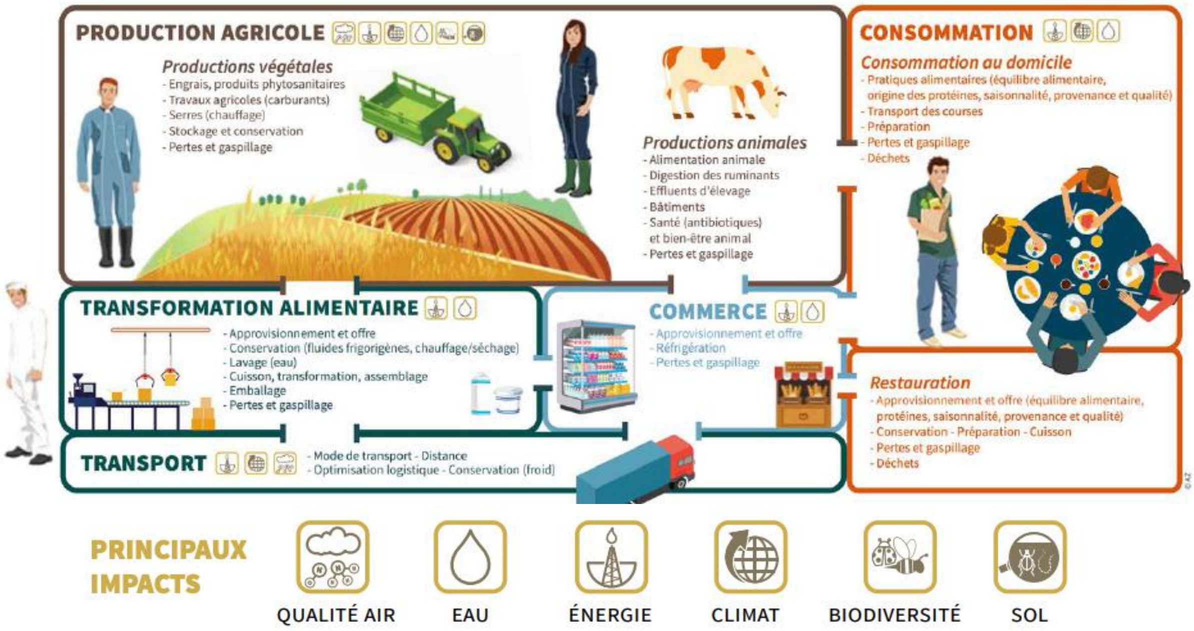


Figure 1: Environmental impacts: from field to plate (ADEME, 2016)

To change food habits there must be change in both supply and demand. A growing number of citizens aspire to more responsible and sustainable consumption; as evidence of this the recent Citizens' Climate Convention in France endorsed the idea of a carbon score for consumer products(Convention Citoyenne pour le Climat, 2020).Despite the availability of many tools that incite consumers to change their behaviour, a large swathe of the population has little awareness of the environmental stakes of food consumption. For example, many people are convinced that consuming locally grown food will shrink the environmental footprint of their food consumption. In this context, and despite the trends of organic foods, local consumption, short distribution circuits and renewed vegetarianism, the food system as a whole is slow to achieve a transformational change in the food products put on the market.

Legislation on waste and the circular economy enacted in France in the first quarter of 2020 proposes voluntary display of environmental information in all retail sectors, particularly food. Article 15 of this bill implements an experimental phase to determine what methods are the best candidates for an official and harmonized environmental information display system by sector, under the auspices of government ministries, the Ecological Transition Agency (ADEME) and their partners (Legifrance, 2020).The food system represents a broad opportunity for this experimentation, in both retail distribution and the restaurant sectors, because consumer spending for food is regular and constitutes a significant share of the household budget. This sector also has major environmental stakes, as roughly 25% of greenhouse gas (GHG) emissions in France are related to food.

This is the context in which ADEME and the Institut National de la Recherche Agronomique, Alimentation et Environnement (French National Research Institute for Agriculture, Food and the Environment, INRAE) published in June 2020 the updated Agribalyse database in its 3.0.1 version, compiling the LCA inventories of 2,500 food products marketed in France. This publication and other work in this area published since 2010 create favourable conditions for testing environmental information display in the food sector.
This analysis focuses exclusively on the LCA indicators given by Agribalyse. The authors recognize that at the time of this writing these indicators do not cover all the environmental impacts of the food sector

(preservation of biodiversity, for instance). This limitation must be kept in mind, and these analyses supplemented in future work with additional indicators in order to carry out "complete" environmental assessments in the food sector (see the note on "the limitations of LCA methods" on the Agribalyse website).

AIMS OF THE STUDY

The overall objective of this study is to closely analyse the Agribalyse 3.0.1 database and identify structuring parameters to reveal the environmental impact of food products on the market, specifically with a view to environmental information for consumers.

This most recent version of the database largely covers the range of food products for sale in France. The impacts calculated for each product are based on "average" products. These average foodstuffs are composite profiles made up of several ingredients with differing characteristics depending on provenance or production. The data are drawn from multiple sources and reliable values are not always available; as a consequence some "average products" may not accurately reflect current consumption in France. For greater precision these products and foodstuffs for which better data are needed should be identified to obtain values that can be used in a environmental information system based on LCA analyses.

The general objective of this study is to explore the use of Agribalyse data for environmental information intended for consumers. Several supporting objectives structure this report and serve to advance thinking on this subject:

- A data review to establish the limitations associated with each foodstuff or category, and to classify products in coherent categories.
- Establish the validity of the EF3 single score by correlation with the climate change indicator.
- Identify correlations between environmental indicators and the FSA/Nutri-Score scale of nutritional value.
- Identify and characterize all the parameters that structure the environmental impact of a given product and compare them within and between categories.
- Carry out an in-depth sensitivity study for 20 selected commercial preparations and products chosen for their representativeness and their variability parameters, and compare them to the mean values in Agribalyse.
- Summarize the main observations of this work to recommend directions to be pursued in the development of environmental information display for consumers.

DEFINITION OF TERMS

Life Cycle Analysis (ADEME, 2020)
Life cycle analysis is a method used to quantify the environmental impacts of goods and services across all the stages of the value chain. This method inventories and quantifies physical flows of matter and energy associated with human activities according to the criteria of the ISO 14044 standard. Potential impacts are evaluated by several indicators: for example climate change induced by emissions of CO_2 equivalent. There are several ways to characterize this impact. The method used in this study and in the Agribalyse programme is the Product Environmental Footprint (PEF) method developed by the European Commission. This method attributes a single aggregated performance score based on 16 indicators (European Commission, 2018).

Agribalyse (ADEME, 2020)
The Agribalyse programme was launched by ADEME and INRAE in 2009 to provide elements for an environmental assessment of the food industry in France. The initial database of LCA results for 137 products was issued in 2013, and expanded and improved up through its 1.3 version in 2018. Version 3.0.1 published in 2020 compiles information for some **2,500 raw foodstuffs and processed food products**. The product characteristics are identical to those for products in the CIQUAL nutrition database (ANSES, 2020).This is the most complete LCA database to date on the environmental impact of food products consumed in France.

EF3 single score (European Commission, 2018)
The EF3 single score aggregates 16 LCA environmental indicators that are weighted on the basis of factors determined after extensive research and consultations. This methodology based on robust indicators and focusing on today's challenges, is widely recognized by the scientific community. In the present study the EF3 single score is expressed in points (Pt) or millipoints (mPt) per kilogram of product. The point is defined as the average yearly impact of a European on the environment (2010). The EF3 single score aggregates the following indicators:

Table 1: Environmental indicators and weighting for EF3 single score (European Commission, 2018)

Indicator	Unit	Description	Weighting factor
Climate change	kg CO_2 eq	Climate change due to GHG emissions	22.2%
Fine particulate matter	Disease incidence	Penetration of living organisms	9.5%
Water use	m^3	Water consumption in relation to availability in the territory	9%
Energy use	MJ	Consumption and depletion of fossil energy resources	8.9%
Land use	Pt	Land occupation and transformation (buildings, agriculture, transportation)	8.4%
Use of mineral resources	kg Sb eq	Consumption and depletion of non-renewable mineral resources	8.1%
Ozone depletion	kg CF11 eq	Degradation and depletion of the atmospheric ozone layer causing increased exposure the ultraviolent radiation	6.8%
Acidification	mol H+ eq	Discharge of acid chemical molecules with wide ecosystem impact	6.6%
Ionizing radiation	kBq U-235 eq	Emission of radiation from radioactive nuclear power waste	5.4%

Photochemical ozone	kg NMVOC eq	Deterioration of air quality causing harm to human health	5.1%
Terrestrial eutrophication	mol N eq	Excessive concentration of nutrients, notably nitrogen, in soil	3.9%
Marine eutrophication	kg N eq	Marine ecosystem asphyxiation (dead zone) cause by excessive nutrient concentrations, notably nitrogen	3.1%
Freshwater eutrophication	kg P eq	Asphyxiation of freshwater ecosystems due to excessive nutrient concentrations, notably phosphorus	2.3%
Freshwater toxicity, Human toxicity, cancer effects Human toxicity, non-cancer effects	CTUe CTUh CTUh	Indicators toxicity for the environment, and for human health via environmental contamination. These indicators are not very robust for the time being.	1.92% 2.13% 1.84%

CIQUAL (ANSES, 2020)
The CIQUAL table of nutritional composition was developed by the Agence Nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (French National Agency for Food, Environmental and Occupational Health & Safety, ANSES). It furnishes macro and micro nutrient content for close to 3,000 products. This publicly available table is used by professionals in nutrition and the food processing industry, and guides policy decisions.

Nutri-Score (Santé Publique France, 2020)
The Nutri-Score logo is displayed on consumer food products sold in France to indicate nutritional values on a colour-coded scale of five values from A (green) to E (red). The methodology used to calculate these scores is based on several parameters (sugars, fats, salt, proteins, etc). Some product categories are assessed according to specific formulas (cheeses, added fats, and beverages). **A score from -15 to 35** including bonuses and penalties is obtained, and then translated into a letter and colour code for consumer packaging. The score is also known as the **FSA score** as it was developed by the United Kingdom Food Standards Agency to measure the nutritional value of foods and beverages.

1. Methodology

In this data study we used Sima Pro and Open LCA software with the Agribalyse 3.0.1 database to model life cycle inventories and extract impacts broken down by life cycle stage. So-called " commercial " products were used for sensitivity studies on product ingredients and characteristics.
Additional documentation (LCA reports, research publications) and interviews with experts validated certain hypotheses and supplemented the inventories. For more information see:
https://ecolab.gitbook.io/documentation-agribalyse/documentation-complete

Product selection and classification

At the beginning of the study we reviewed the Agribalyse database to establish homogeneous categories and make sure that the product list was firm and did not include duplicate entries for the same product. For example cooked products for which the raw equivalent appeared in the database were excluded.

Given the large numbers of indicators and products to be assessed, our first priority was to review the EF3 single scores and the climate change scores. We chose the climate change score because there is a broad consensus among specialists on this indicator and its unit (kg CO_2 eq/kg of product) is easy to interpret and compare. The indicator quantifies GHG emissions according to their potential to contribute to global warming expressed in terms of CO_2, the reference gas. The EF3 single score aggregates and weights a number of LCA indicators (see Definitions), so that products can be compared in terms of overall impact (European Commission, 2018).The EF3 single score is expressed in mPt/kg of product in the findings of this study.

Following the database review we created an initial set of product categories to group products by environmental impacts on a consistent basis, while maintaining unified nutritional groups. This classification was improved and enhanced in the course of the study and in light of its findings. The results reported here are based on this classification.

Correlation between the EF3 single score, climate change impact and Nutri-Score

We compared EF3 single scores and climate change indicators using graphic and statistical tools to assess the **degree of correlation** between these two variables. On the basis of this analysis a reference value was defined for the EF3 single score to be used in subsequent assessments.
A similar study was conducted to measure correlation between environmental impacts and Nutri-Score ratings, by comparing the EF3 single score and FSA score (see Definitions).

In both comparisons the correlation study was applied to the entire product set, and then to food categories, using the mean EF3 single score, climate change score and FSA score.

Examination of structuring data parameters

1. The structuring stages of the life cycle

This assessment covered all life cycle stages by product category: agriculture, processing, packaging, transport, distribution and consumption. This assessment identified characteristics for each product category.

2. Specific approach for packaging and transport

Packaging and transport were studied in parallel, looking at the minimum and maximum variability with each product category.

The EF3 single score for each category was recalculated to integrate packaging with lesser or greater impact as previously identified. This same approach was used for the transport stage. We then observed the effect of these variables on the EF3 single score and compared these values to the mean EF3 single score in Agribalyse.

3. Sensitivity to production mode for 16 representative products

Using Sima Pro we recalculated the EF3 single score for 16 representative products (various meat and fish products, dairy products, coffee, chocolate, fruit, vegetables, rice, and others) according to different types of production listed in the database. Examples of production modes are conventional swine production, Label Rouge quality, organic crops and Bleu Blanc Cœur quality. These scores were compared to average consumption mixes in Agribalyse. This enabled us to observe a first range of variability by production modes for data obtained under the Agribalyse programme.

4. Variation by ingredients

We reconstituted recipes for 327 prepared food products to identify the ingredients with the greatest impact, and recalculated scores using values corresponding to 50% less and 50% more of these ingredients. A EF3 single score was recalculated for each food product to observe variation linked to ingredients and the product composition.

Overview

We summarize the above observations in the table below to present the parameters with the greatest impact for each product category quantitatively and visually. The table highlights the percentage variation in the final EF3 single score.

Products available in stores

To supplement earlier conclusions we selected 21 types of commercial products, on the basis of our findings and the eating habits of the French population, to observe the variability of the EF3 single score on certain products in stores. For chili con carne, for example, we recalculated the EF3 single score for some ten "real-life" commercial preparations with different characteristics (composition, origin of ingredients, meat production mode, packaging, etc).

2. Results

2.1. Database characteristics

2.1.1. Principal impact categories

What classification should be used to analyse the database?

We classified the Agribalyse products according to the groups used in the CIQUAL table, reflecting nutritional composition. One group is made up of meat products, eggs and fish; this group contains a subgroup of raw meat that includes beef, lamb, pork and poultry, for instance. As a result the environmental impacts by food group are undifferentiated.

Agribalyse code	CIQUAL code	Food group	Food subgroup	Product description
28104	28104	Meat, eggs, fish	Raw meat	Pork ribs, raw
36203	36203	Meat, eggs, fish	Raw meat	Duck, skin-on boneless thigh, raw
36023	36023	Meat, eggs, fish	Raw meat	Chicken, skin-on wing, raw
21514	21514	Meat, eggs, fish	Raw meat	Lamb, collar, raw

Figure 2: From Agribalyse database and nutritional category

Graphically we observe extreme values for most categories (Figure 3). These "box and whiskers" graphs represent statistical indicators in visual form, e.g. the median, the quartile distribution of values and intervals for each category. Points plotted indicate extreme values for products relative to the other products.

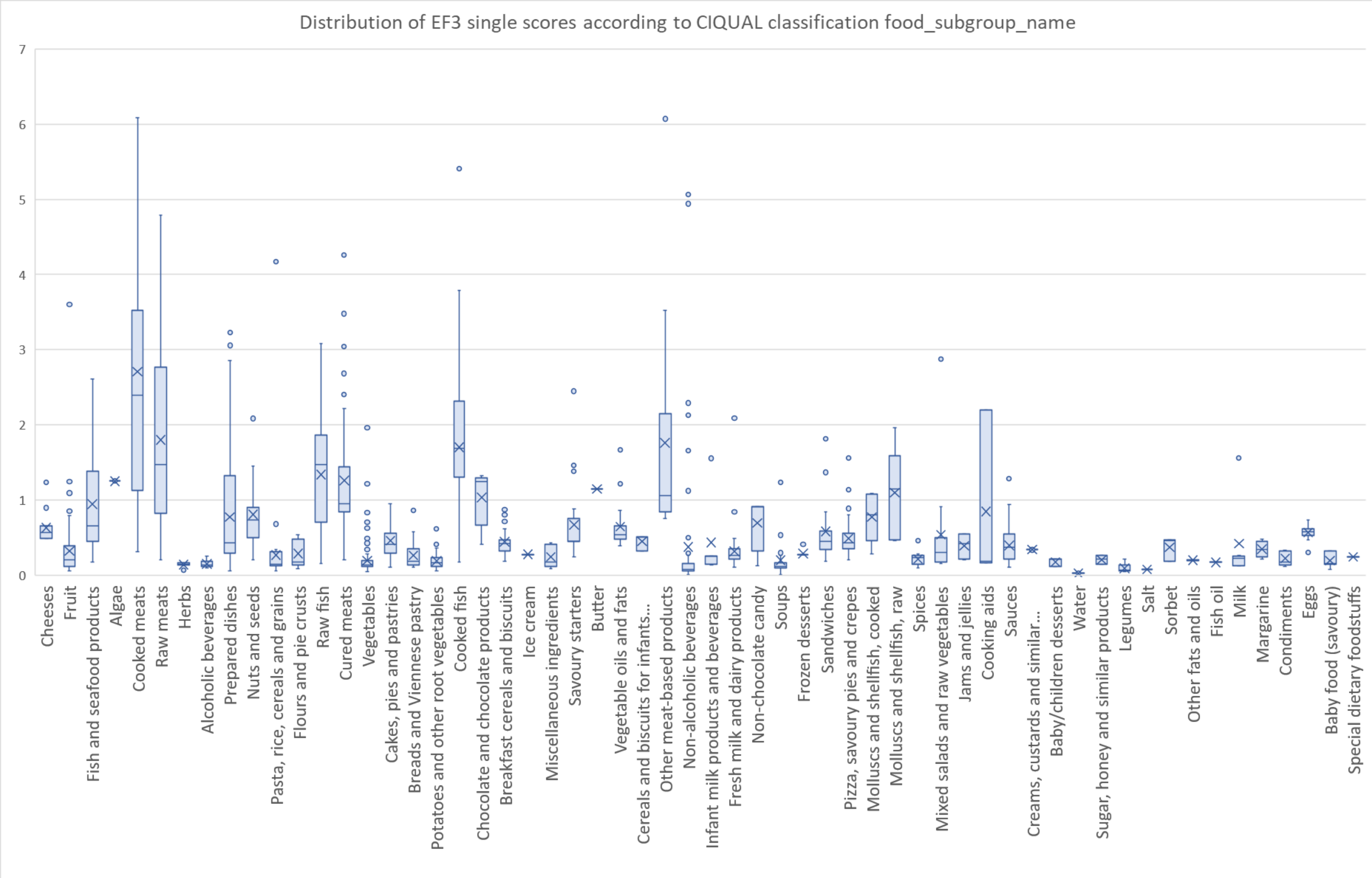


Figure 3: Distribution of EF3 single scores according to CIQUAL classification food_subgroup_name

Using this analysis we created a new classification of homogeneous groups, while aiming to stick as closely as possible to the CIQUAL groups. This classification groups products by environmental characteristics, while preserving a nutritional grouping.
Level 1 (L1) includes 14 principal categories Level 2 (L2) includes 42 subcategories to differentiate products in the same L1 category by environmental impact to obtain subsequent analyses that are more coherent (Figure 4).

The initial database of 2,480 food products was reduced to 2,181 products after exclusion of cooked products. Cooked products were excluded because this information is based on raw products, and therefore are duplicates that provide no additional information for our study. As an example, for carrots we retained raw carrots and eliminated cooked carrots.

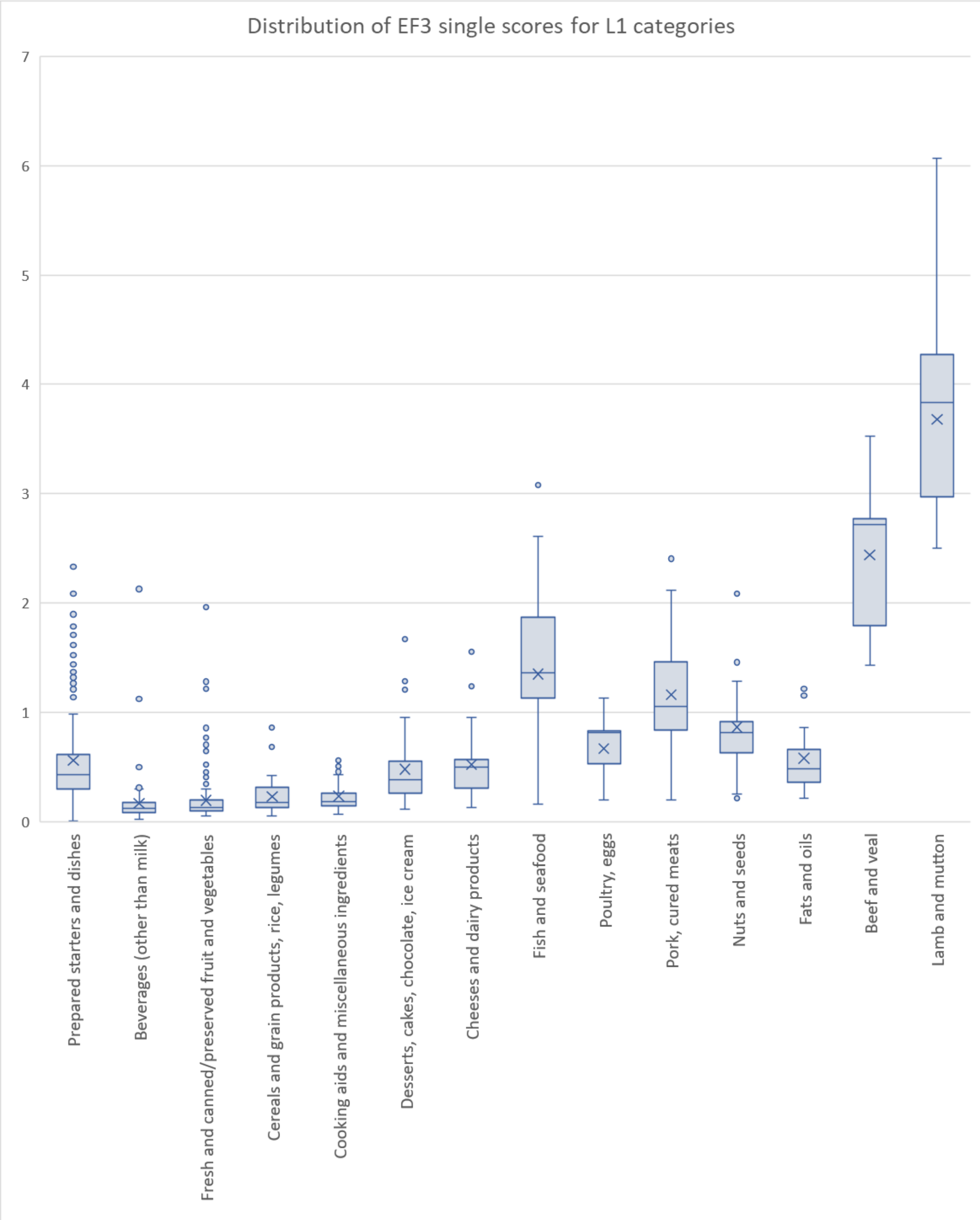
Some items among the 2,181 raw products were identified as problematic, and also eliminated. For example 86 types of bottled water were deemed redundant because they corresponded to the same proxy, some products lacked packaging, for others the ingredients and composition were found to be unrealistic, or the EF3 single score appeared to be inconsistent. These clarifications can be used to clean up the Agribalyse database in future versions. In the end 1,842 products were retained.

L1 category	Number of products	L2 categories	Number of products
Cooking aids	**117**		
		Cooking aids and miscellaneous ingredients	117
Beef and veal	**54**		
		Beef and veal	54
Plant-based beverages	**108**		
		Alcoholic beverages	41
		Non-alcoholic beverages	61
		Instant and ground coffee	4
		Water	2
Cereals and legumes	**162**		
		Cereals, flour, breads	139
		Legumes	15
		Rice	8
Prepared desserts	**235**		
		Chocolate and chocolate products	31
		Desserts, cakes, ice cream	191
		Chocolate cakes	13
Prepared starters and dishes	**252**		
		Prepared starters and dishes containing fish	46
		Prepared starters and dishes containing red meat	19
		Prepared starters and dishes containing white meat	52
		Meatless prepared starters and dishes	58
		Pizzas, pies, sandwiches and savoury crepes	77
Nuts and seeds	**42**		
		Cereals, flour, breads	2
		Nuts and seeds	40
Fruit and vegetables	**260**		
		Dried fruit and vegetables	8
		Fresh fruit	58
		Fresh vegetables	99
		Potatoes and other root vegetables	34
		Soups, compotes, canned/preserved fruit and vegetables	61
Fats	**42**		
		Butter	7
		Vegetable oils and fats	35
Lamb and mutton	**18**		
		Lamb and mutton	18
Fish, seafood	**135**		
		Algae	16
		Other wild fish	72
		Prepared starters and dishes containing fish	9
		Molluscs and shellfish	8
		Small fatty fish	24
		Farmed fish	6
Pork and cured pork meats	**150**		
		Pork organ meats and pâtés	8
		Cured meats (pork)	118
		Raw pork meat	24
Dairy products	**191**		
		Cheeses	118
		Milk and milk products	68
		Powdered milk	5
Poultry and egg products	**76**		
		Poultry organ meats and pâtés	14
		Eggs and egg products	14
		Poultry	48
		Overall total	**1,842**

Figure 4: L1 and L2 categories

The number of products per categories varies from 18 to 260 at Level 1 and from 1 to 192 at Level 2. In this preliminary phase it was clear that some products could be assigned to several categories, particularly those containing multiple ingredients. These products might introduce a bias or discrepancy in mean values by group, and potentially affect conclusions. This is notably the case for organ meats that are grouped together in the CIQUAL classification, and not by type of animal. The classification category is all the more important because the study findings could be used in displaying environmental information for consumers.

EF3 single scores ranged from 0.01 to 6.09 mPt/kg, across all products. The mean score is 0.71 mPt/kg, with a mean standard deviation of 0.68 mPt/kg. Climate change scores range from 0.02 to 62.73 kg CO_2 eq/kg, with a mean value of 5.91 kg CO_2 eq/kg and a mean standard deviation of 4.15 CO_2 eq/kg. The graphs below show the distribution of these two indicators for the new categories:



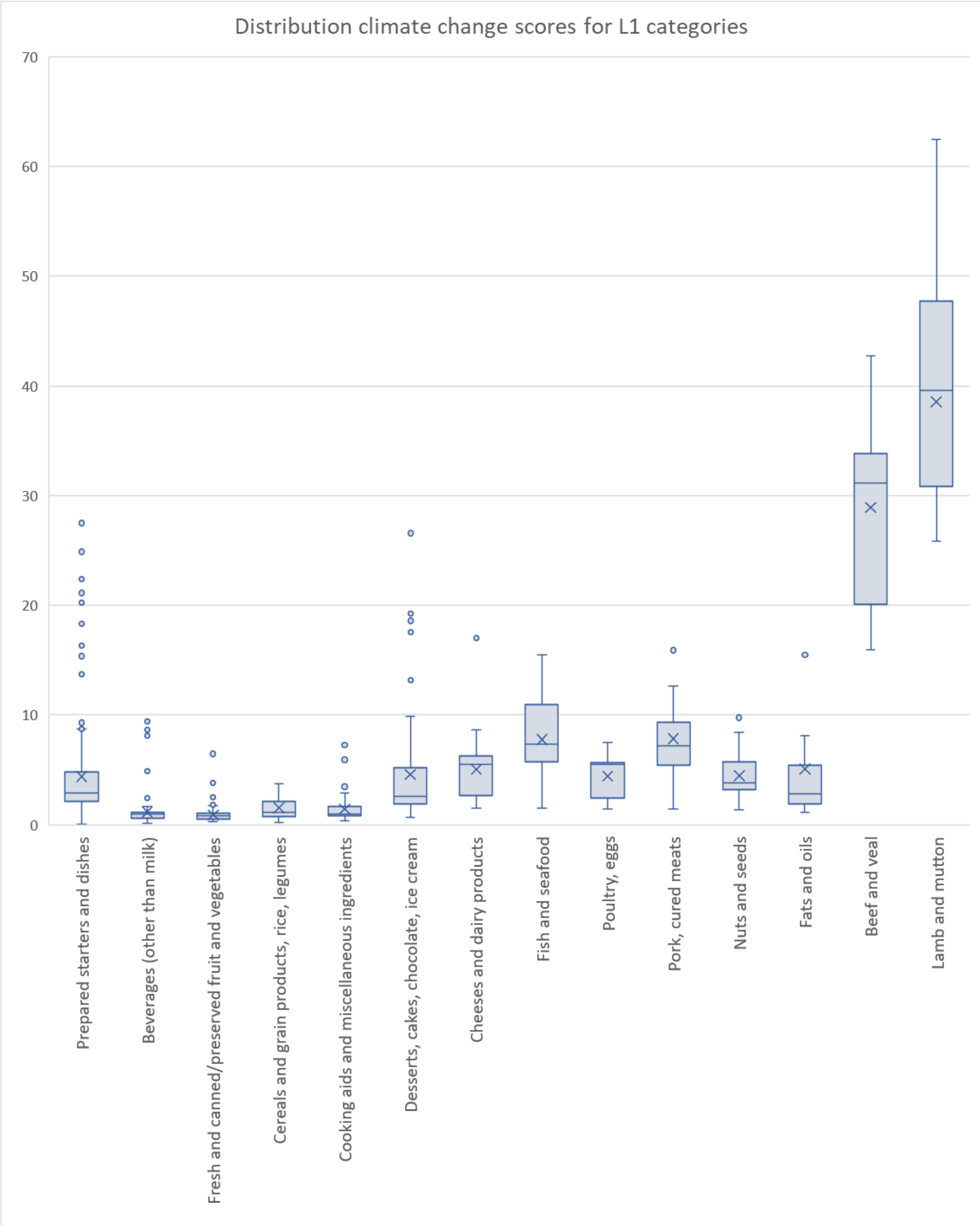


Figure 5: Distribution of EF3 single scores and climate change scores for L1 categories

Among the 12 L1 categories, ten have median values under 10 kg CO_2eq/kg; the exceptions are beef and lamb. The same distribution is found for the median EF3 single score above 2 mPt/kg. For both indicators, vegetable-based products have lower values than meat products. This is not an unusual result; nonetheless it should be noted that some agricultural crops are high consumers of water, increasing the EF3 single score. Generally speaking coffee, chocolate and nuts and products containing them have a strong impact on the environment. Consequently the categories that contain these products, as foodstuffs or as ingredients, show disparate scores with extreme values. The Beverage and Cooking aids categories include a wide range of products with varying characteristics, and the associated impacts may also vary widely.

Among animal products, the median values for dairy products are lower than for meat and fish. The distribution is lower for fish, compared to beef and lamb, but is similar to that of pork. The median values for the EF3 single score and climate change scores are significantly higher for beef than for lamb. Their distributions match however, meaning that some cuts of beef have an impact equal to that of some cuts of lamb. This can be explained by the yield per carcass weight and classification assigned at the time of the inventory. Other factors may also be involved and will be discussed in other sections of this report.

Some of the categories in this classification are still not homogeneous. The graph in Figure 6 for EF3 single score by L2 category shows more homogeneous groupings and more distinct distributions, even though some continue to show high variability.

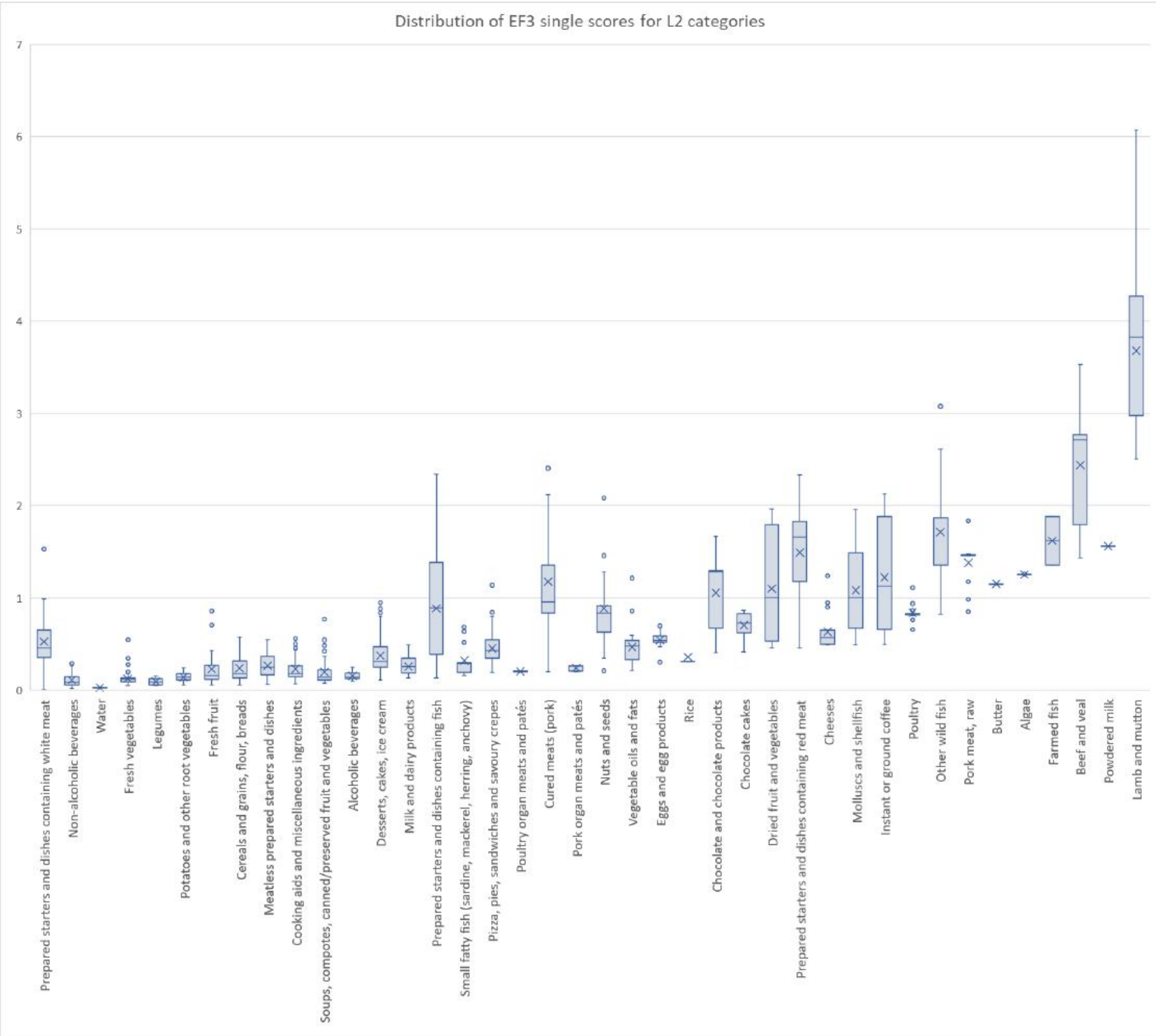


Figure 6: Distribution of EF3 single scores for L2 categories

The L2 categories are suitable for comparison of specific products (e.g. chicken and beef), while the L1 categories are appropriate for comparison of food groups or families (e.g. meat compared to legumes). In this study we use the L1 or L2 category depending on which is most appropriate. We occasionally go down to the individual product level when useful.

2.1.2. Correlation between EF3 single score and climate change score

What is the degree of correlation between EF3 single score and climate change score?

The climate change indicator is widely used to quantify environmental impacts. It is also the indicator that consumers understand the best. The EF3 single score proposed by the European Commission is a recently developed aggregated indicator and for the time being is used only by LCA experts. Nonetheless, this indicator that aggregates complex indicators in a simplified unit is likely to be readily comprehensible for consumers. In this section we look at the correlations that exist between climate change indicator values and the EF3 single score. Our aim is to assess the link between a relatively comprehensive abstract indicator, covering a complex array of impacts, and a unidimensional indicator that is widely recognized, but more restricted in scope.

The figure below reveals a similar curve for these two values in L2 categories, with discrepancies for some categories.

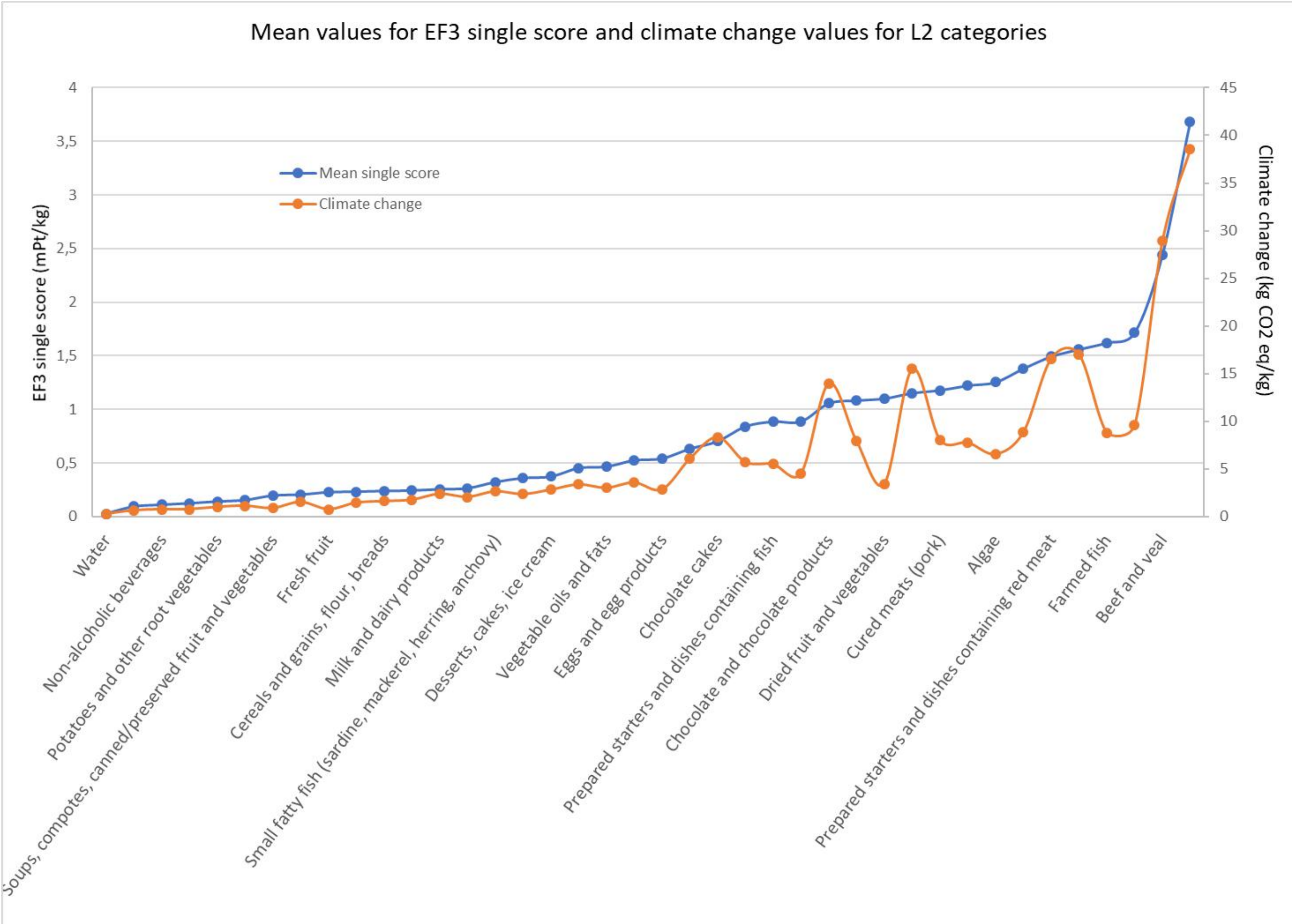


Figure 7: Correlation between EF3 single score and climate change values for L2 categories

For some products there is a significant difference between the EF3 single score and the climate score. These can be attributed to high values for some environmental indicators that are not directly correlated to GHG emissions, such as depletion of water resources, eutrophication or photochemical ozone formation. In the category of vegetal foods, for example, the EF3 single score for almonds is quite a bit higher than for other food products in the same category, even though they have very similar climate change scores. The reason for this deviation is that almond trees require a lot of water, which is reported in the water use indicator. In this case a recognized major environmental impact is reflected better by the EF3 single score than by the climate score.

The figure below confirms the parallel trend for these two environmental indicators plotted by product.

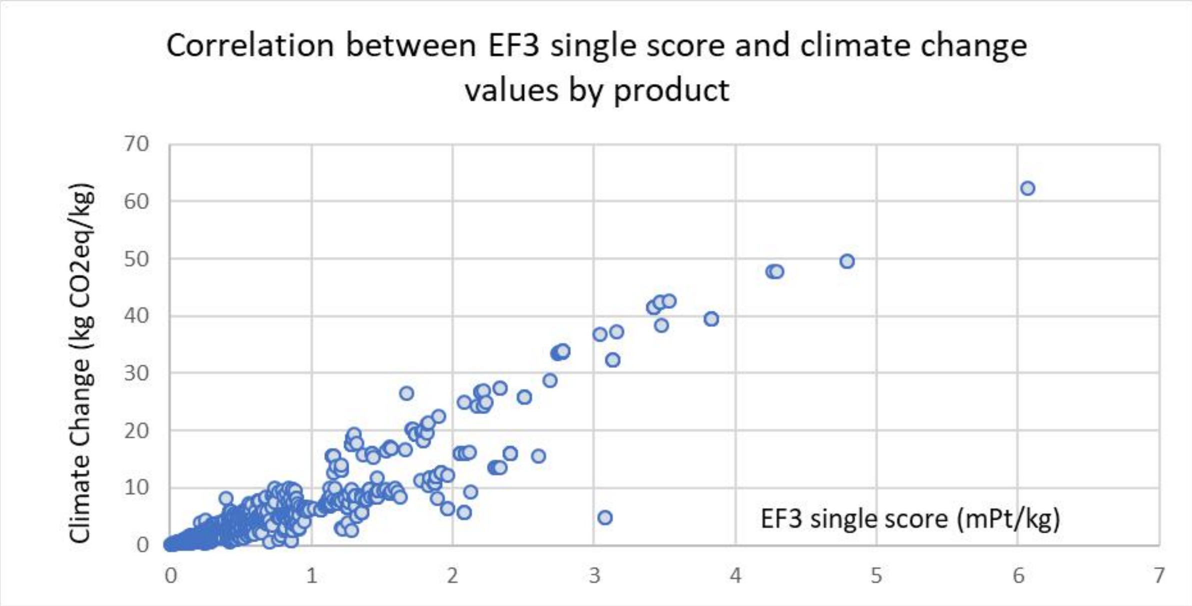


Figure 8: Correlation between EF3 single score and climate change values by product

We calculate the Pearson coefficient to complete the graph series. This statistical indicator measures the intensity of simple linear correlation between two variables. It is obtained by dividing the covariance by the arithmetic product of the standard deviations of the two variables. The coefficient range is from -1 to +1; a value close to zero indicates a poor correlation.

The Pearson coefficient of the correlation between EF3 single score and climate change score is 0.92, revealing a strong correlation.

This analysis confirms the correlation between the EF3 single score and the climate change score indicators. Considering that the EF3 single score more completely represents LCA findings and environmental impacts, we have chosen to base our analyses exclusively on this indicator.

The EF3 single score is strongly correlated to climate change values. This single score is a valid indicator that aggregates environmental impacts shown in life cycle assessments and it is the indicator used in the analyses presented below.

2.1.3. Correlation between EF3 single score and Nutri-Score

What is the degree of correlation between EF3 single score and FSA (Nutri-Score) score?

FSA scores (the scale from which the French Nutri-Score scale of A to E is derived) were calculated for all products according to the official Nutri-Score methodology (Legifrance, 2020)..
These scores take into account the nutritional values of the CIQUAL database and supplements them with other data (fruit and vegetable content in %, rapeseed oil, olive oil, walnut oil), in particular for prepared foods containing multiple ingredients. The FSA scores range between -15 and 35. The higher the score, the lower the nutritional quality. We compared these scores to the EF3 single scores of products in the Agribalyse database.

When the nutritional and environmental scores for these products are plotted in graphs a very uneven distribution appears. A graph of the line formed by EF3 single score and FSA score coordinates reveals no trend or relational curve. The Pearson coefficient for these two variables is 0.11.

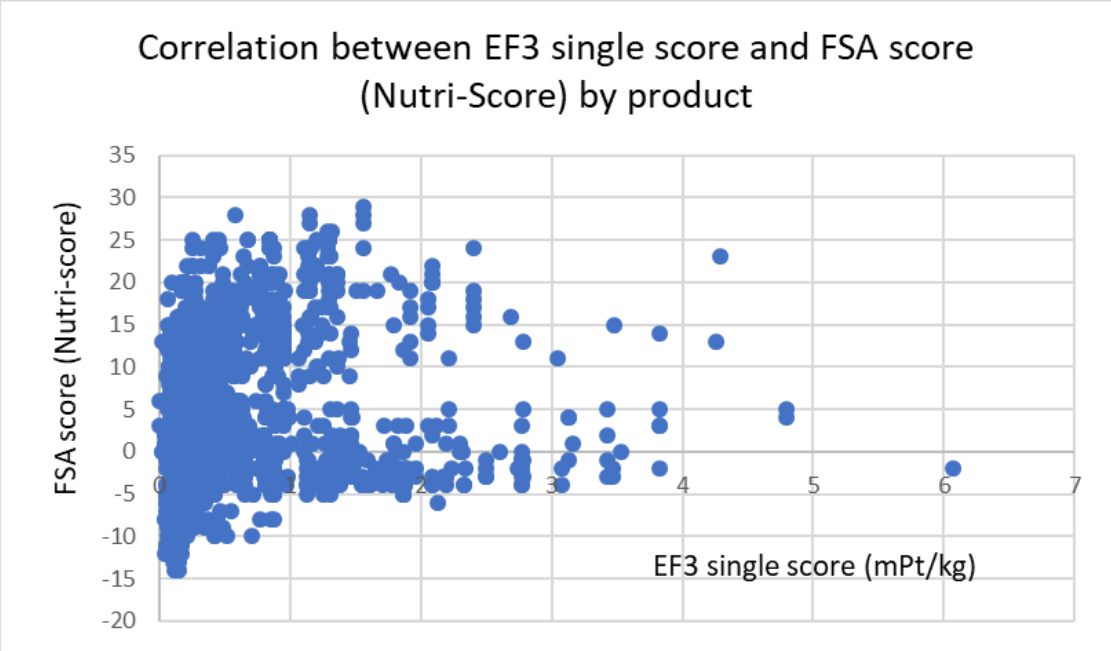


Figure 9: Correlation between EF3 single score and FSA score (Nutri-Score) by product

The apparent absence of correlation across the entire set of products could be a logical result, given the difference in nature between nutritional scores and environmental indicator. We also looked for correlations by food product category (Figure 10).

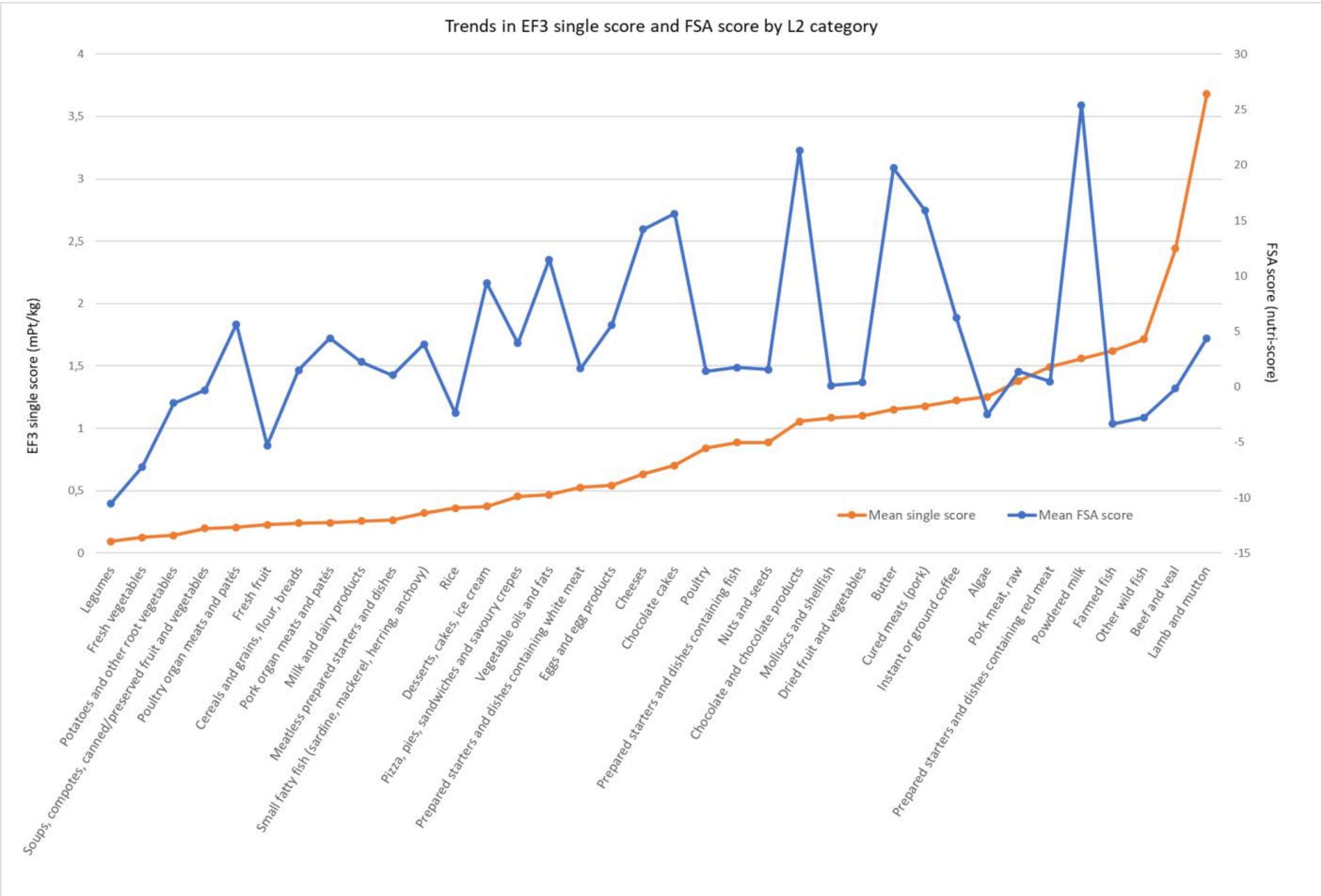


Figure 10: Trends in EF3 single score and FSA score by L2 category

The mean FSA score by food category does not follow the same trajectory as the mean EF3 single score. Certain products (bottled water, spices, sugar, etc) not included in the Nutri-Score calculations because of their particular nature were also excluded from our comparison.

To identify product families with remarkable characteristics for both of these indicators we chose a different type of graphic representation. The graph below plots environmental impacts on the *x* (horizontal) axis, from lowest to highest, and FSA score on the *y* (vertical) axis. The lower the value, the higher the nutritional quality. For example, products in the lower left-hand quadrant have high nutritional value and low environmental impact.

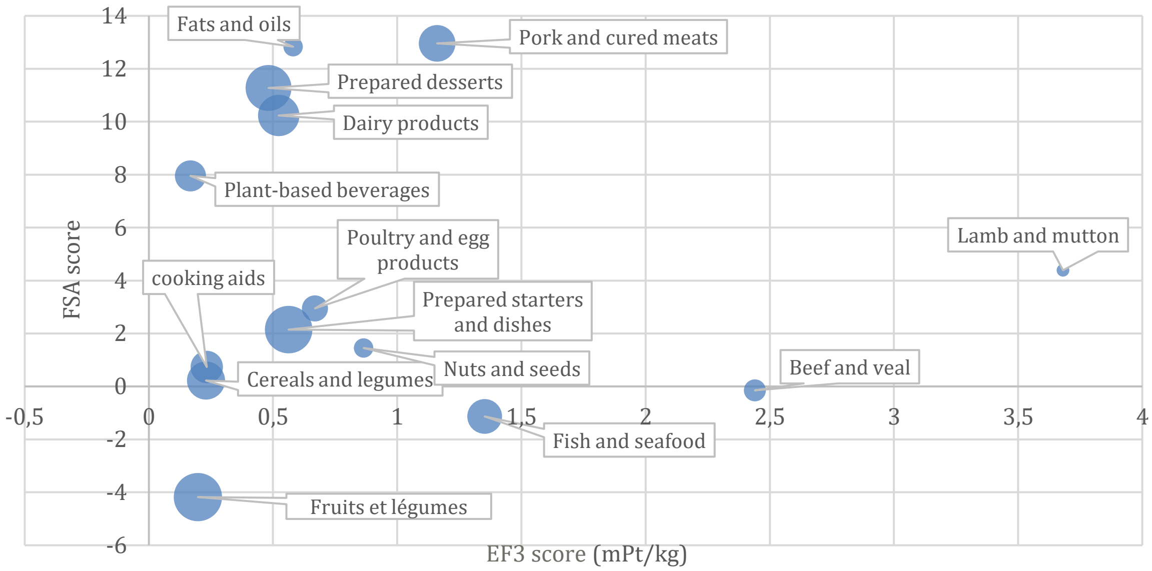


Figure 11: Mean EF3 single score values and FSA score values by L2 category

On this graph we can see food categories that have correlated nutritional and environmental aspects, with low values and impacts, or on the contrary high values and impacts, and categories that have inversely correlated profiles for these aspects, e.g. nutritionally healthy but environmentally harmful.

Products with good nutritional value and low environmental impact: plant-based foods
Raw plants, high in fibre and low in calories, have low environmental impact and good nutritional scores, but when vegetal ingredients are industrially processed for food products their nutritional value declines.

Products with good nutritional value (low FSA score) but high environmental impact: lean red meat, fish
Meats can have high nutritional value, especially lean meats, because they have high protein content in relation to fat content. FSA scores for fish are low, even though their environmental impact is high, because fish are rich in unsaturated fatty acids.

Products with high FSA score and high environmental impact: animal fats (cheese, butter), cured meats, and chocolate-based products.

This approach deserves more work to compare environmental and nutritional scores for various dietary regimens and profiles. WWF France conducted a study of this sort in 2017 to evaluate the environmental impact of a typical French diet(WWF & ECO2 Initiative, 2017)..

There is no direct correlation between EF3 single score and FSA score (Nutri-Score) but some general conclusions can be drawn: generally speaking fruit, vegetables, grains and legumes are foodstuffs that can be said to be good for both human health and for the environment. For other food product families the profiles in these two domains are not as well aligned.

2.2. Structuring parameters

2.2.1. Life cycle stages

In what proportions do life cycle stages contribute to final EF3 single score?

This section is devoted to life cycle stages and their respective contributions to overall environmental impact. These six stages span the entire value chain of a product: agriculture, processing, packaging, transport, distribution and consumption. In this study we highlight the processes that have the most environmental impact, and the variations introduced when certain parameters are modified.

This bar graph on a scale of 0% to 100% (Figure 12) shows the percentages of environmental impact by life cycle stage for L2 categories, with more detailed results than for L1 categories.

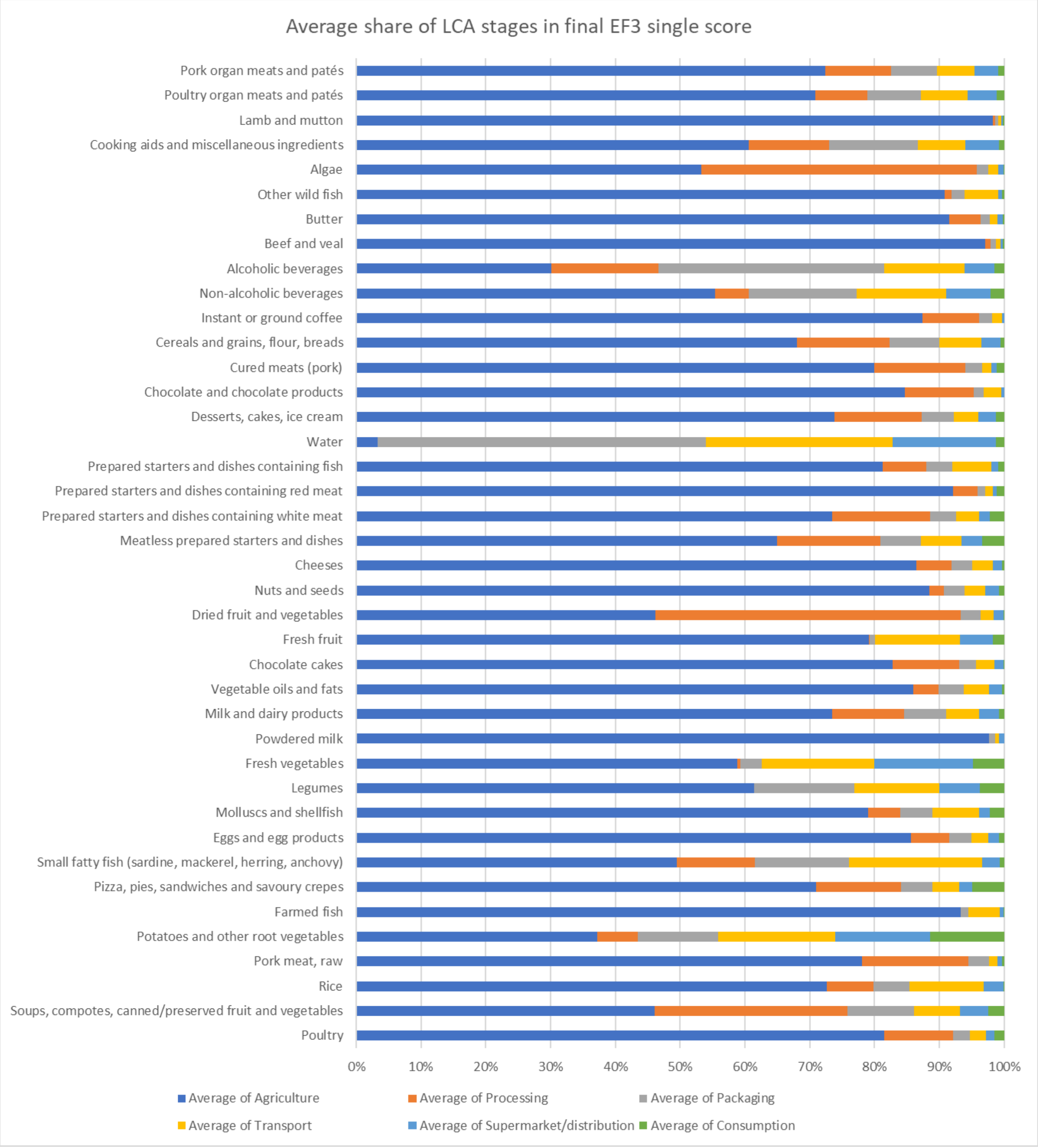


Figure 1 : Average share of LCA stages in final EF3 single score by L2 category

The following graph presents data in absolute values for L1 categories, and more clearly highlights the preponderant share of the agriculture phase and the composition of prepared foods.

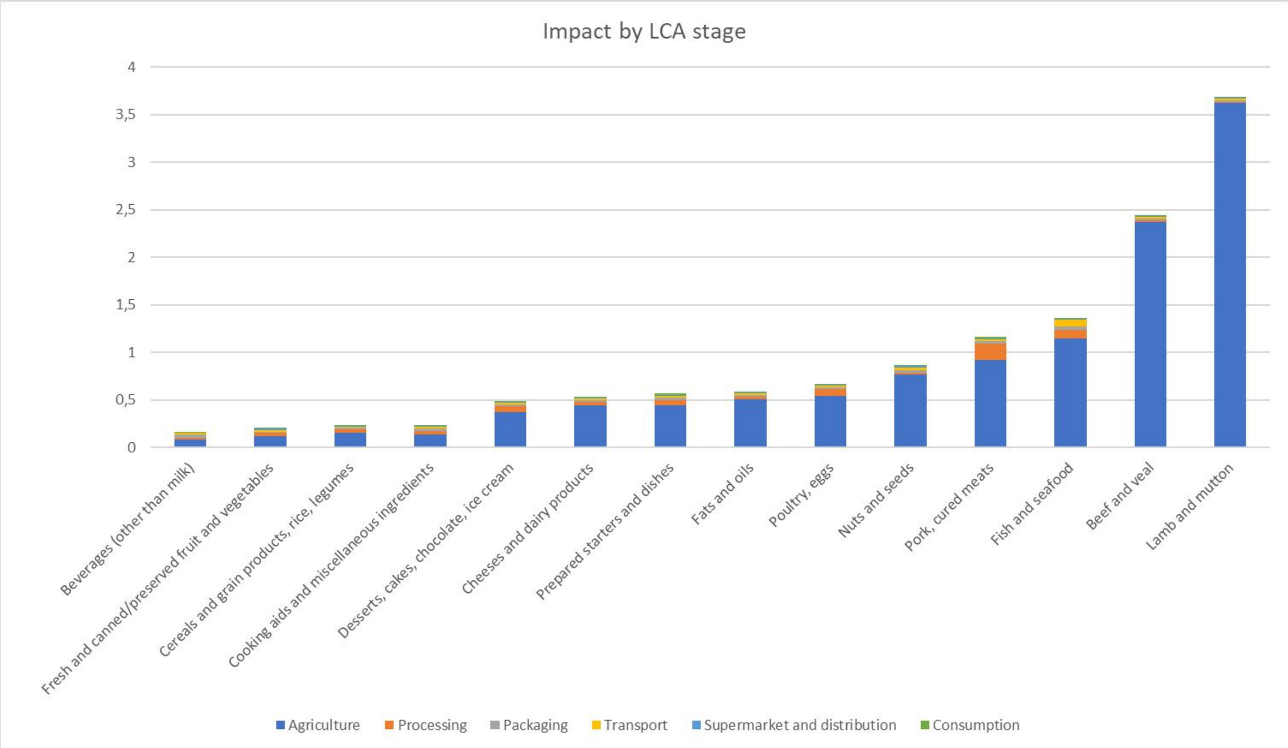


Figure 13 : Average share of LCA stages in final EF3 single score by L2 category

Agriculture

Leaving aside alcoholic beverages and bottled waters, agriculture represents at the very least 37% of final impact, with a mean value of 72%. Proportions of over 90% are attributed to lamb and mutton, other wild fish, butter, beef products, prepared starters and dishes containing red meat, and powdered milk products and farmed fish. The total environmental impact of these products of animal origin is found almost entirely in the upstream agricultural stage. The impacts due to processing, packaging or transport are relatively low for these products. Production modes and their impacts will be the object of future studies.

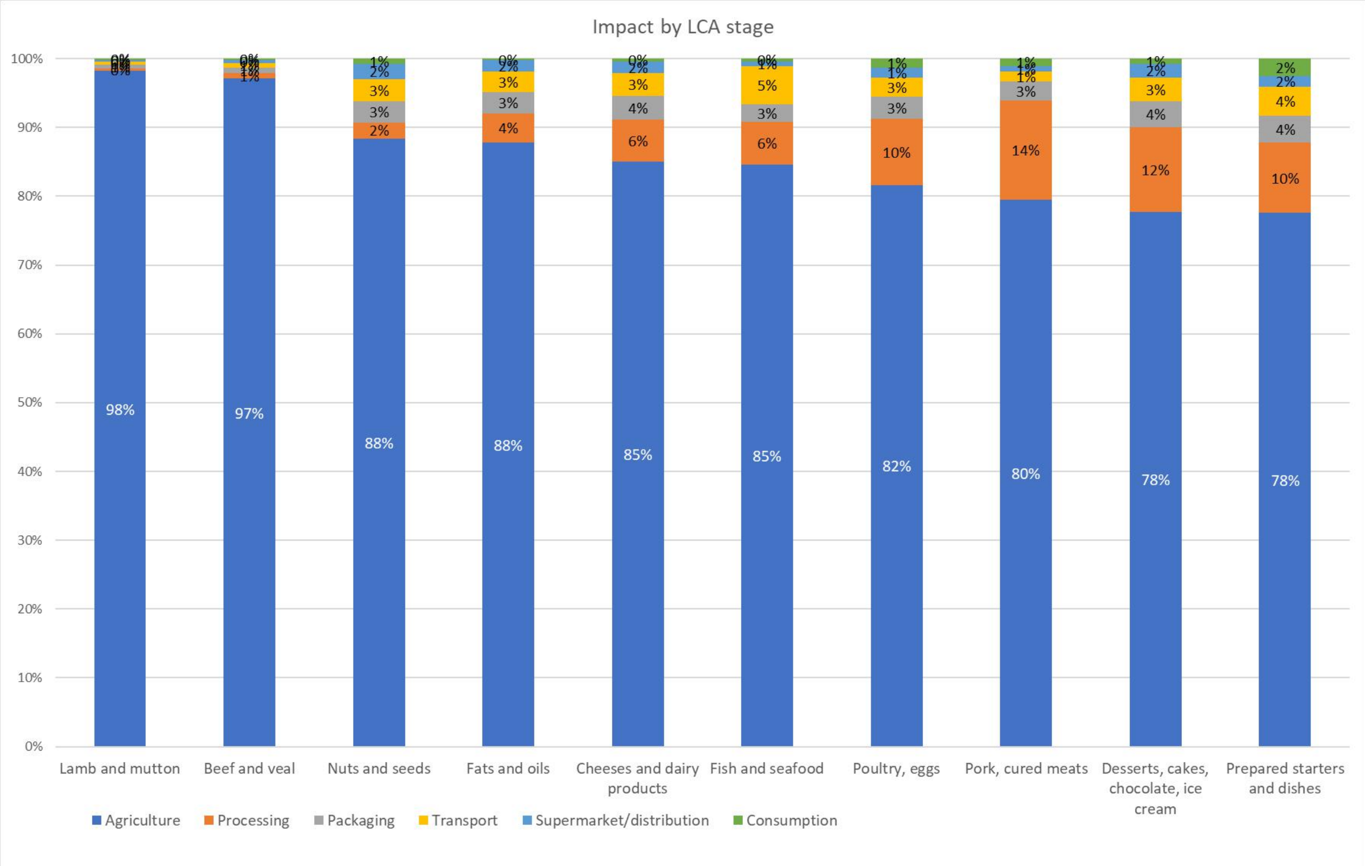


Figure 14 : Average share of LCA stages in final EF3 single score by L2 category, where agriculture is above 75%

Processing

This stage contributes on average about 10% of the EF3 single score, for the full set of products. Overall this stage has little effect on the score. For certain products such as algae and dried fruit and vegetables however, processing contributes much more to environmental impact (42% and 47% respectively). Drying processes consume large amounts of energy, and are associated with products for which agricultural impact is low. Mechanically the impact of processing is proportionately higher.

Packaging and transport

Packaging and transport stages are quantified in each LCA inventory because they can be accurately modelled for each food product. The 3.0.1 version of Agribalyse presents product flows for typical products consumed in France and that are representative of manufacturing and transport modes. Transport represents less than 20% of final impact for all L2 categories except water. The same order of magnitude (1% to 17%) is found for packaging, except for alcoholic beverages (35%) and water (51%). Packaging and transport have higher impact for beverage than for solid foods, while the impact of other stages is low. The weight of these stages is even greater when glass packaging is used. These two stages are broken down in greater detail in the next section, with different scenarios for packaging material and transport distance.

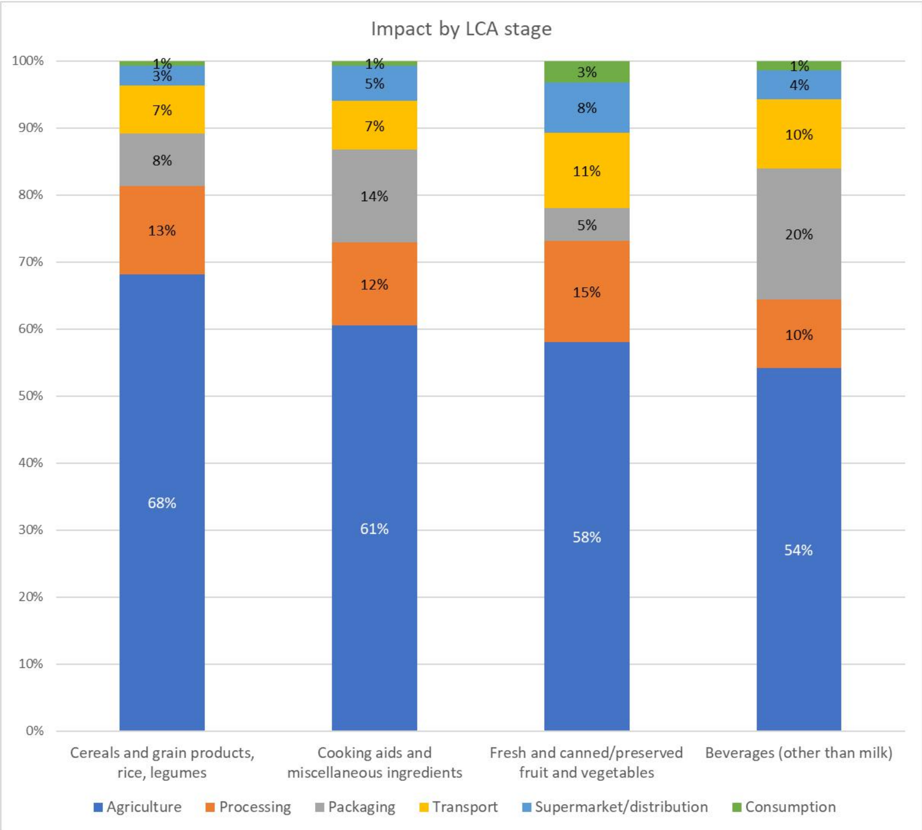


Figure 15 : Average share of LCA stages in final EF3 single score by L2 category, where agriculture is below 70%

<u>Distribution</u>

The contribution of the distribution stage (essentially storage and refrigeration) to environmental impact is highest for fresh vegetables, root vegetables and beverages. The Agribalyse database does not take local and short distribution patterns into account; the logistics model considered is that of "conventional" mass consumer retail food distribution.

<u>Consumption</u>

For most food product categories the environmental impact of the consumption stage is less than 5% of the overall impact. Consequently, the energy efficiency of appliances used by consumers, microwave oven vs. conventional oven for instance, has little effect on the final impact of food consumption.
As food processing, distribution and consumption depend on industrial and consumer behaviours, it is difficult to observe variation in these stages in the Agribalyse database. These stages cannot be analysed in greater detail using currently available data.

Table 2: Mean contribution by life cycle stage for all product data analysed

Agriculture	Processing	Packaging	Transport	Supermarket	Consumption
78%	8%	5%	5%	2%	1%

The upstream agriculture stage represents a large part of the final EF3 single score. Food processing, packaging and transport are three key stages that contribute significantly to the score. The contributions of distribution and consumption to impacts are low.

2.2.2. Variability of packaging and transport impacts

What are the possible ranges of variation for packaging and transport?

To model the impact of transport, different transport scenarios were tested for each product. The transport stage is defined as transit of the product from farm to distribution point.

Environmental impacts were calculated for a maximum and minimum distance based on three products: 11,370 km for cashew nuts, 4,605 km for scallops (refrigerated transport) and 660 km for T55 wheat flour. These same distances were applied to all products. Transport modes were not modified, only the transport distance. This enables us to observe the variation in EF3 single score between a domestically produced product transported 660 km and an imported product shipped over more than 11,000 km. We did not model air freight shipment, because this mode of transport is marginal for the French food market. It is of course well known that the environmental impact is much greater for products transported by air.

Table 3: Maximum and minimum transport distances applied in study calculations

Type	Transport max	Refrigerated transport max	Transport min
Truck	1,054 km	1,594 km	660 km
Train	154 km	9 km	0 km
Ship	10,162 km	3,002 km	0 km
EF3 single score	**0.1 mPt/kg**	**0.3 mPt/kg**	**0.009 mPt/kg**

Unlike the transport analysis, the method used to observe variability for packaging is based on identification of the types of packaging with the greatest and the least impact by category. These extreme characteristics (materials and quantities) were then applied to all the products in each category. Different and specific types of packaging are used for foods, depending on their nature and stabilization processes. It would not make sense to simulate the same type of packaging across the entire database as was done for transport. In our study we did not model bulk foodstuffs without packaging, because these products are always transported in some sort of secondary or tertiary container or wrapping before arriving in stores.

Table 4: Maximum and minimum packaging criteria

L1 category	Packaging max	Packaging min
Beef and veal	PS	PS
Plant-based beverages	Glass	Cardboard box
Cereals and legumes	LDPE	LDPE
Prepared desserts	LDPE	PP
Prepared starters and dishes	PP	Cardboard box
Nuts and seeds	LDPE	LDPE
Fruit and vegetables	Glass	PP

Fats	PETE	PP
Lamb and mutton	PS	PS
Lamb and mutton	Glass	Cardboard box
Fish, seafood	PS	PS
Pork and cured pork meats	PS	PP
Dairy products	LDPE	HDPE
Poultry and egg products	PS	PS

Combined maximum and minimum variation for transport and packaging are represented in the graphs below.

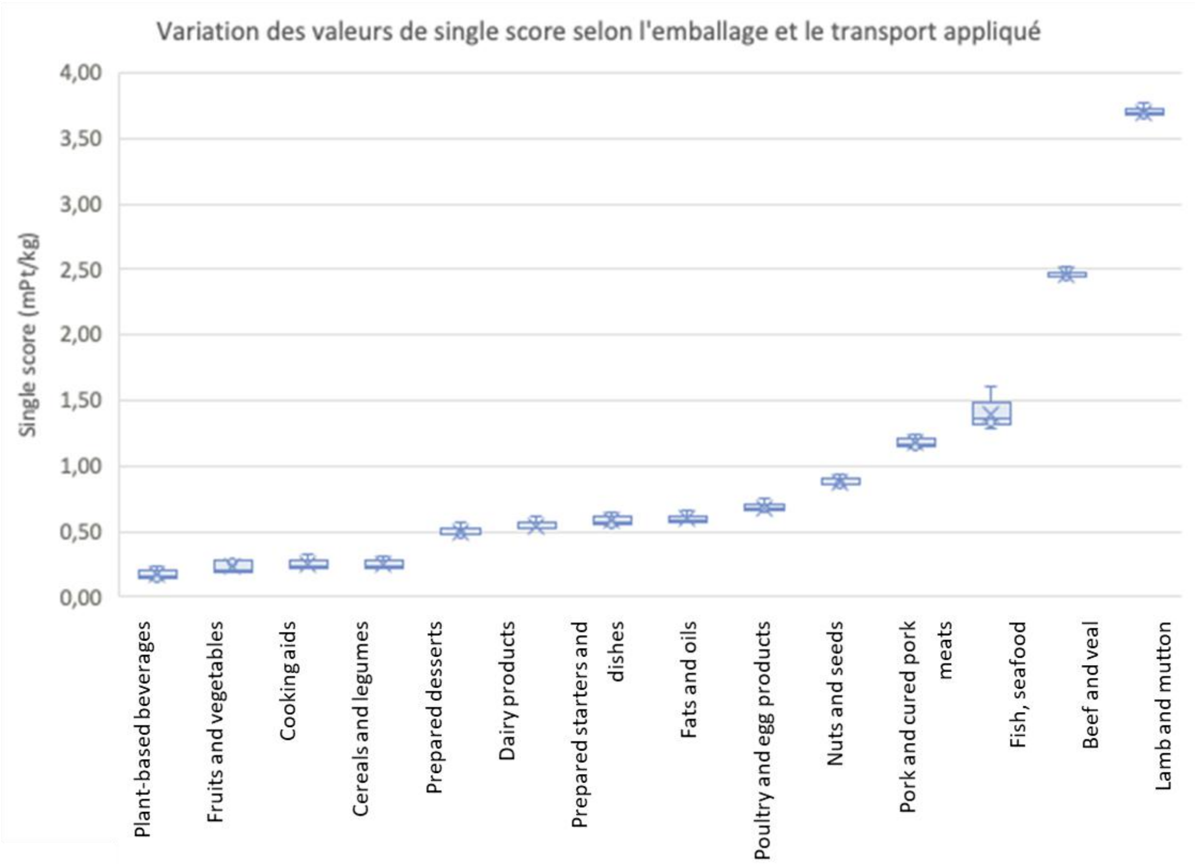


Figure 16: Variation in EF3 single score according to transport and packaging

Variation in EF3 single score due to transport and packaging is relatively low for meat products, where most of the impact comes during production. This variation is also low for the other categories, even those for which agriculture has little impact. The category for which this variation is greatest is fish and seafood, involving long-distance and refrigerated transport.

The table below gives the values used to construct the graph above.

Table 5: EF3 single score values by category after modification for transport and packaging

	No variation	Packaging max	Packaging min	Transport max	Transport min
	EF3 single score (mPt/kg)				
Cooking aids	0.23	0.25	0.22	0.32	0.23
Beef and veal	2.44	2.44	2.44	2.52	2.44
Plant-based beverages	0.16	0.18	0.14	0.24	0.15
Cereals and legumes	0.23	0.24	0.22	0.31	0.22
Prepared desserts	0.48	0.49	0.48	0.57	0.48
Prepared starters and dishes	0.57	0.60	0.56	0.64	0.55
Nuts and seeds	0.86	0.88	0.86	0.94	0.85
Fruit and vegetables	0.21	0.27	0.20	0.28	0.19
Fats	0.58	0.58	0.58	0.66	0.57
Lamb and mutton	3.69	3.69	3.68	3.77	3.68
Fish, seafood	1.36	1.36	1.34	1.60	1.29
Pork and cured pork meats	1.16	1.19	1.14	1.24	1.15
Dairy products	0.52	0.52	0.52	0.61	0.52
Poultry and egg products	0.67	0.67	0.67	0.75	0.66

Long-distance transport induces the greatest variation for poultry and eggs (12.2%) and for dairy products (15.8%). Considering transport factors alone, consuming local beef, lamb and butter has an impact of less than 1%.

Variation is wider for fish, ranging from less 4.7% for minimum transport distance to plus 17.9% for maximum transport distance. Transport is a particularly significant factor for reducing the impact of these products. Opting for local fish and seafood products will also have a positive impact compared to imported products.

In the category of vegetal products, the greatest variability in packaging impacts is seen for plant-based beverages (-10.3% and +12.6%) and fruits and vegetables (-4.9% and +29.4% for canned/preserved fruit and vegetables). This variability is due to the low impact of the upstream agriculture stage on final impact, which automatically induces higher impacts for other life cycle stages in percentage terms.

The transport distance between farm and distribution platform for fresh and processed fruit and vegetables also has an effect on the final market value. The EF3 single score for fruit and vegetables grown in France or neighbouring countries is on average 6.4% lower than for the products in the database as a whole. Limiting consumption of food products imported from countries outside of Europe reduces the environmental impact of fruits and vegetables by 36.9% on average compared to "standard" products in today's market. In this category fresh fruit and vegetables must be distinguished from processed fruit and vegetables (canned/preserved foods, soups, jams and jellies, compotes, etc). In the processed fruit and vegetables subcategory, the EF3 single score may vary from -9% to +20%, depending on packaging.

Similar variability is found for beverages, where the impact of variability due to packaging ranges from -3% to +32%. Consumption of locally grown fruit and vegetables would reduce the EF3 single score by 10.3% on average, compared to data modelled in the Agribalyse database. Compared to imported beverages alone, the EF3 single score would be 52.1% lower.

In conclusion, the greatest average variability for transport and packaging is found for these categories: beverages, fruit and vegetables, and cereals and grains. Changes in the provenance and/or packaging of these foods can significantly reduce or increase the EF3 single score.

Local provenance and type of packaging are structuring factors of the final environmental impact of beverages, soups, fresh and processed fruit and vegetables. These factors are also discriminating factors within product categories, but with lesser impact for categories such as meat and dairy products.

2.2.3. Mode of production

Do production systems have an incidence on the final EF3 single score for products?

In this section we analyse the upstream agriculture stage in detail for various production systems. A large proportion of environmental impacts for both meat and plant products occur during this stage. Growing crops and raising livestock calls for energy, water, infrastructure, equipment and land, in addition to labour. By reducing the impacts associated with this stage the environmental footprint of final products can be improved.

This analysis of production modes is the most complex part of our study, as LCA indicators alone do not suffice to assess all the environmental issues related to agriculture. They do not address biodiversity , for example. Action basing improvement measures on climate criteria or on LCA indicators alone could lead to agricultural production modes that would be undesirable to society at large, for instance battery-raised poultry. The developers of the Agribalyse database clearly recommend that the limitations of LCA be taken into account and additional indicators used for comparative studies and for projects designed with environmental outcomes in mind[1]. Agricultural systems are "interdependent". For example production of sheep's milk cheeses (e.g. Roquefort blue cheese) is linked to production of lamb and mutton. These ratios of these relationships can be adjusted, but only within certain limits. Accordingly the findings of this initial approach should be taken with precaution. This analysis does provide, however, ranges and orders of magnitude to give an idea of the potential environmental gains that can be suggested on the basis of available indicators.

As all production systems are not represented in Agribalyse, we selected 16 common major agricultural products for a sensitivity analysis comparing different cultivation and animal husbandry methods and different product origins.

Agribalyse product data are based on a mixed "basket" of various production methods and provenances. For example, data for raw tomato in Agribalyse are a mix of French and Spanish crops, heated and unheated greenhouse cultivation, etc. Data for beef include different types of cattle (suckler cows, dairy cows) and feed methods (extensive, intensive).

The composition of mixed data are given in the annexes of the Agribalyse methodological documentation. (Asselin-Balençon, et al., 2020). Other information is available on the ADEME website (ADEME, 2020)..

The table below is based on Agribalyse data for all the different production modes modelled in the database. The data for "conventional French beef" is a mixed basket of several types of cattle raising operations. The "consumption mix" refers to the mean value used in Agribalyse for an *entrecôte* (rib steak) cut of meat.

Table 6: EF3 single score of different consumption mixes modelled in Agribalyse 3.0.1

Products		EF3 single score (mPt)	Stream
Tomato	Tomato	0.098	Consumption mix
	Tomato	0,284	Tomato, average basket, conventional, heated greenhouse, France
	Tomato	0,142	Tomato, conventional, unheated, Spain/Morocco
	Tomato	0,075	Tomato, conventional, soil-based, unheated, France
	Tomato	0,038	Tomato, organic, greenhouse production, national average, France

[1] https://ecolab.gitbook.io/documentation-agribalyse/methodologie-acv#limites-et-besoin-devolution-de-la-methodologie-acv

Beef	Beef	2.768	Consumption mix
	Beef	2.557	Cull cow, conventional, highland milk system, grass fed, at farm gate, France/Unitary process
	Beef	1.169	Cull cow, conventional, lowland milk system, silage maize 10 to 30%, at farm gate, France/Unitary process
	Beef	2.791	Cull cow, conventional, lowland milk system, silage maize 5 to 10%, at farm gate, France/Unitary process
	Beef	1.731	Cull cow, conventional, lowland milk system, silage maize >30%, at farm gate, France/Unitary process
	Beef	2,065	Cull cow, organic feed, lowland milk system, silage maize 5 to 10%, at farm gate, France/Unitary process
	Beef	3.654	Suckler cull cow, conventional, suckler cow system, less than 1.2 LU per ha, at farm gate, France/Unitary process
	Beef	2.122	Suckler cull cow, conventional, suckler cow system, more than 1.2 LU per ha, at farm gate, France/Unitary process
	Beef	3.408	Suckler heifer, conventional fattening system, more than 1.2 LU per ha, at farm gate, FR/U
Pork	Pork	1,464	Pig, conventional, national average, at farm gate
	Pork	2.311	Pig, organic, at farm gate
	Pork	1.896	Pig, Label Rouge, outdoor system, at farm gate
	Pork	1,462	Pig, conventional, Bleu Blanc Coeur, at farm gate

We modified these consumption mixes for the selected products to recalculate the LCA inventory for each of them and compare these values to the Agribalyse value. Environmental impacts are systematically noted for the final product at the consumer stage (Figure 17).

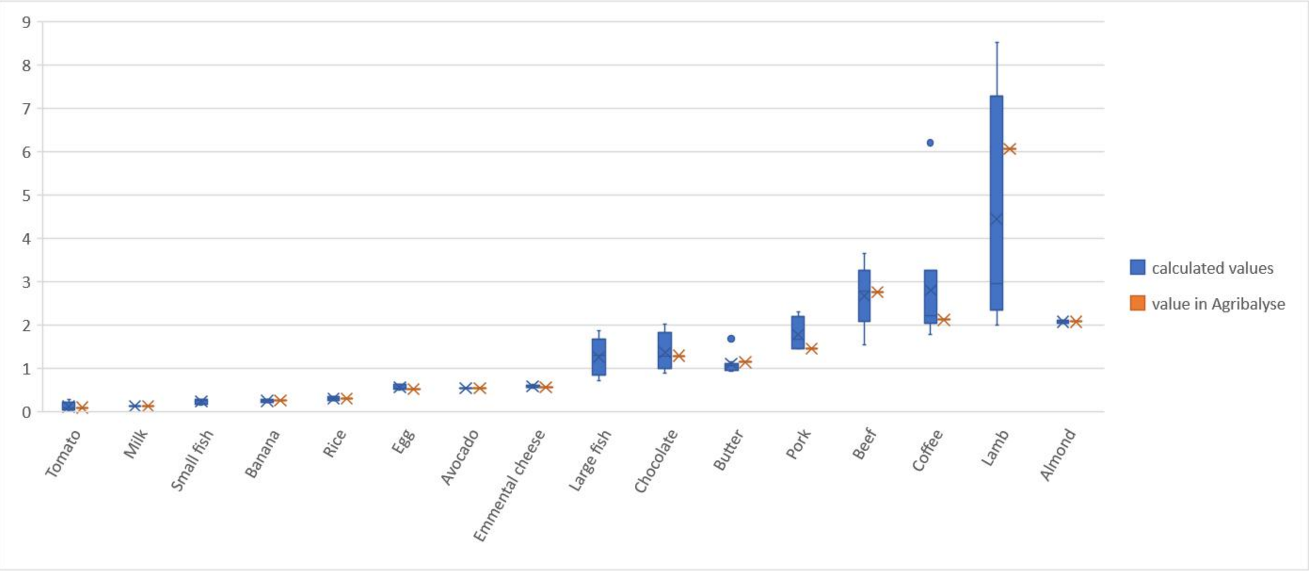


Figure 17: Variation in EF3 single score by production mode

The largest deviation is seen for lamb, for which impacts vary by the livestock operations mode used, in particular for organic farming. Yields and emissions depend on the breed. "Meat only" production chains and "mixed meat/milk" production chains show different types of environmental performance, for all ruminant animals. The operations mode also plays a significant role in the impact of beef and pork. Land use and type of feed are two other factors that have an effect on the environmental impact of these products.

Depending on provenance, the score for coffee may vary by almost 2 mPt/kg. The increase or decrease in impact is not associated with transport distances in this case, but with fertilization methods, occupation of farmland, deforestation risk, etc. More sustainable and environmentally friendly cultivation methods would lower the environmental impact of coffee. Considering the production chains in the Agribalyse database, chocolate products have the same profile, with variation of 1 mPt/kg in the EF3 single score.

The score for "large fish" varies by fishing technique, depending on energy consumption, and on catch volume.

Variations are lower in absolute values for other vegetal products, dairy products, eggs and small fish, compared to other categories. For these groups the farming methods appear to have less effect on the EF3 single score of the finished product. For example, organically grown tomato and conventional tomato are attributed practically the same results under current LCA calculations.
But if we zoom in for a closer look within the fruit and vegetables category tomatoes grown in heated greenhouses have three times as much impact as tomatoes grown in non-heated greenhouses.

The variability due to agricultural methods has been explored in studies of earlier versions of the Agribalyse database and in projects to develop environmentally responsible production chains (Ecoalim 2018, CTIFL 2020, GreenGo projects, among others). LCA calculations generally project that environmental gains for agriculture on the order of 5% to 20% can be achieved by "classic" conversion to sustainable practices, i.e. "optimization" without introducing brand-new technology or disruption.

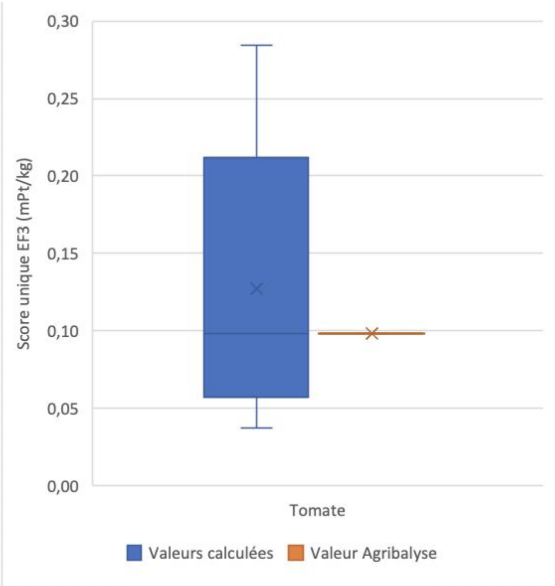


Figure 18: EF3 single scores for tomato by production mode

Variability is high for meat products, especially beef and lamb. Here the production system plays an important role in final impact, but this does not modify the overall ranking compared to vegetal products.
This is also the case for coffee, for which the final score can be affected by provenance and cultivation techniques. The same type of variation is seen for chocolate, but is less pronounced. Other products show less variation by production system, as represented by the data in the Agribalyse 3.0.1 database.

2.2.4. The limitations of the production system approach

Above and beyond the limits of LCA indicators, assessment of all production systems for products found in food markets raises other questions. While it is quite useful for distinguishing between individual products, comparison between products in the same family based on production mode is not very robust and is highly dependent on the data available and the methodology applied. An approach based on mean values also masks wide variations between farms that use conventional farming techniques, and even greater differences with organic farms (Van der Werf et al., 2020). It is possible to compare livestock operations in the French production mix, because under the Agribalyse programme many LCA studies have been conducted going back several years, and methodological approaches are consistent. But when comparing French beef to beef from Germany or Brazil, using LCA data from the Ecoinvent database, for example, we will run into problems: each database uses different production mixes, allocation and modelling techniques.

Likewise, in Agribalyse data for chocolate are calculated with a strong deforestation coefficient, but no chocolate data are modelled for cultivation without deforestation.

The most significant limitations of comparison by production system are the absence of some modes of production in Agribalyse modelling, and the absence of certain types of imported foods. To resolve these issues in the next version the Agribalyse product list could be harmonized with other LCA databases. Research to achieve fine-grained analysis of agricultural production systems using LCA data should be pursued, in particular to support environmental information for consumers.

The Agribalyse database already contains some parameters to reflect environmental variability by production mode, for example meat-only operations vs meat and milk operations, greenhouse production vs field-grown crops, and products that are linked to deforestation. More work needs to be done to differentiate between agricultural systems and to establish the connection between these techniques and information at the finished product level. Today in conventional supermarket stores it is "impossible" for consumers to know how the "fresh tomato" they buy is grown.
For the time being using production mode data is not recommended for comparison of products of the same type.

2.2.5. Ingredients and product composition

Do ingredient proportions have an effect on the final EF3 single score for products?

Product composition and proportions of ingredients are the last parameters studied here to assess variation in the environmental impact of products. We looked at 327 prepared foods, and for each product varied proportions of ingredients by increasing and decreasing the ingredient with the greatest impact by 50% (in weight) in both directions (+50% and -50%). The proportions of other ingredients were redistributed while remaining consistent with the original recipe. This analysis demonstrated the dominant effect of the main ingredients in the product composition. For 74% of products, the two main ingredients (ranked by quantity) accounted for over 70% of the final impact. For one-third of products a single ingredient accounted for over 70% of the final impact.

Table 7: Effects of ingredients 1 and 2 on final product impact

Impact by ingredient	Mean impact
Ingredient 1	63%
Ingredient 1+2	83%

	Number of prepared food products	% of prepared food products

Impact Ingredient 1>70% of final impact	126	31%
Impact Ingredient 1+2>70% of final impact	306	74%

We grouped these prepared food products into specific groups for comparison in this section. The groups are defined by main ingredient with the greatest impact: white meat, red meat, fish, egg, butter, milk, fruit and vegetables, nuts and seeds, chocolate and beverages.

The graph below shows an analysis by group. In each group values are given for each production composition:

- Agribalyse value
- Value with -50% of ingredient with the greatest impact
- Value with +50% of ingredient with the greatest impact

This first overview reveals great disparity in the meat and fish categories, and for cholate and nuts. This shows that prepared product classification, e.g. typical lasagne, may not be pertinent for comparing products containing meat or fish. To obtain a meaningful comparison the analysis must go down to the specific product level, e.g. brand of lasagne, in each category.

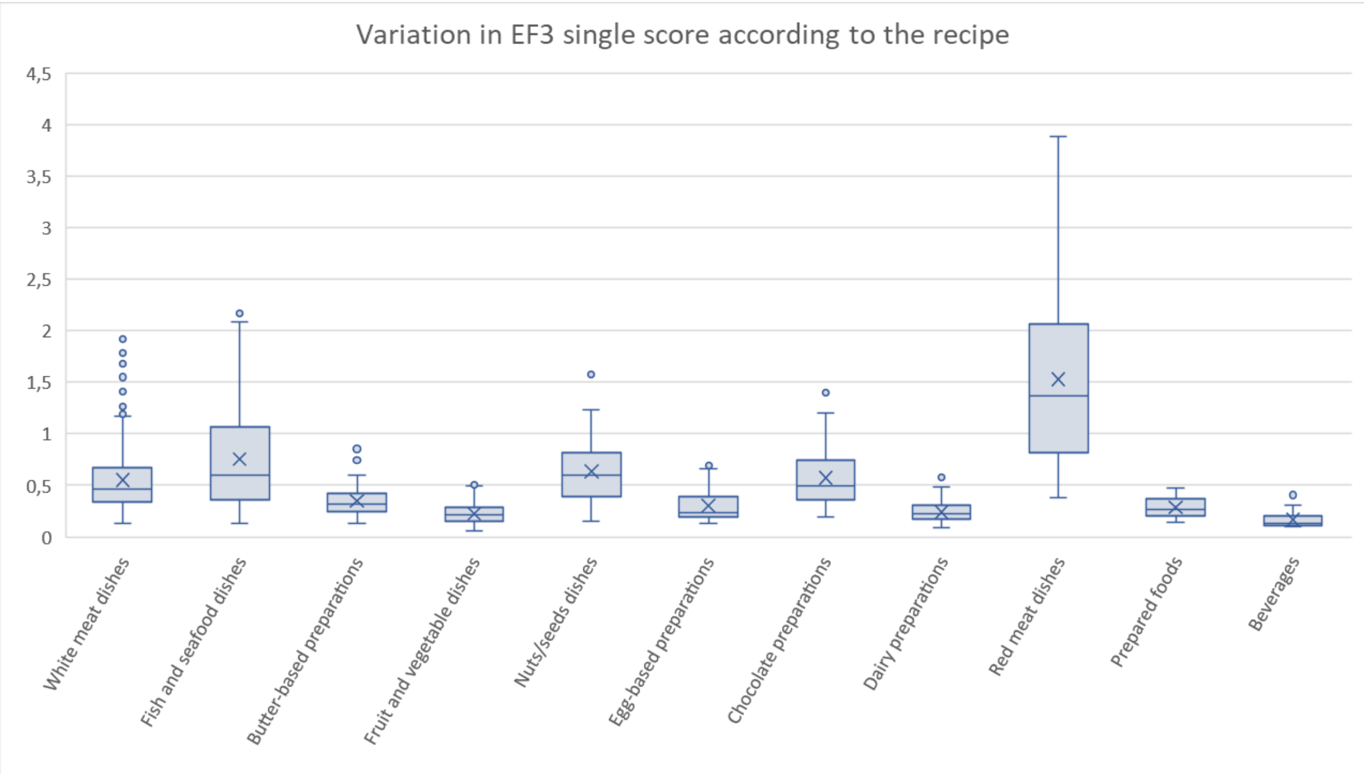


Figure 19: Variation in EF3 single score by product composition (+/-50% by weight of main ingredient)

The graphs below trace this variation for all the different preparations in the same product category. The Agribalyse value for each preparation is represented by an X, and the extremes are the minimum and maximum values calculated with -50% and +50% of the main ingredient. For example, in the graph the mean Agribalyse value for prepared *osso bucco* is 1.44 mPt/kg, the value with 50% less meat is below 1, and for 50% more meat about 2.2 mPt/kg. These variations can substantially modify the final EF3 single score obtained for this type of prepared product. For fruit and vegetable preparations all compositions have a score below 0.5 mPt/kg.

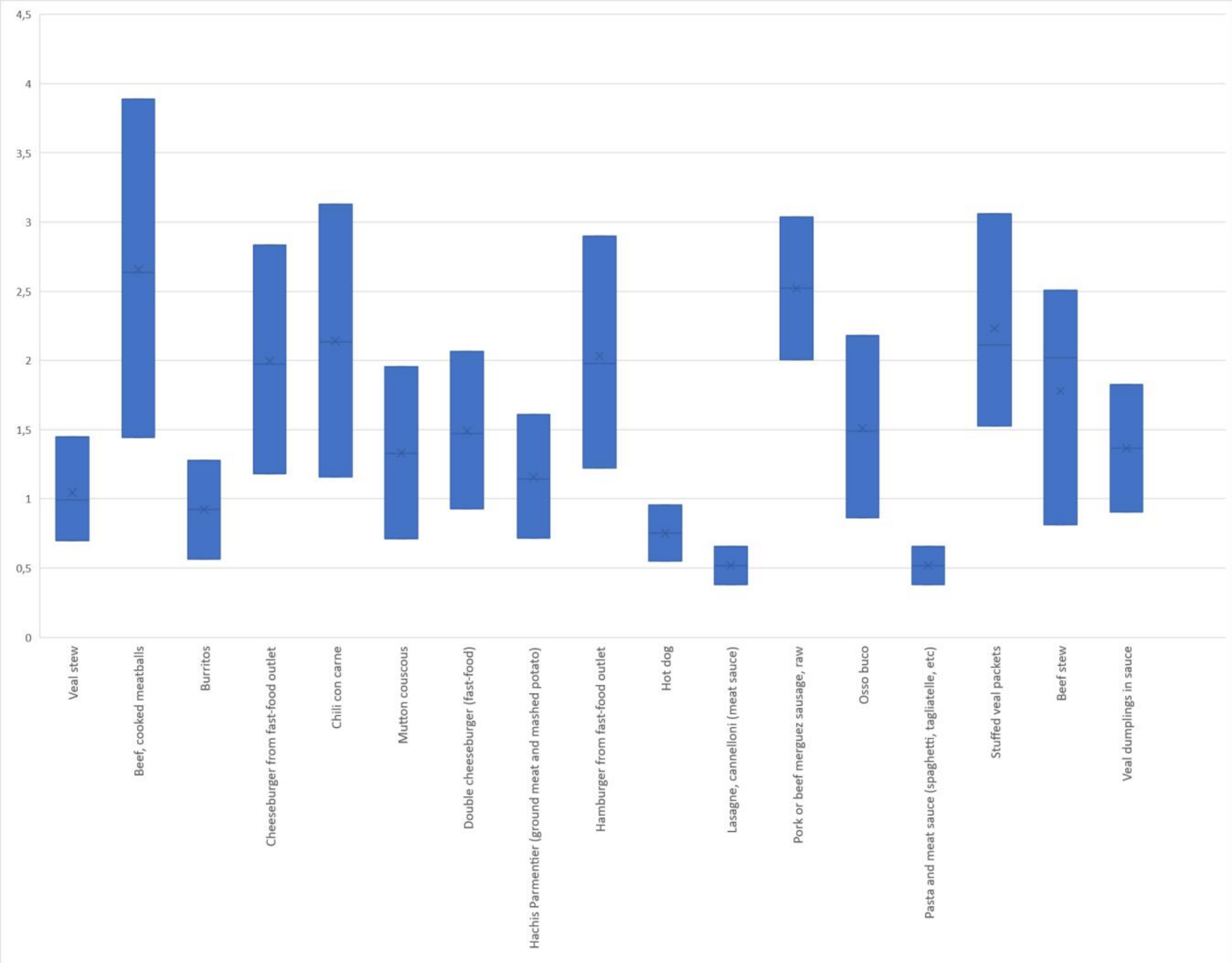


Figure 20: EF3 single score values for prepared products containing red meat

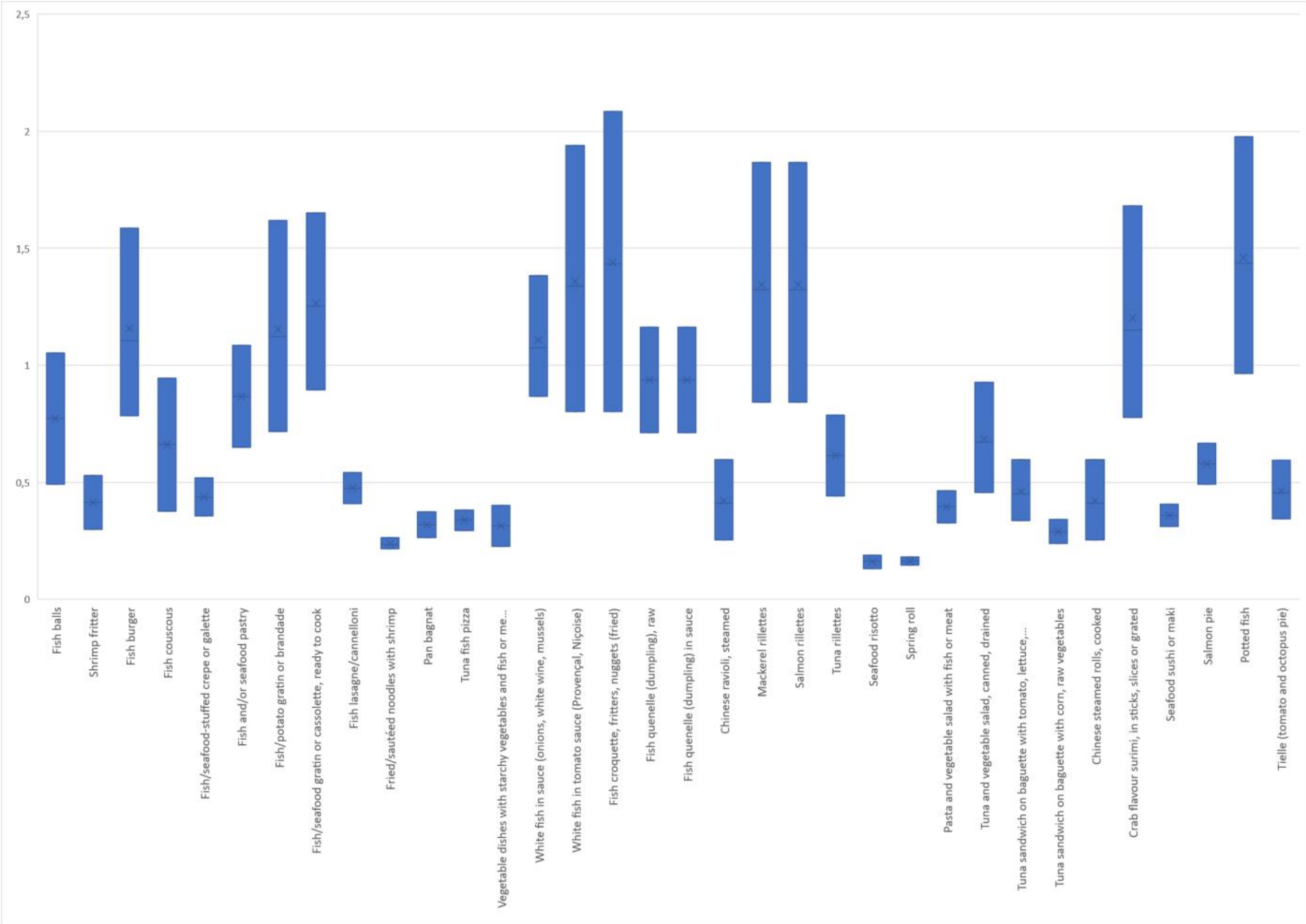


Figure 21: EF3 single score values for prepared products containing fish

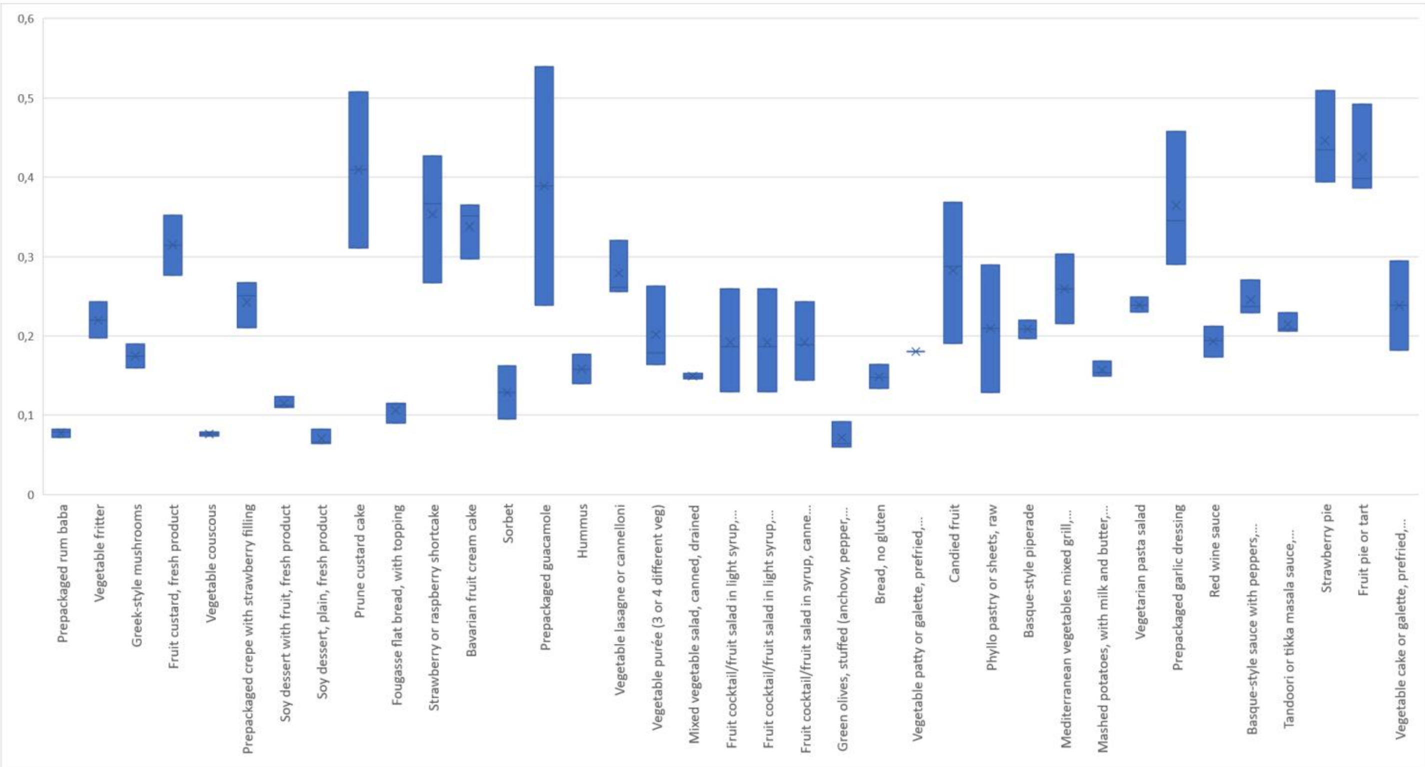


Figure 22: EF3 single score values for fruit and vegetable prepared products

The final impact of different ingredient proportions varies widely for meat, fish and chocolate preparations when the main ingredient is modified. The composition of a prepared product may change the ranking of preparations in different categories.

2.2.6. Summary of findings

The table below summarizes the quantitative and qualitative findings of the analyses reported here. Mean values are attributed for L2 product categories. The respective contributions of life cycle stages to the final EF3 single score are calculated for each category. When possible, the associated processes within each stage are listed. Only effects of over 10% in the final impact are given in the table. Mean Nutri-Score values are given in the last column.

These findings are particularly useful for determining the processes that structure the environmental impact of a given product. While they are most accurate at the product category level, these findings can be used to point researchers to the factors most likely to reduce the footprint of a given product, or to provide useful information for consumer choices. Taking the example of rice, the upstream agricultural stage is the most important factor in environmental impact. Product provenance also induces variation in the EF3 single score, from -9% for rice grown in France, to +16% for rice from another country. For the purposes of environmental information display, these findings can help ascertain priorities for parameters to be studied in relation to an "average" Agribalyse value.

Table 8: Summary of findings

Catégories N2	Étapes		Paramètres structurants supérieurs à 10% du single score moyen															Nutri-scores
	Agri Transfo Emb Transp Distri Conso		Agriculture/élevage		Transformation		Emballage			Transport			Distribution	Consommation	Composition			
	Parts moyennes des étapes dans les single score final	Single score (mPt/kg)	*% Impact*	*Procédés impactants*	*% Impact*	*Procédés impactants*	*% Impact*	*Impact de la variation sur le single score total*	*Types*	*% Impact*	*Impact de la variation sur le single score total*	*Type*	*% Impact*	*% Impact*	*Impact de la variation sur le single score total*	*Impact sur la recette de l'ingrédient principal*	*Ingrédient*	
Boissons alcoolisées		0,15	30%		17%	Distillation Stabilisation	35%	+17% -25%	Verre Plastique HDPE	12%	+53% -6%	Froid						
Boissons sans alcool		0,11	55%				17%	+32% -3%	Verre Plastique HDPE	14%	+79% -4%	Froid						
Café en poudre ou moulu		1,22	87%	Déforestation Énergie														
Eau		0,03					51%	+141% 0%	Verre Plastique PET	29%	+331% 8%		16%					
Céréales, farines, pains		0,24	68%	Énergie Fertilisants	14%	Raffinage						Froid						B
Légumineuses		0,09	61%	Fertilisants Irrigation			15%	+11% -7%	Acier Plastique LDPE	13%	+92% -2%							A
Riz		0,36	73%	Irrigation Fermentation						11%	+16% -9%							A
Fruits à coque et graines oléagineuses		0,86	88%	Irrigation														B
Fruits et Légumes séchés		1,07	46%		47%	Séchage												B
Fruits frais		0,27	79%	Fertilisants Irrigation						13%	+38% -10%							A
Légumes frais		0,13	59%	Fertilisants Irrigation						17%	+58% -9%		15%					A
Pommes de terre et autres tubercules		0,14	37%				12%	+9% -12%	Plastique LDPE Vrac	18%	+52% -11%	Froid	15%	11%				A
Soupes, compotes, Fruits et légumes appertisés		0,18	46%		30%	Stabilisation	10%	+20% -9%	Verre Carton									B
Entrées et plats composés avec viande rouge		1,49	92%									Froid			+39% -38%	83%	Viande rouge	B
Entrées et plats composés avec viandes blanches		0,52	73%		15%	Modification Stabilisation						Froid			+24% -20%	67%	Viande blanch	B
Entrées et plats composés avec poisson		0,84	81%									Froid			+50% -16%	73%	Poisson/fruit de mer	B
Entrées et plats composés sans viande		0,29	65%		16%	Modification Stabilisation						Froid			+10% -1%	43% 54%	Légume Produit laitier	B
Pizzas, tartes, sandwichs et crêpes salées		0,45	71%		13%	Modification Stabilisation						Froid			+19% -13%	56% 62%	Viande blanche	B
Aides culinaires et ingrédients divers		0,23	61%		12%	Séchage Modification	14%	+8% -7%	Verre Carton									B
Chocolats et produits à base de chocolat		1,06	85%	Irrigation Déforestation	11%	Modification Stabilisation												E
Desserts, gâteaux, glaces		0,37	74%		13%	Modification Stabilisation						Froid			+15% -12%	49% 52%	Beurre Lait	C
Gâteaux à base de chocolat		0,70	83%	Irrigation Déforestation	10%	Modification Stabilisation									+18% -17%	55%	Chocolat	D
Fromages		0,63	86%	Alimentation animale (Fertilisants-énergie-usage des sols) Digestion (Méthane)								Froid						D
Lait et produits laitiers		0,26	73%	Alimentation animale (Fertilisants-énergie-usage des sols) Digestion (Méthane)	11%	Affinage Stabilisation						Froid						B
Laits en Poudre		1,56	98%	Alimentation animale (Fertilisants-énergie-usage des sols) Digestion (Méthane)														E
Beurres		1,15	92%	Digestion (Méthane) Alimentation animale (Fertilisants-énergie-usage des sols)								Froid						E
Huiles et graisses végétales		0,47	86%	Irrigation Énergie														D
Abats et pâtés de volaille		0,21	71%	Alimentation animale (Fertilisants-énergie-usage des sols) Epandage des déjections (Ammoniac)								Froid						C
Oeufs et ovoproduits		0,54	86%	Digestion (Méthane) Alimentation animale (Fertilisants-énergie-usage des sols)								Froid						C
Volaille		0,85	81%	Alimentation animale (Fertilisants-énergie-usage des sols) Epandage des déjections (Ammoniac)	11%	Découpe						Froid						B
Algues		1,25	53%		42%	Séchage												A
Autres poissons sauvages		1,68	91%	Carburant bateaux														A
Mollusques et crustacés		1,08	79%	Carburant bateaux								Froid						B
Petis poissons gras (sardine, maquereau, hareng, anchois)		0,31	50%	Carburant bateaux	12%	Stabilisation	14%	+45% -10%	Aluminium Plastique PS	21%	+79% -17%	Froid						B
Poissons d'élevage		1,62	93%	Énergie - Alimentation animale								Froid						A
Abats et pâtés de porc		0,25	72%	Alimentation animale (Fertilisants-énergie-usage des sols) Epandage des déjections (Ammoniac)	10%	Découpe Modification						Froid						B
Charcuteries (porc)		1,18	80%	Alimentation animale (Fertilisants-énergie-usage des sols) Epandage des déjections (Ammoniac)s	14%	Salage Modification						Froid						D
Porc, viande		1,38	78%	Alimentation animale (Fertilisants-énergie-usage des sols) Epandage des déjections (Ammoniac)	16%	Découpe						Froid						B
Bœuf et veau		2,44	97%	Digestion (Méthane) Alimentation animale (Fertilisants-énergie-usage des sols)								Froid						B
Agneau et mouton		3,69	98%	Digestion (Méthane) Alimentation animale (Fertilisants-énergie-usage des sols)								Froid						C

2.3. Common consumer products

Is the Agribalyse product list representative of the food market?

To evaluate whether the Agribalyse product list is aligned with food products on the market we looked at **21 different types of products and preparations**. These 21 products were chosen from among the products studied in the above analysis; they are representative of the various structuring parameters for each category. Between 7 and 15 commercial brands were studied for each product type. In all we reviewed a total of 208 products of various brands, provenances, ingredients and packaging types. The data used come from the Open Food Facts platform (Open Food Facts, 2020). This information was checked against the labels on the food products. As detailed information is not always available, some parameters were estimated, notably the provenance and proportions of ingredients. These estimations aim to be as realistic as possible, on the basis of information drawn from supermarket chain websites, from the literature and the knowledge of the project leader. A percentage that states the proportion of estimated data was calculated for each type of product. To complete the comparison the equivalent Agribalyse product was identified and its characteristics noted.

A range of products was determined for each type of product, reflecting the diversity of products found on supermarket shelves, in terms of packaging, provenance and conservation process. The value for the average Agribalyse food product was compared with the most commonly found products, but also with "atypical" products. All product types considered, the percentage of "estimated" data is relatively high; this confirms the absence of information available to consumers to evaluate environmental performance on the basis of product labelling for common consumer products.All these parameters are summarized in the table below.

Product characteristics							Percentage of estimated data		Characteristics of associated Agribalyse product				
Products	Number	Provenance of main ingredients	Packaging	% range of main ingredients	Labels	Conserva-tion	Ingredient proportions	Prov-enance	Provenance of main ingredients	Packaging	% range of main ingredients	Labels	Conserva-tion
Green lentils	13	France/ World	Flexible LDPE plastic, Can, Cardboard, Glass	-	Organic (5) Conventional (8)	Dry	-	38%	France	Flexible LDPE plastic	-	Conventional	Dry
Vegetable soup	11	Europe/ France	Beverage carton, Glass bottle, PET plastic bottle	-	Organic (3) Conventional (8)	Dry	37%	95%	Europe	Beverage carton	-	Conventional	Dry
Red wine	12	France/ Europe/ World	Glass bottle, Mixed materials	-	Organic (4) Conventional (8)	Dry	-	0%	France	Glass bottle	-	Conventional	Dry
Orange juice	10	Europe/ World	Beverage carton, Glass bottle, PET bottle	-	Organic (2) Conventional (8)	Refrig. (1)/ Dry (9)	-	50%	Europe	Beverage carton	-	Conventional	Dry
Chocolate custard dessert	7	Europe/ World	Glass, PP tray	Milk: 60 - 72%	Organic (3) Conventional (4)	Refrig.	58%	87%	Europe/ World	PP tray	Milk: 80%	Conventional	Refrig.
Yogurt with fruit	8	France/ Europe/ World	PP tray	Milk: 65 - 86%	Conventional (5) Organic (3)	Refrig.	36%	80%	Europe	PP tray	Milk: 76%	Conventional	Refrig.
Seafood sushi	9	Salmon, shrimp: Europe/ Vietnam/ World	PS tray, Mixed materials	Rice: 60-83% Fish: 10-21%	Conventional Organic	Refrig.	9%	69%	Europe/ World	PS tray	Rice: 20%, Salmon: 10%	Conventional	Refrig.
4-cheese pizza	10	Europe/ World	Mixed materials	Cheese: 22-48%	Conventional Organic	Refrig. (4)/ Frozen (6)	33%	88%	Europe/ World	Mixed materials	Cheese: 47%	Conventional	Frozen
Melted ham and cheese sandwich (croque	10	France/ Europe/ World	Flexible LDPE plastic, Cardboard, Mixed materials	Bread: 33-54% Ham: 9-20%	Organic (1) Conventional (9)	Refrig. (9)/ Frozen (1)	15%	91%	France/ Europe	PS tray	Bread: 47% Ham: 19%	Conventional	Refrig.
Sardine in oil	7	Atlantic Ocean/ Europe/ World	Can	Sardine: 72-81%	Conventional Organic MSC	Dry	71%	94%	Atlantic Ocean/World	Metal tin	Sardine: 75%	Conventional	Dry
Strawberry jam	12	France/ Europe/ World	Glass	Strawberries: 45-65%	Organic (6) Conventional (5)	Dry	54%	88%	France	Glass	Strawberries: 56%	Conventional	Dry
Lasagne and meat sauce	15	Europe/ France	Flexible LDPE plastic, Cardboard, Mixed materials	Pasta: 8-21% Beef: 7-24% Tomato: 4-40%	Organic (2) Conventional (13)	Refrig. (6)/ Frozen (9)	26%	80%	Europe	PP tray	Pasta: 37% Beef: 7% Tomato: 11%	Conventional	Refrig.
Chocolate/hazel nut spread	10	France/ Europe/ World	PET, Glass	Hazelnuts: 4-16%	Conventional Organic	Dry	66%	89%	France/ Europe	Glass	Hazelnuts: 15%	Conventional	Dry
Chocolate cake	7	Europe/ World	LDPE, Mixed materials	Chocolate: 8-22%	Conventional Organic	Dry	67%	93%	France/ Europe/ World	LDPE	Chocolate: 29%	Conventional	Dry
Shrimp	10	Honduras/ Ecuador/ Vietnam/ World	PS tray	-	Conventional Organic MSC/ ASC	Refrig. (5)/ Frozen (5)	-	20%	China	PS tray	-	Conventional	Refrig.
Milk chocolate tablet	14	Cote d'Ivoire/ Dominican Republic/ Madagascar/ Latin America/ World	Mixed materials	Chocolate paste: 13-65%	Conventional Organic	Dry	86%	92%	World	Mixed materials	Chocolate paste: 20%	Conventional	Dry
Cheeseburger	13	Europe/ France	Cardboard, Flexible LDPE plastic, Mixed materials	Bread: 38-44% Beef: 26-54%	Organic (1) Conventional (12)	Refrig. (6)/ Frozen (7)	0%	85%	Europe	PS tray	Bread: 24% Beef: 42%	Conventional	Refrig.
Chili con carne	15	France/ Europe/ World	Conserve, Carton, Glass, Mixed materials, Flexible LDPE plastic	Beef: 6-25% Red beans: 6-34% Rice: 11-38%	Organic (2) Conventional (13)	Refrig. (8)/ Dry (7)	18%	84%	Europe	PP tray	Beef: 47%, Red beans: 7%	Conventional	Refrig.
Coffee	10	Latin America	Mixed materials	-	Organic (6) Conventional (4) Fairtrade (7)	Dry	0%	0%	World	Can		Conventional / Faitrade	Dry
Beef and lamb merguez sausage	5	France/ Europe/ World	PS tray	Beef: 60-85% Mutton: 8-15%	Conventional Organic	Refrig.	62%	73%	France/ Europe	PS tray	Beef: 59%, Mutton: 37%	Conventional	Refrig.

Figure 23: Characteristics of commercial products surveyed and the Agribalyse equivalent

An LCA inventory was constituted for each of the 208 selected products, on the basis of available and estimated data: ingredients, provenance, proportions in the preparation, packaging. For some products (cheeseburger, prepared lasagne) different livestock production modes were simulated in addition to the above factors.

The graph below is based on the EF3 single score values obtained for each product, and the mean Agribalyse value.

Some products have highly variable scores: cheeseburger, coffee, beef merguez sausage. EF3 single scores are also variable for lasagne, chili con carne and chocolate in tablet form, but less so. We observe a non-negligible difference in LCA inventory between commercial products and average Agribalyse values, some of which are derived from "domestic" recipes that differ from industrial preparations. There is no significant variability with respect to mean Agribalyse values and to category values for the other types of products.

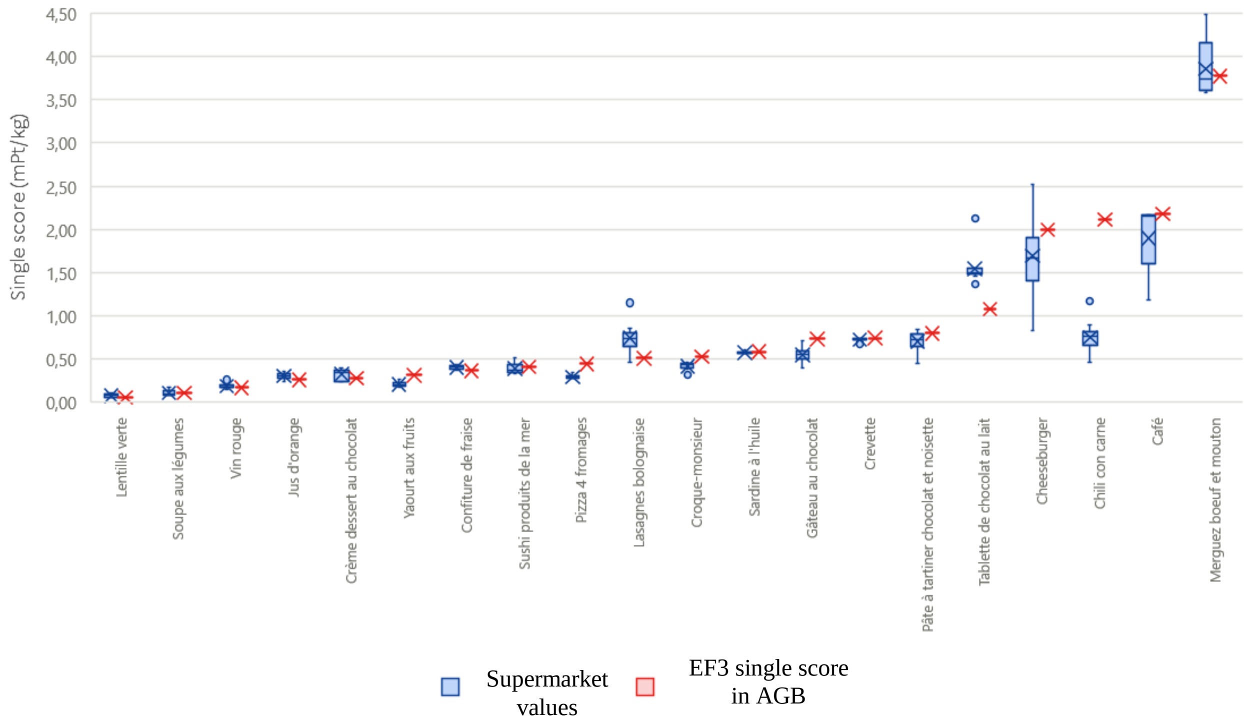


Figure 24: Variation in EF3 single score by products on the market

As for product composition, in addition to this overview it is useful to refer to each individual product and compare it to an "average" product and also at a broader scale. These comparisons yield very different findings.

Products for which the average Agribalyse value is pertinent:

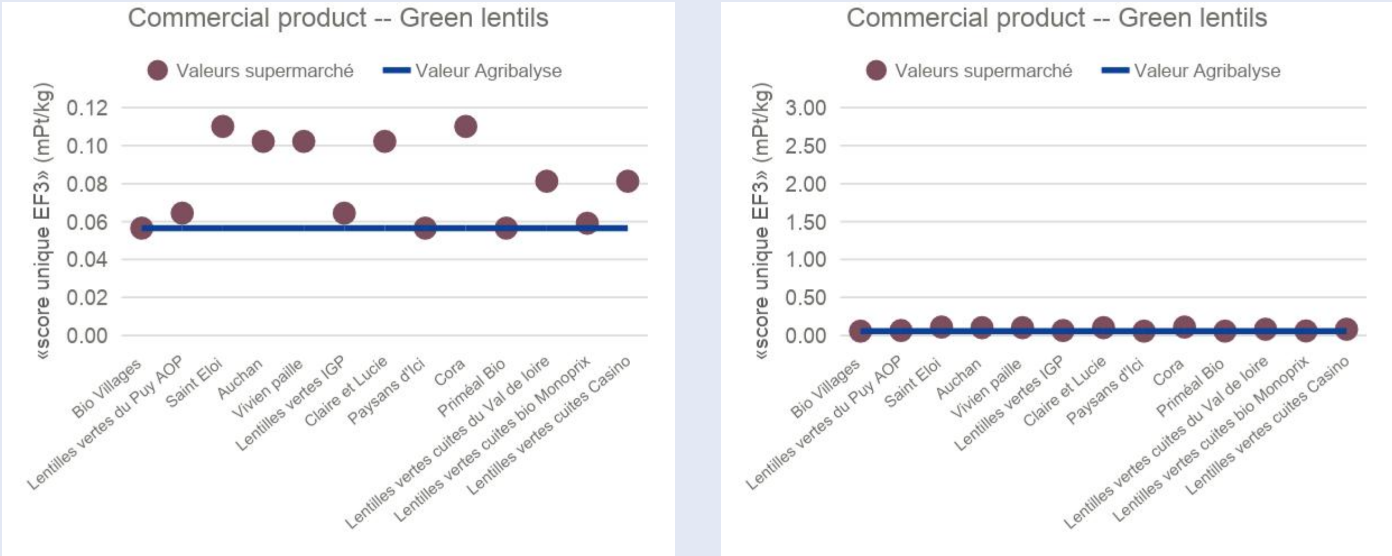


Figure 25: Commercial products: green lentils at two scales of comparison

These two perspectives show that the EF3 single score in the lentils category can vary by a factor of 2, depending in particular on provenance and packaging factors. At the same time, in the overall perspective of the environmental footprint of food consumption, locally grown lentils and lentils packaged in bulk have negligible impact compared to the impacts of other foodstuffs. The average Agribalyse value is entirely valid as a consumer indicator of environmental impact for lentils compared to other products in the store.

Products for which the average Agribalyse value needs to be adjusted:

Looking at other types of products we see that there are products for which the average Agribalyse value may be insufficient. This is the case for prepared foods such as chili con carne and for chocolate in tablet form. In these two cases we see that while scores for commercial products are fairly similar among the products themselves, the average Agribalyse value is rather far from the real impact of these products. This is due to the modelling of ingredients and proportions in Agribalyse. The values used for modelling should be revised in the next version of the database.

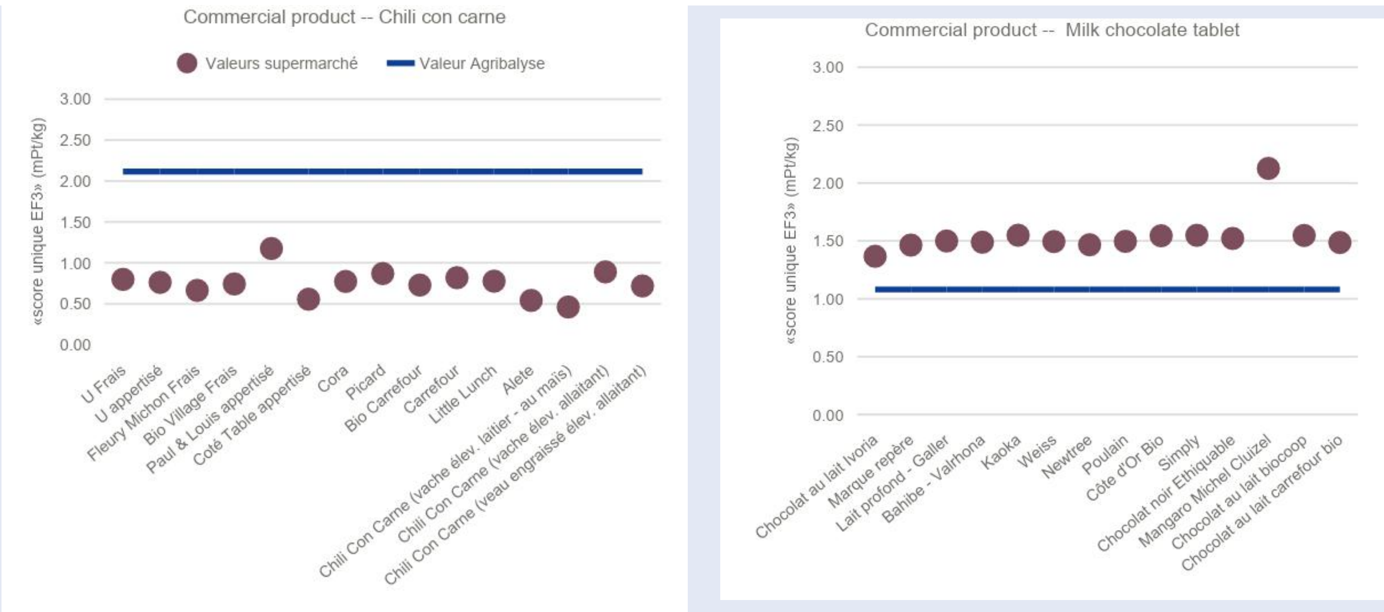
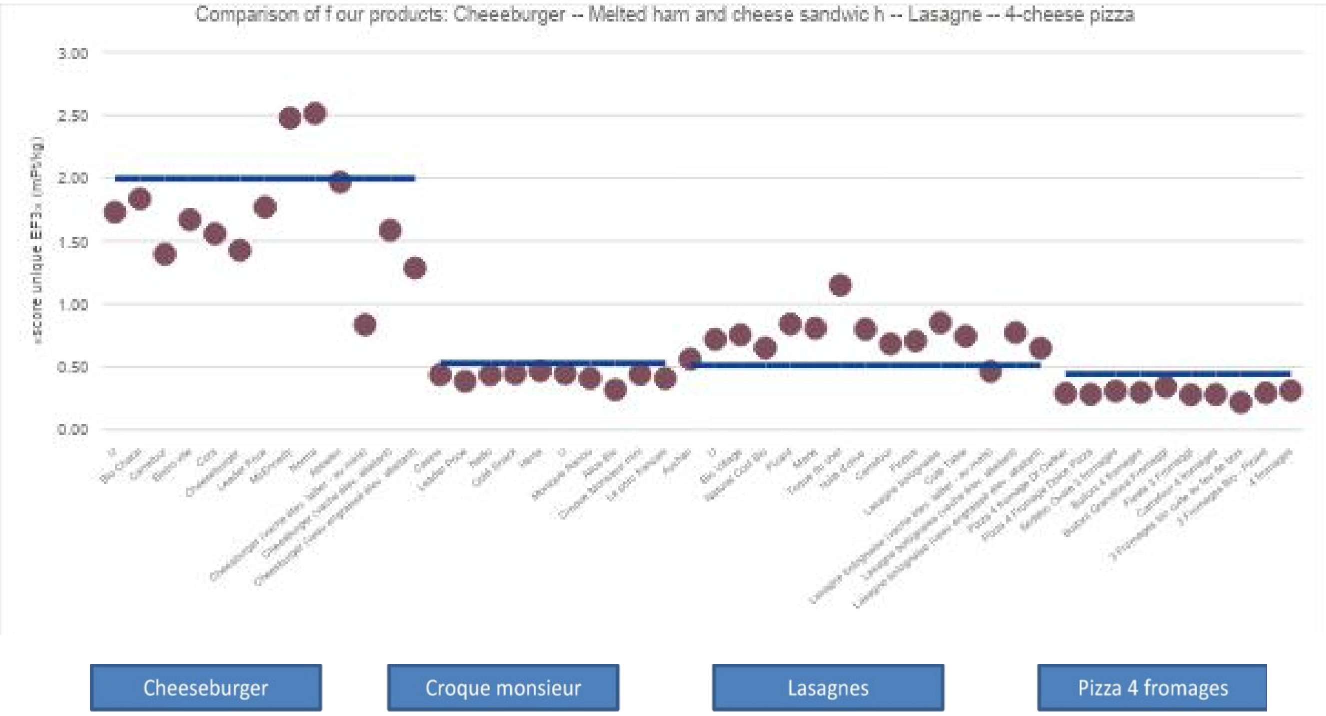


Figure 26: Commercial products survey: chili con carne and chocolate

Products for which the Agribalyse average is not adequate and should be recalculated

Major discrepancies between products are seen in the following instances: LCA inventory values for *croque-monsieur* preparations (melted ham and cheese sandwich) and four-cheese pizzas are relatively homogeneous (<0.5 mPt/kg), but are more variable for cheeseburger and lasagne preparations. In these two cases the variation depends on the proportion (by weight) of red meat in the composition, and on the meat production system. This is most evident for cheeseburgers, a product for which we simulated three different types of cow for each product. For these product types LCA inventory values should be recalculated to distinguish products by composition, and not rely solely on an average drawn from the Agribalyse database.



In conclusion we observe relatively little variation among products of the same type, and with the average Agribalyse value, with the exception of some products that have a high EF3 single score and a preponderant main ingredient, as is the case for prepared foods containing red meat or fish.

The Agribalyse programme furnishes a database that is adequate and generally representative of the commercial food market for a large majority of products.

This database can be used to model the environmental impact of specific products, on the condition that provenance and proportions in product composition are estimated using a clearly defined method.

The EF3 single scores for similar commercial products are generally situated within a narrow range of values. The impact of foods of the same type is subject to little variation.

Globally speaking the values for commercial products do not vary greatly from average Agribalyse values, except for preparations containing meat and chocolate-based products. As a general rule product type is the main determinant of environmental impact, ahead of production mode, provenance or packaging.

3. Findings and perspectives

The findings of our review of Agribalyse 3.0.1 data are presented in this report. The principal findings are listed by number in the Table 9.

- The EF3 single score is correlated with the climate change indicator score. There is no obvious link between nutritional value and environmental impact of products.
- The upstream agriculture stage represents the largest component of the final EF3 single score. The processing, packaging and transport stages can also have an effect on the EF3 single score, but to a lesser extent, and distribution and consumption have very little effect on the final impact.
- Different production systems inflect the EF3 single score for meat products, large fish, coffee and chocolate. For dairy products, fruit and vegetables, production factors induce very little variation in impact. It would be useful to pursue analysis of this component.
- Product composition and proportions of ingredients in prepared foods also have an effect on the EF3 single score, depending on the predominant ingredient. This is true in particular for products containing red meat, fish, or chocolate.
- Distance of transport and packaging type are structuring parameters for the final impact of plant-based beverages, fruit and vegetables, and small fatty fish, but these stages do not modify the position of these categories compared to other products on an environmental impact scale.
- As food processing, distribution and consumption depend on industrial and consumer behaviours, it is difficult to observe variation in these stages in the Agribalyse programme. At the time of this writing Agribalyse data are not sufficiently informative to distinguish products that incorporate environmental concerns among mass-produced industrial food products. Inversely, these data can be used by industrial producers to develop more detailed LCA inventories for their products.

Table 9: Structuring parameters by category

Categories	Structuring parameters that determine more than 10% of the EF3 single score					
	Agriculture	Packaging		Transport		Composition
	% Impact	*% Impact*	*Impact of variation on final EF3 single score*	*% Impact*	*Impact of variation on final EF3 single score*	*Ingredient*
Plant-based beverages	55%	17%	+32% -3%	14%	+79% -4%	
Cereals and legumes	68%	8%		6%		
Dairy products	86%	3%		3%		
Nuts and seeds	88%	3%		3%		
Fresh fruit and vegetables	79%	1%		13%	+38% -10%	
Soups, compotes, canned/preserved fruit and vegetables	46%	10%	+20% -9%	7%		
Fats and oils	86%	4%				
Prepared starters and dishes containing red meat	92%	1%				+39% -38%
Prepared starters and dishes containing white meat	73%	4%				+24% -20%
Prepared starters and dishes containing fish	81%	4%				+50% -16%
Meatless prepared starters and dishes	65%	6%				+10% -1%
Pizza, pies, sandwiches and savoury crepes	71%	5%				+19% -13%
Chocolate and chocolate products	85%	2%				
Desserts, cakes, ice cream	74%	5%				+15% -12%
Red meat	97%	1%				
Pork	78%	3%				
Poultry	81%	3%				
Other wild fish	91%	2%				

Small fatty fish	50%	14%	+45% -10%	21%	+79% -17%	
Farmed fish	93%	1%				

This study characterizes the structure of Agribalyse data with a view to developing environmental information for consumers. It also highlights ways in which the database can be improved, and indicates some suggestions for more targeted environmental information display.

Database improvements for the next edition

- Modify composition profiles for the prepared foods with the greatest impact, to better match the composition of commercial products on the market.
- Integrate and model new LCA inventories for imported products, in particular meat, so that meats of different provenances can be compared.
- Integrate and model alternative production modes (quality labels, cultivation without deforestation) for foods with high impact such as meat, coffee and chocolate.

Recommendations for labelling and information display

- Correct values for provenance and packaging for vegetal products and for beverages.
- Distinguish between provenance and production mode for raw products with high impact, when an LCA value is available.
- Recalculate ingredient proportions for prepared foods with high impact and containing an ingredient with high impact.

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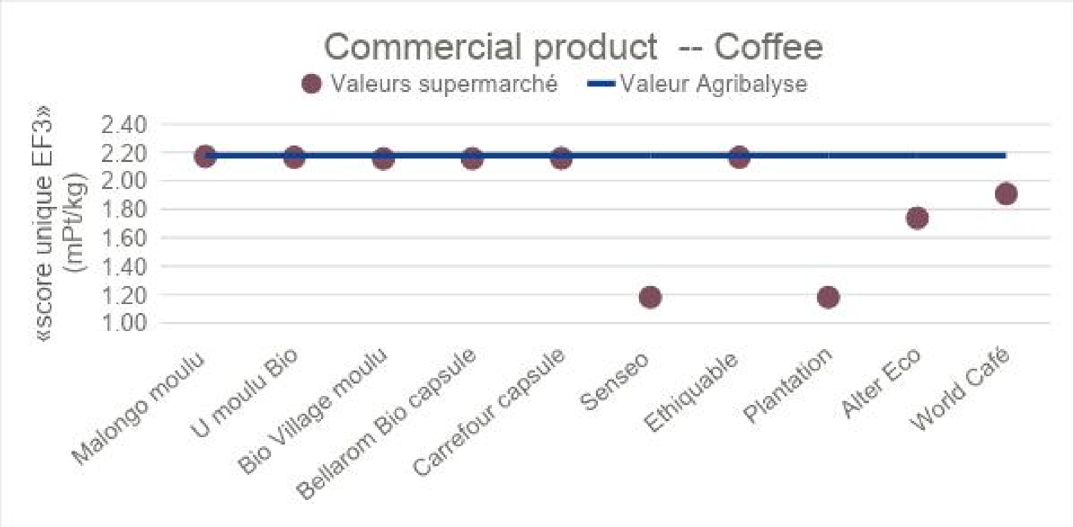
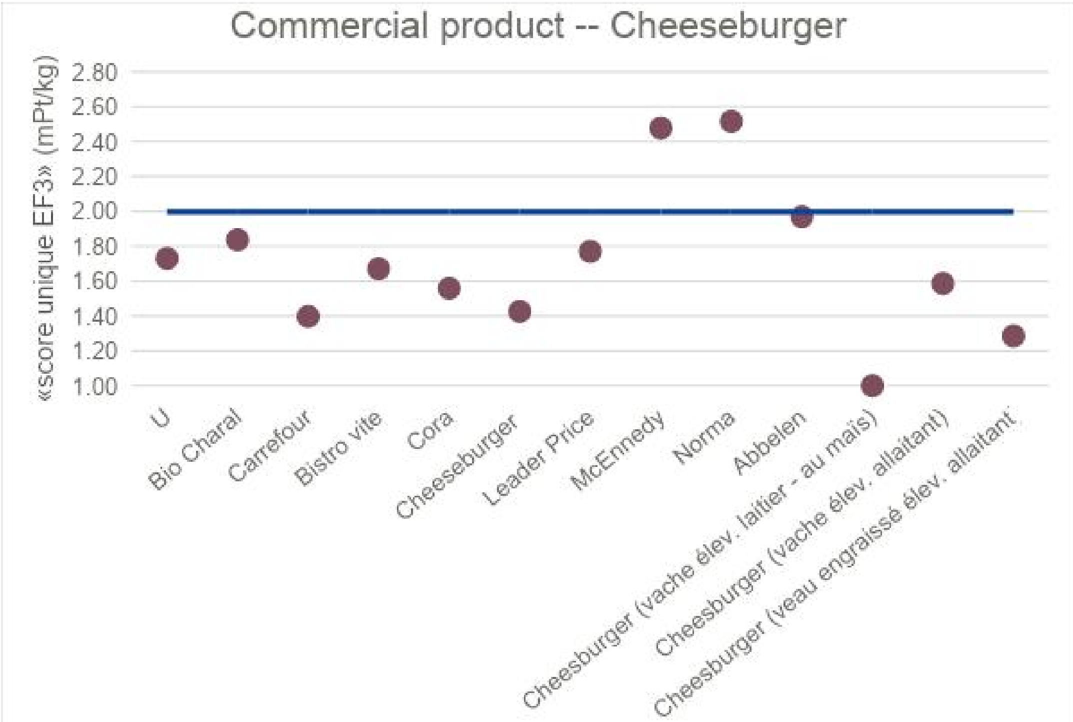
ABBREVIATIONS AND ACRONYMS

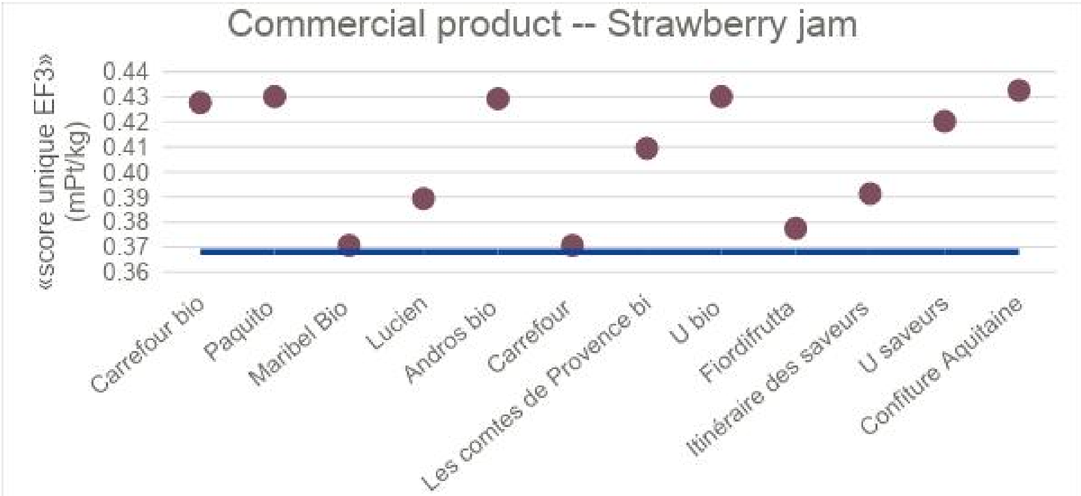
ADEME	French Agency for ecological transition
LCA	Life cycle analysis
ANSES	Agence Nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (Agency for Food, Environmental and Occupational Health & Safety, France)
CIQUAL	Nutritional values table
FSA	Food Standards Agency (United Kingdom)
LCI	Life cycle inventory
INRAE	Institut National de Recherche pour l'Agriculture et l'Environnement (French National Research Institute for Agriculture, Food and the Environment, France)

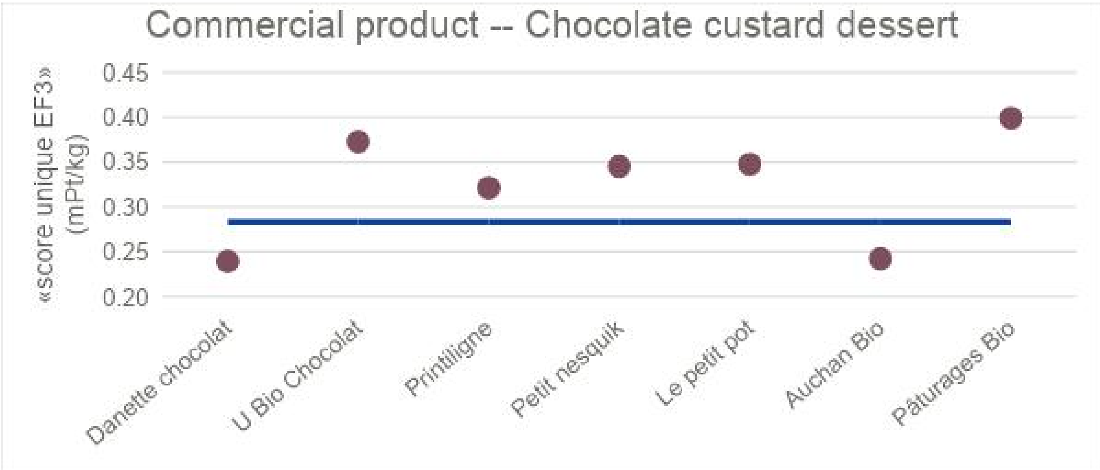
TABLE OF ANNEXES

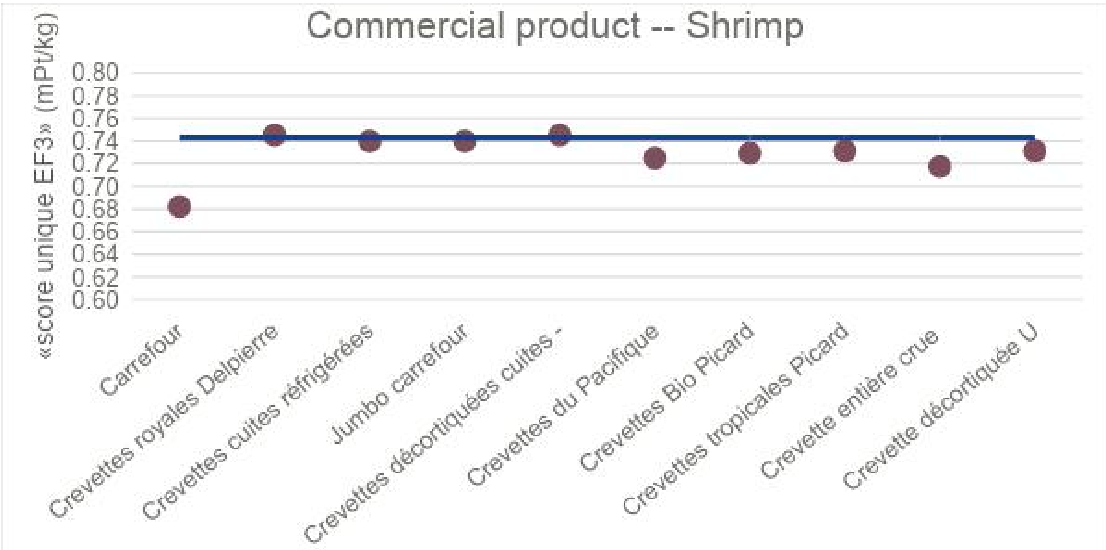
ANNEX: COMMERCIAL PRODUCTS COMPARISON GRAPHS

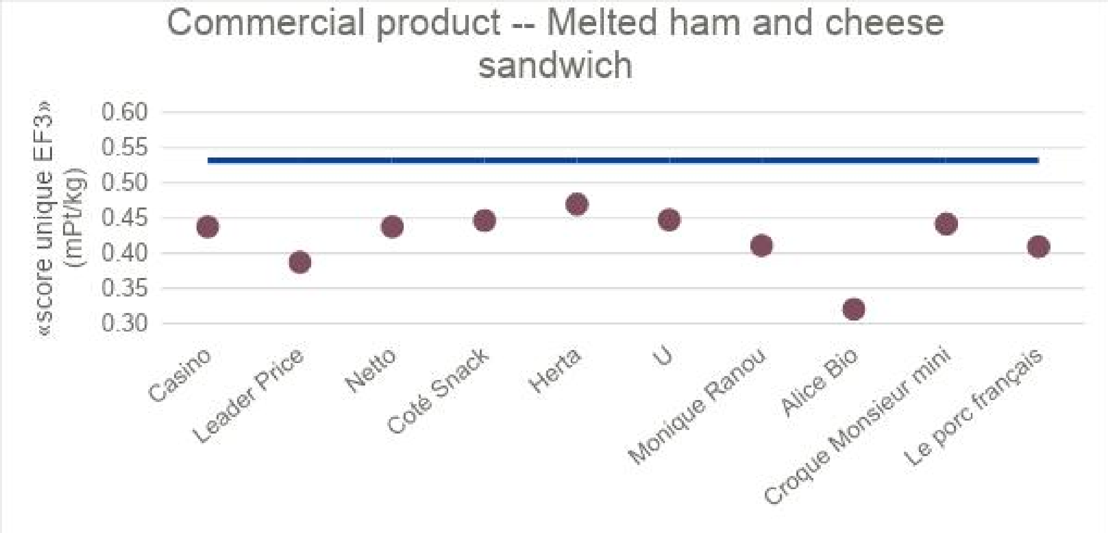


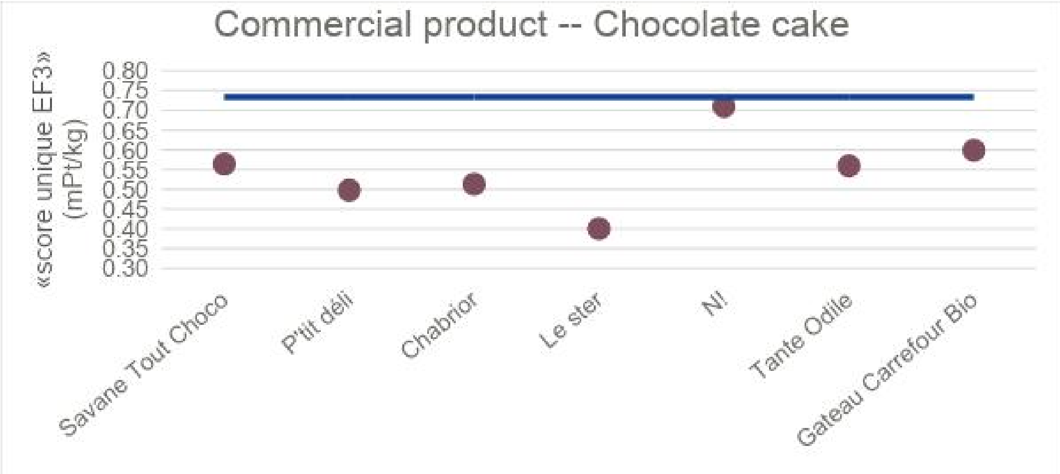


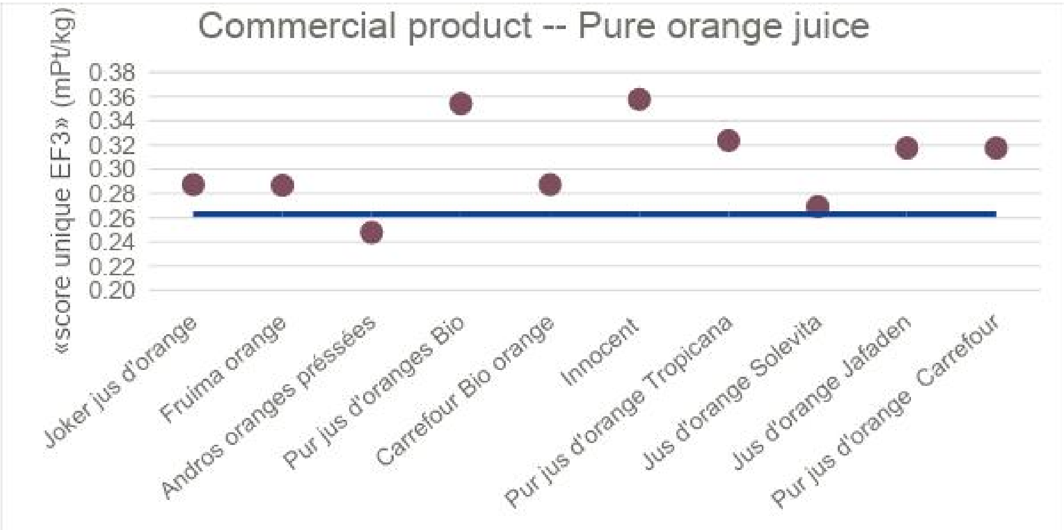

Commercial product -- Strawberry jam
«score unique EF3» (mPt/kg)
0.44
0.43
0.42
0.41
0.40
0.39
0.38
0.37
0.36
Carrefour bio
Paquito
Maribel Bio
Lucien
Andros bio
Carrefour
Les comtes de Provence bi
U bio
Fiordifrutta
Itinéraire des saveurs
U saveurs
Confiture Aquitaine

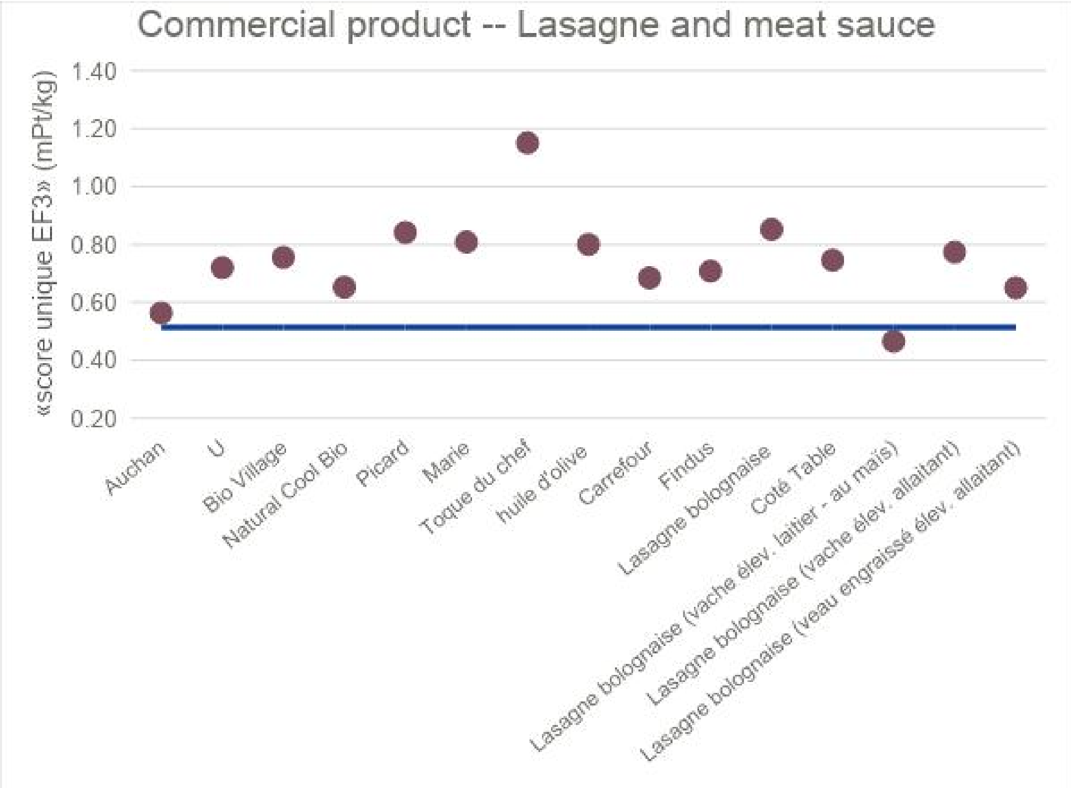

Commercial product -- Chocolate custard dessert
«score unique EF3» (mPt/kg)
0.45
0.40
0.35
0.30
0.25
0.20
Danette chocolat
U Bio Chocolat
Printiligne
Petit nesquik
Le petit pot
Auchan Bio
Pâturages Bio

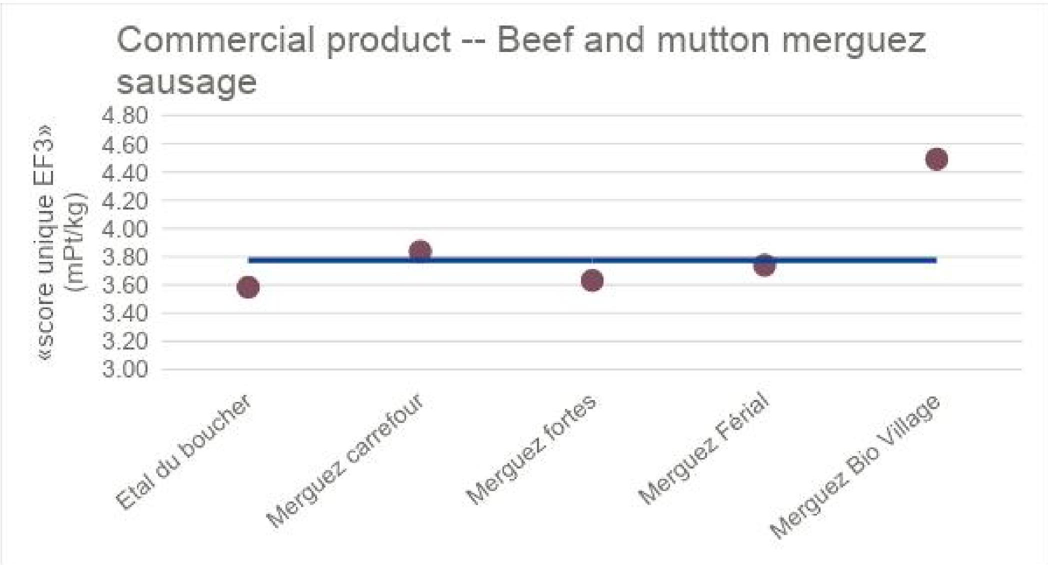

Commercial product -- Shrimp
«score unique EF3» (mPt/kg)
0.80
0.78
0.76
0.74
0.72
0.70
0.68
0.66
0.64
0.62
0.60
Carrefour
Crevettes royales Delpierre
Crevettes cuites réfrigérées
Jumbo carrefour
Crevettes décortiquées cuites -
Crevettes du Pacifique
Crevettes Bio Picard
Crevettes tropicales Picard
Crevette entière crue
Crevette décortiquée U

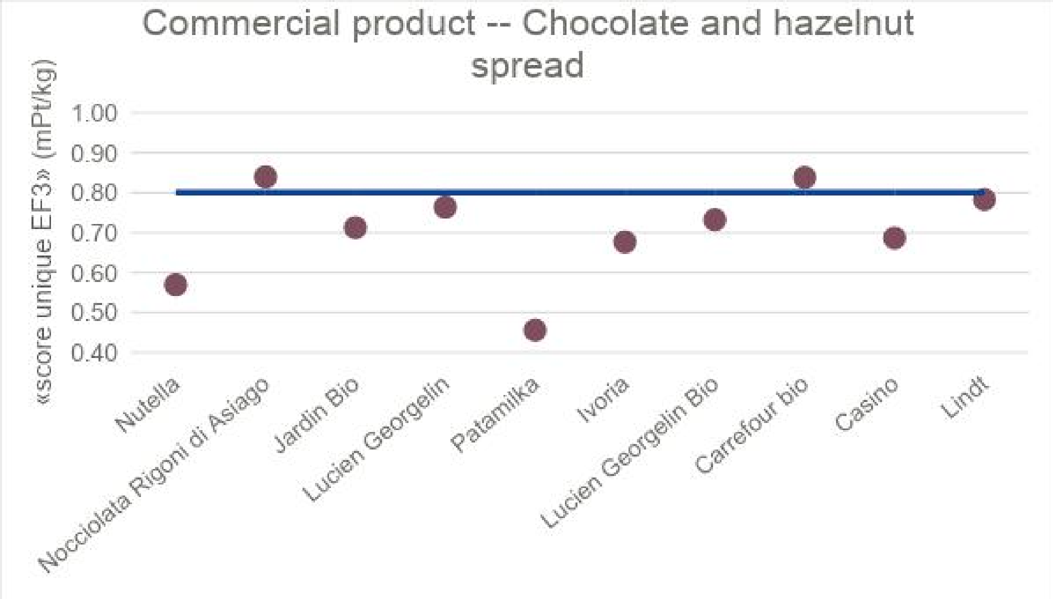

Commercial product -- Melted ham and cheese sandwich
«score unique EF3» (mPt/kg)
0.60
0.55
0.50
0.45
0.40
0.35
0.30
Casino
Leader Price
Netto
Coté Snack
Herta
U
Monique Ranou
Alice Bio
Croque Monsieur mini
Le porc français


Commercial product -- Chocolate cake
«score unique EF3» (mPt/kg)
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
Savane Tout Choco
P'tit déli
Chabrior
Le ster
N!
Tante Odile
Gateau Carrefour Bio

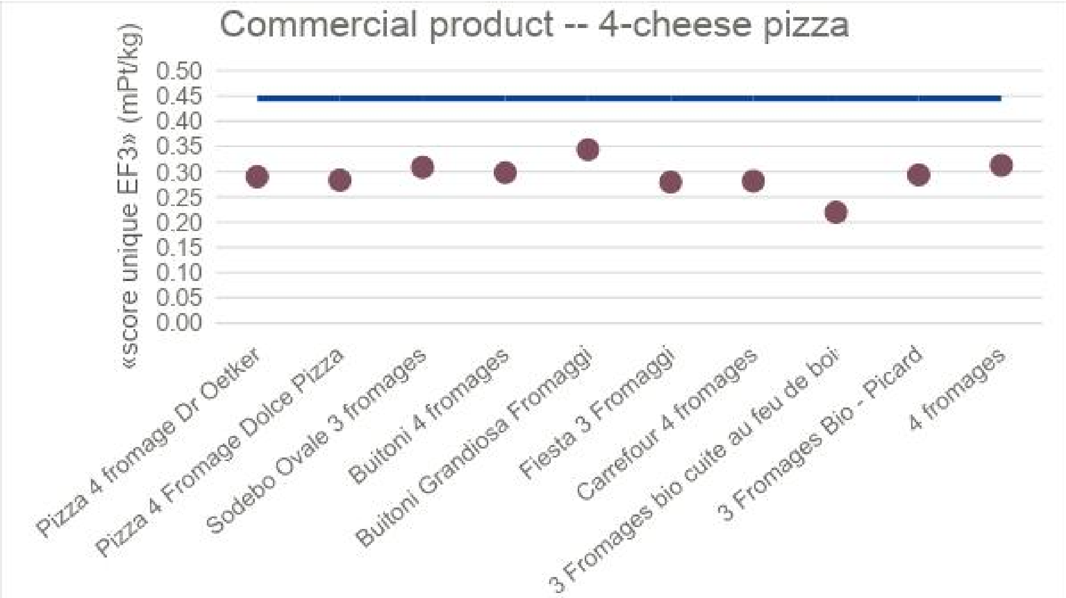

Commercial product -- Pure orange juice
«score unique EF3» (mPt/kg)
0.38
0.36
0.34
0.32
0.30
0.28
0.26
0.24
0.22
0.20
Joker jus d'orange
Fruima orange
Andros oranges préssées
Pur jus d'oranges Bio
Carrefour Bio orange
Innocent
Pur jus d'orange Tropicana
Jus d'orange Solevita
Jus d'orange Jafaden
Pur jus d'orange Carrefour


Commercial product -- Lasagne and meat sauce
«score unique EF3» (mPt/kg)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
Auchan
U
Bio Village
Natural Cool Bio
Picard
Marie
Toque du chef
huile d'olive
Carrefour
Findus
Lasagne bolognaise
Coté Table
Lasagne bolognaise (vache élev. laitier - au maïs)
Lasagne bolognaise (vache élev. allaitant)
Lasagne bolognaise (veau engraissé élev. allaitant)

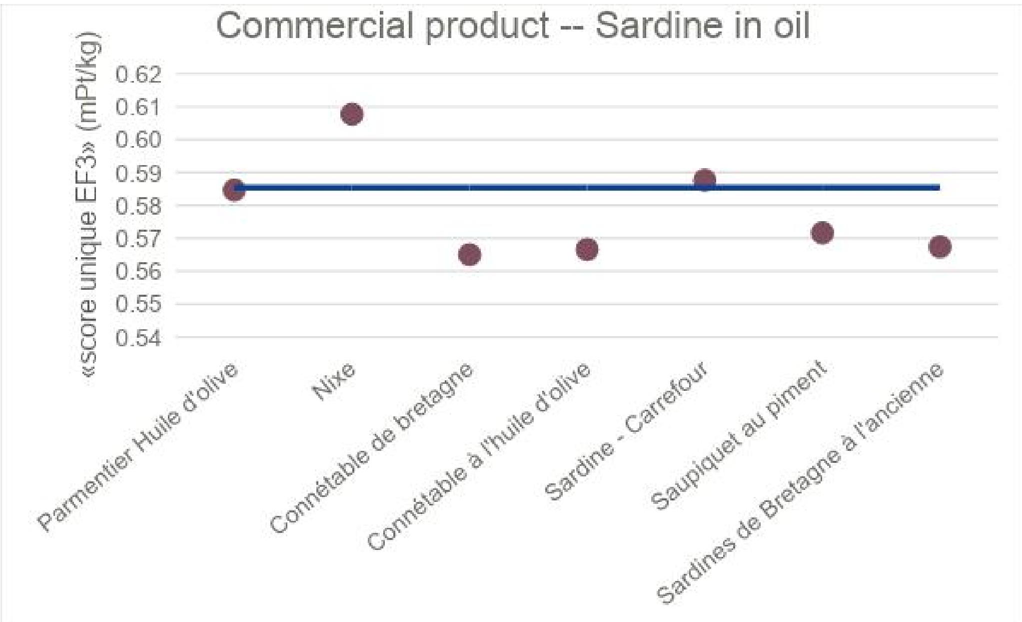

Commercial product -- Beef and mutton merguez sausage
«score unique EF3» (mPt/kg)
4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40
3.20
3.00
Etal du boucher
Merguez carrefour
Merguez fortes
Merguez Férial
Merguez Bio Village



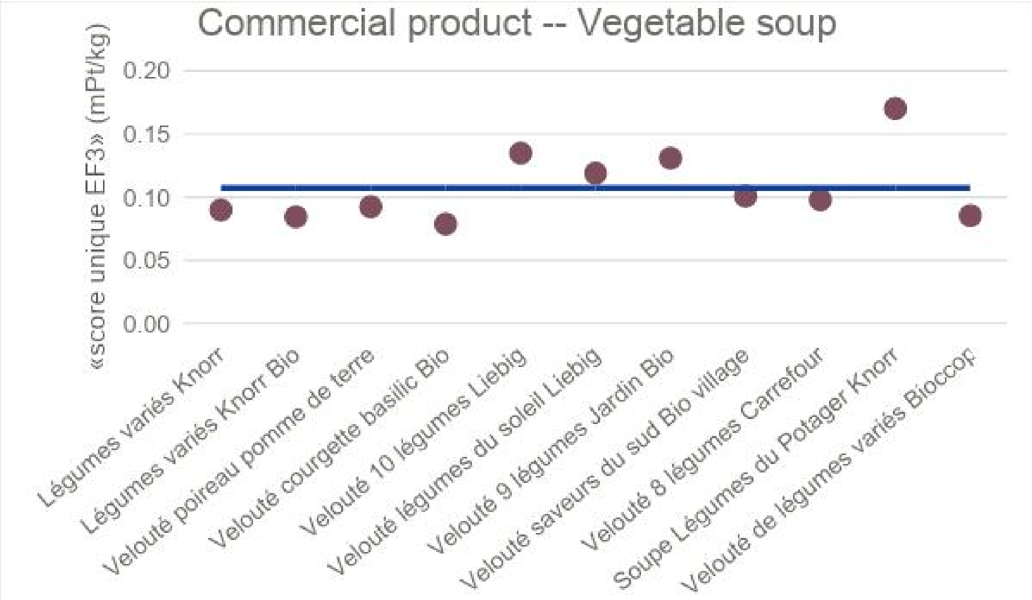
Commercial product -- Chocolate and hazelnut spread
«score unique EF3» (mPt/kg)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
Nutella
Nocciolata Rigoni di Asiago
Jardin Bio
Lucien Georgelin
Patamilka
Ivoria
Lucien Georgelin Bio
Carrefour bio
Casino
Lindt

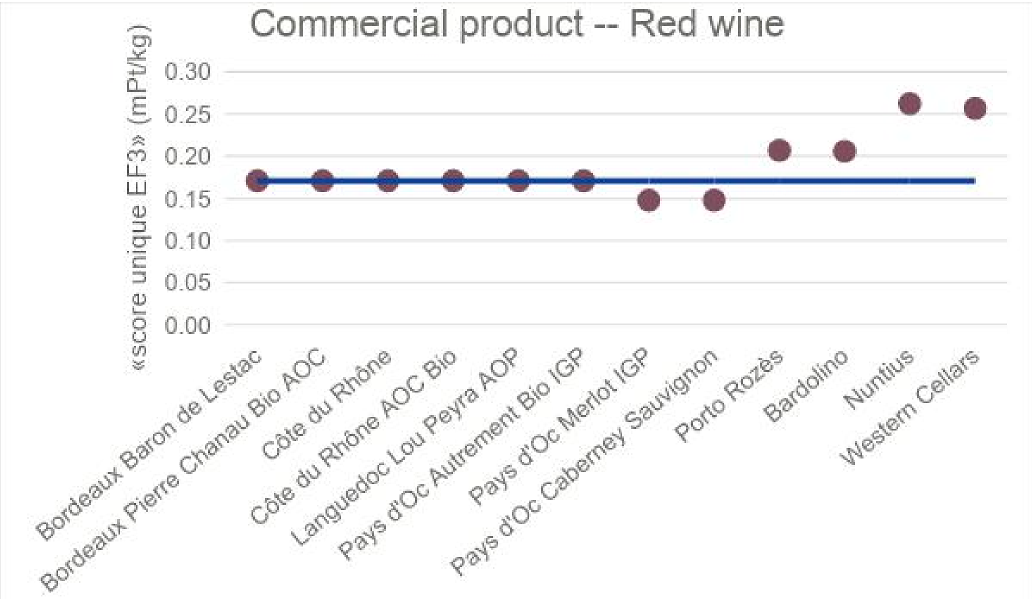


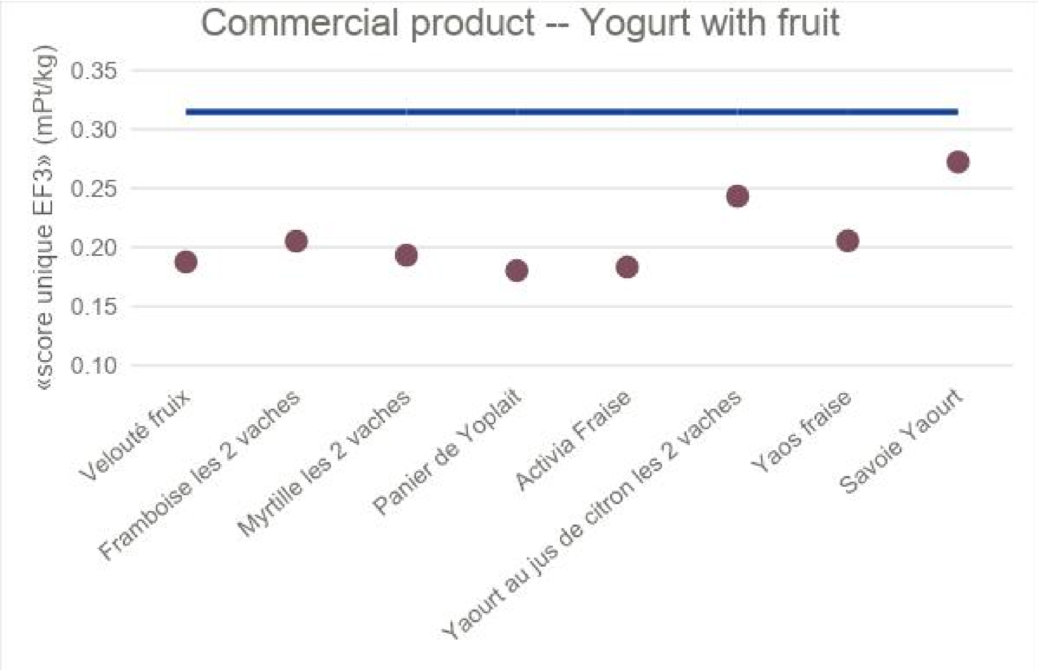
Commercial product -- 4-cheese pizza
«score unique EF3» (mPt/kg)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Pizza 4 fromage Dr Oetker
Pizza 4 Fromage Dolce Pizza
Sodebo Ovale 3 fromages
Buitoni 4 fromages
Buitoni Grandiosa Fromaggi
Fiesta 3 Fromaggi
Carrefour 4 fromages
3 Fromages bio cuite au feu de boi
3 Fromages Bio - Picard
4 fromages



Commercial product -- Sardine in oil
«score unique EF3» (mPt/kg)
0.62
0.61
0.60
0.59
0.58
0.57
0.56
0.55
0.54
Parmentier Huile d'olive
Nixe
Connétable de bretagne
Connétable à l'huile d'olive
Sardine - Carrefour
Saupiquet au piment
Sardines de Bretagne à l'ancienne


Commercial product -- Vegetable soup
«score unique EF3» (mPt/kg)
0.20
0.15
0.10
0.05
0.00
Légumes variés Knorr
Légumes variés Knorr Bio
Velouté poireau pomme de terre
Velouté courgette basilic Bio
Velouté 10 légumes Liebig
Velouté légumes du soleil Liebig
Velouté 9 légumes Jardin Bio
Velouté saveurs du sud Bio village
Velouté 8 légumes Carrefour
Soupe Légumes du Potager Knorr
Velouté de légumes variés Biocoop


Commercial product -- Red wine
«score unique EF3» (mPt/kg)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Bordeaux Baron de Lestac
Bordeaux Pierre Chanau Bio AOC
Côte du Rhône
Côte du Rhône AOC Bio
Languedoc Lou Peyra AOP
Pays d'Oc Autrement Bio IGP
Pays d'Oc Merlot IGP
Pays d'Oc Cabernet Sauvignon
Porto Rozès
Bardolino
Nuntius
Western Cellars



Commercial product -- Yogurt with fruit
«score unique EF3» (mPt/kg)
0.35
0.30
0.25
0.20
0.15
0.10
Velouté fruix
Framboise les 2 vaches
Myrtille les 2 vaches
Panier de Yoplait
Activia Fraise
Yaourt au jus de citron les 2 vaches
Yaos fraise
Savoie Yaourt

A BRIEF PROFILE OF ADEME

The French Agency for ecological transition (ADEME) is strongly committed to fighting global climate warming and resource depletion.

We mobilize citizens, actors in the economy and territorial authorities on all fronts. We given them the means to work towards an economy that conserves resources and emits less carbon, and towards a more harmonious society that treats its members more fairly.

We advise, guide and help finance projects in all domains – energy use, circular economy, food, mobility, air quality, adaptation to climate change, soil quality – from research to solutions in the field.

We make our expertise and forward-looking research available at all levels to serve and inform public policy.

ADEME is a public agency under the joint supervision of the Ministry for an Ecological and Solidarity-Based Transition, and the Ministry for Higher Education, Research and Innovation.

ADEME PUBLICATIONS

FACTS AND FIGURES
ADEME is a reference ADEME provides objective analyses based on regularly updated quantitative indicators.

KEYS TO ACTION
ADEME is a facilitator ADEME compiles practical handbooks and guidelines to help actors implement their projects methodically and in compliance with regulations.

ACTION AND ACCOMPLISHMENTS
ADEME is a catalyst Actors and stakeholders talk about their experience and share their know-how.

EXPERTISE
ADEME is an expert ADEME reports on research, studies and collective work carried out under its supervision.

HORIZONS
ADEME looks to the future ADEME promotes a forward-looking and realistic view of the energy and environment transition and what is at stake for society, to build a desirable future together.

RÉPUBLIQUE
FRANÇAISE

Liberté
Égalité
Fraternité

ADEME

AGENCE DE LA TRANSITION ÉCOLOGIQUE

EXPERTISES

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AGRIBALYSE 3.0.1 DATA VARIABILITY

Agribalyse 3.0.1, issued in 2020, is a life cycle analysis (LCA) database covering some 2,500 foods consumed in France.

This document presents the findings of a review of the database and data variability, to analyse the domain of validity of these data and identify the parameters that structure the environmental impact of food products. This study aims in particular to look at how Agribalyse data could be used to develop environmental labelling and information display for consumers.

This review underscores the correlation between the aggregated EF3 single score and the climate change score for products, and clearly identifies the structuring parameters for environmental impact by product category.

The findings by LCA stage show that the upstream agricultural phase is the largest contributor to the overall final impact, representing 78% of this impact, ahead of processing (8%), packaging (5%) and transport (5%).

Variation in parameters such as product composition and ingredient proportions, packaging, production or transport mode have little effect on the final EF3 single score, except for a few categories, mainly red meat, fish, coffee and chocolate.