

Article

Estimating the Cost of the Spanish Sustainable Food Basket through the Reference Budgets Approach

Elena Carrillo-Álvarez ¹, Júlia Muñoz-Martínez ¹, Blanca Salinas-Roca ^{1,2} and Irene Cussó-Parcerisas ^{3,*}

¹ Global Research on Wellbeing (GRoW) Research Group, Blanquerna School of Health Science, Ramon Llull University, Padilla, 326-332, 08025 Barcelona, Spain; elenaca@blanquerna.url.edu (E.C.-Á.); juliamm1@blanquerna.url.edu (J.M.-M.); blancasr@blanquerna.url.edu (B.S.-R.)

² Department of Nursing and Physiotherapy, University of Lleida, Montserrat Roig 2, 25198 Lleida, Spain

³ Pedagogy, Society, and Innovation with ICT support (PSITIC) Research Group, Blanquerna School of Psychology, Education and Sport Sciences, Ramon Llull University, Císter 34, 08022 Barcelona, Spain

* Correspondence: irenecp2@blanquerna.url.edu; Tel.: +34-932533000

Abstract: Reference budgets (RB) are illustrative priced baskets containing the minimum goods and services necessary for well-described types of families to have adequate social participation. Cross-country comparable food RB with the minimum cost were previously developed in 26 EU countries. However, sustainability was not considered. The aim of this paper is to present the development of healthy and sustainable food baskets for Spanish adults. This work follows the steps proposed in previous European projects to build RB: (1) revision of guidelines on healthy and sustainable eating and expert consultations, (2) translation into a concrete list of foods, (3) pricing. The results indicate that a sustainable diet can be cheaper than current recommendations when only the dietary content is considered, representing monthly savings of about EUR 7.27. This is mainly explained by the shift towards more plant-based proteins. Adding constraints on origin, packaging and seasonality increases the overall cost of the food basket by EUR 12.22/month compared with current recommendations. The Spanish Sustainable Food Reference Budget illustrates the cost of applying different criteria to improve dietary sustainability in the Spanish context, and can be useful to support the ecological transition, since providing different levels of adherence to a sustainable dietary pattern can ease its access across socioeconomic groups.

Keywords: reference budgets; food basket; sustainable diet; diet cost; healthy eating; inequalities



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1. Introduction

Worldwide, dietary risks are the leading cause of death and their effects on diseases and disability constitute the second cause of DALYs (Disability-Adjusted Life Year) [1]. According to the 2017 Global Burden of Disease study, 11 million deaths and 255 million DALYs were attributable to dietary risk factors [2]. The same analysis provides data on the long-lasting health inequalities among and within countries, which in European countries, increased after the 2008 Recession [3,4] and with the COVID-19 pandemic are further widening [5,6].

As a determinant of health, diet explains part of these divergent results among groups [7], linked to differences in dietary patterns considering breastfeeding, fruit and vegetable intake, processed food and soft-drinks consumption and general dietary composition primarily based, at the individual level, on income and educational status [8,9]. In developed countries, food access, as one of the dimensions of the construct food insecurity, mediates this relationship through diet cost [10].

By using European Union Statistics on Income and Living Conditions (EU-SILC), and comparing the cost of a healthy diet with the level of minimum income schemes for specific household types using microsimulation techniques, Penne and Goedemé [11] show how in 16 out of 24 European countries, at least 10% of the population in (sub)urban areas face

income-related food insecurity. According to their data, 8% of people living in densely and intermediately populated areas in Spain have a net disposable income after housing costs below the cost of a healthy diet for their household type. The cost of a healthy diet in Spain in 2015 ranged between 138 and 634 EUR/month depending on the household composition (from one adult to a couple with two children) [12].

In Penne and Goedemé's analysis, the cost of a healthy diet for each country is estimated using the Reference Budgets (RB) approach in the framework of a European study funded by the Commission's Directorate-General for Employment, Social Affairs and Inclusion (DG EMPL). RBs are priced baskets containing the minimum goods and services necessary for well-described family types to have an adequate social participation, understood as the ability of people to fulfil the various social positions they should be able to play as members of society. In this project, a standard methodology was followed to develop cross-national comparable Healthy Food Baskets (hereafter HFB) [13].

The results of the RB approach have yielded very relevant data for diverse social applications for social policies and actions [14,15]. At the macro level, RB can be used to assess the adequacy of minimum income protection, pensions, minimum wage, as well as a complementary indicator to analyse the poverty threshold [15–17]. At the micro level, RB can serve for direct educative and social actions, such as a tool for needs assessment, debt advice or budget counselling at the individual or household level, among other applications [18]. Particularly, HFB could contribute to tackle and analyse diet-related health inequalities [12,15,16], and there exist different experiences committed to use the HFB results to promote a healthy diet at the minimum cost for vulnerable groups [19,20]. However, at this stage of development and in the light of the latest data regarding environmental degradation [21], RBs have one major flaw: environmental sustainability is not considered. Therefore, in this paper we introduce for the first time the dimension of "sustainability" within the estimation of the HFB.

In an attempt to guide stakeholders involved in every layer of the food system towards sustainability, the EAT-Lancet Commission proposed in 2019 a set of specific thresholds to reduce greenhouse gas emissions (GHGe) from current dietary intake. They seek to provide guidance to enhance sustainability of the food industry and induce changes at the consumption level in order to shift to more plant-based diets with lower consumption of processed food, animal and dairy products [22,23].

Their document entails the five main pillars that characterise sustainable diets as defined by the Food and Agriculture Organisation (FAO) in 2010: food production, health, environment, cultural acceptance and socioeconomic variables, the last two being tailored to each specific region [24]. When designing sustainable diets, these pillars must be equally considered as each of them relates to one another. Therefore, it is important to design diets that promote health with low environmental impact, as well as promote its acceptance, affordability and accessibility among the population of interest.

Different barriers and facilitators for sustainable and healthy food purchases have been identified, including cost, education, social norms and food packaging [25,26]. Cost is frequently perceived as a limitation to follow a healthy diet and therefore becomes a barrier for low-income households [27–30]. Additionally, food purchasing is also influenced by education and perceptions on what sustainable and healthy diets are. More concerned subjects tend to consume less meat and more organic products for health and sustainability reasons [31–33]. Social norms also play a role in how foods are acquired since some individuals may prefer acquiring fresh food in local markets in order to enhance social economy [34].

Other drivers susceptible to influencing environmental stability are whether the food purchased is in-season or not [35], or how food is packed. Food packaging, especially plastic, is a concern for the food industry due to its repercussions on the environment [36,37] and the pollution derived from its production [38]. Although it may seem obvious that acquiring package-free food would be more sustainable than wrapped, evidence questions

this notion, as packaging is also a mean to reduce food waste. Nonetheless, the major contributor seems to be the foods that characterises each dietary pattern [39].

All these variables entail the purpose of our research, which aims to determine the minimum cost of a sustainable food basket. Therefore, in this paper, we describe the process of updating the Spanish Healthy Food Reference Budget (SHFRB) to include the dimension of sustainability, with the aim of providing data that can orientate policymakers towards the promotion of affordable, sustainable and healthy diets. Because sustainable options have been said to be more expensive [40,41] and because the provision of a pathway towards the ecological transition has been identified as a key aspect to promote societal changes [42,43], we propose a Sustainable Food Reference Budget for the Spanish population (the name of the “Healthy Food Reference Budget” has been changed to “Sustainable Food Reference Budget” (omitting the word healthy) following the FAO’s definition of sustainable diets provided in the introduction section), hereafter SSFRB, at three levels of sustainability based on the disposition of different criteria with influence on the sustainability of diets, as explained in the next section.

2. Materials and Methods

In this study, we adapted the methodology for the development of cross-nationally comparable RB described by Goedemé et al. [13], in order to make allowance for the dimension of sustainability. Therefore, the updated steps to develop the SSFRB were: (1) translation of food-based dietary guidelines (FBDG) into a concrete list of foods; (2) experts’ consultation to determine how to apply the sustainable principles to the acquisition of the list of foods; (3) determination of the food basket based on 3 levels for sustainable food acquisition and pricing of the food baskets. In the next sections, the methodology is described in detail. Because of the sequential nature of the procedure to develop RB, in which the results of one phase are necessary to comprehend the next one, we briefly describe the main findings of each step in this section, leaving for the results section only the final composition of the different levels of the SSFRB.

The target population for this study is men in active age living in the reference city of Barcelona. The choice of men responds to being the adult type with theoretically the greatest nutritional needs, according to the calorie reference values for European adults set by the European Food Safety Authority (EFSA) [44], allowing us to assess a higher cost for adults in a household budget. The SSFRB is designed for prototypical men assumed to be in good health, well-informed and with the competences to make decisions regarding his health and safety. These assumptions are necessary to be considered because any change in these conditions could alter the composition and price of the food basket.

2.1. Translation of Food-Based Dietary Guidelines into a Concrete List of Foods

The EAT-Lancet guidelines were the departing point of our study. The EAT-Lancet report provides a range of consumption for different types of foods compatible with different sustainable and healthy eating patterns. Therefore, to adapt its recommendations to the Mediterranean dietary pattern—as the mainstream eating culture in Spain—we used the national FBDG [45], which takes into account the population’s dietary needs based on the diet-related health situation of the country. Changes were made using dietitian-nutritionists’ knowledge considering that both sustainability principles and acceptability would be preserved, setting the reference amounts within the EAT-Lancet Commission thresholds, but closest to the proposed ranges of the Spanish Society of Community Nutrition (SENC, as its acronym in Spanish).

Table 1 shows the food amounts included in the SSFRB and how they relate to the EAT-Lancet report and the SENC recommendations in 2004 and 2016. We included data regarding the SENC 2004 recommendations for transparency purposes, as the already published SHFRB (level 0) [46], which we will use to compare results, was developed based on them. The combination of the SENC and the EAT-Lancet commission boundaries resulted in the determination of the reference food daily intake for the SSFRB, in grams, for

an adult male. The daily intake amount is the same across the three levels of sustainability (Levels 1–3). We differentiate them from one another in the next step when we consider the seasonality of the food items, packaging and acquisition point (see Section 2.3).

Table 1. Comparison of the dietary recommendations by the EAT-Lancet report, the SENC 2004, the SENC 2016 for an adult man and the chosen food amounts in the SSFRB. All values are net amounts.

Food Groups	EAT-Lancet	SENC 2004	SENC 2016	SHFRB Level 0	SSFRB Levels 1–2–3	SSFRB Levels 1–2–3 Weekly-Daily Distribution		
	g/Day	g/Day	g/Day	g/Day	g/Day	PT Size (g)	PT/Week	PT/Day
Whole grain ¹	232			276 ²	232	80	20	3
Tubercle	50 (0–100)	333–680	250–566	114	100	150	5	
Vegetables	300 (200–600)	300–400	300–400	400	400	200	14	2
Fruits	200 (100–300)	360–600	360–600	450	360	150	17	2
Dairy products	250 (0–500)	260–685 ³	260–685 ³	605	500	250	14	2
Red meat ⁴	14 (0–28)	Occasional	Occasional	50	30	150	1	
Poultry	29 (0–58)	43–71	43–71	54	29	100	2	
Eggs	13 (0–25)	27–36	27–45	60	27	63	3	
Fish	28 (0–100)	54–86	36–64	94	64	150	3	
Pulses	75 (0–150)	17–46	17–34	17	46	80	4	
Nuts and seeds	50 (0–75)	9–30	25	20	25	30	7	
Added fat ⁵	40 (20–80)	30–60 (mL)	-	40	40	10	42	
Added sugar	31 (0–31)	Occasional	0–50	50 ⁶	31 ⁶			

¹ Includes rice, pasta and breakfast cereals. ² In level 0, grains are refined. ³ Both Spanish guidelines recommend low-fat dairy products, whereas the EAT-Lancet promotes whole milk by-products. ⁴ Includes ham. ⁵ Includes sources of unsaturated fat olive, rapeseed, sunflower and peanut oil. ⁶ In the form of table sugar, jam and chocolate. PT Portion, SENC Sociedad Española de Nutrición Comunitaria; SHFRB Spanish Healthy Food Reference Budget; SSFRB, Spanish Sustainable Food Reference Budget.

Determination of edible food portions for potatoes, fresh vegetables, fruits, fresh fish, meat and eggs was 0.9, 0.72, 0.78, 0.7, 0.8 and 0.88, respectively, expressed in coefficients [47]. Therefore, the priced amounts of certain foods in the final food basket will be higher to compensate for food losses before intake.

2.2. Experts' Consultation for the Sustainable Acquisition of the List of Foods

Across the food system, not only diet composition determines the degree of sustainability of a diet. Aspects such as seasonality, distance from origin to consumption and how it is covered, packaging or how the food chain is entwined with the social and economic systems also have a great impact on sustainability [24]. Therefore, to prioritise these points with the aim of establishing food baskets that respond to different levels of sustainability, a Delphi panel was set up to seek expert consensus. An invitation was sent to 12 professionals with expertise on healthy eating and/or sustainability, of which 6 completed the whole process of consultation (GG, AP, NC, MM, FG, MB): together, we had 5 dietitians-nutritionists (two of which also were biologists) and 1 cook. Three of them were scholars, and one works on developing public health policies. In application of the Delphi method recommendations [48], two iterations were completed through an online survey, where the participants gave their input and prioritised options about: (1) elements to take into account to constitute a sustainable food basket and (2) acquisition point for the different food groups, both in a non-restrained and in a budget situation (allowing for the minimum cost). The experts were also asked to provide additional considerations if appropriate, but no further responses emerged. In the first iteration, respondents answered open-ended questions, and their answers were used to construct close-ended questions for the second iteration. Based on the frequency of responses in each question, experts agreed on a sustainable food basket that considers seasonality, that is produced close to

the consumption point and that reduces packaging as much as possible (by using reusable packaging or avoiding packaging altogether). Responses regarding the acquisition point are summarised in Table 2. In general, the experts suggested obtaining sustainable food products in small local producers/sellers and cooperatives such as farmers' markets, specialised shops (butcher shops, fish shops, grain shops), buying directly from the producer or from cooperatives. When applying a budget situation, these acquisition points may not be feasible for their potential higher prices and difficult accessibility without private transportation, therefore making it necessary to choose the best products within supermarkets. There was no consensus on the need to prioritise organic farming options nor what would be the best type of packaging when needed.

Two additional consultations through direct interviewing with life cycle analysis (IM) and food technology (AO) experts were conducted to clarify the options. From their responses, it was evident that there is no precise response to determine the best combination of the above aspects to be applied to all cases, as precise decision-making would entail having available a life cycle analysis for each single product that is considered for the baskets (i.e., all available items for "rice", for "milk", etc.). Both experts agreed that there is no generally preferable type of packaging and that the environmental impact of transportation is, in general terms (except for air transport), less relevant than the production and processing of food. Therefore, we concluded to prioritise not generating waste from food, so SSFRBs were composed with the exact food amounts to meet sustainability. Waste derived from food packaging and the criteria of buying seasonal were established as determinants to differentiate the various levels of sustainability, as well as buying local food, as a means to support the local economies and prevent the environmental footprint that transportation represents.

Table 2. Aggregated responses of the second round of the Delphi panel about where to purchase the Spanish Sustainable Food Reference Budget in a non-restrained and budget scenario.

Food Categories	Purchase Locations	Non-Restrained Scenario				Budget Scenario			
		Strongly Disagree	Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Agree	Strongly Agree
FRUITS	Market	1/6	-	2/6	3/6	1/6	-	4/6 [↑]	2/6 [↓]
	Direct sale from the farmer	-	-	2/6	4/6	-	-	2/6	4/6
	Cooperatives	-	-	2/6	4/6	-	-	2/6	4/6
	Supermarket	3/6	3/6	-	-	3/6	3/6	-	-
VEGETABLES	Market	1/6	-	2/6	3/6	1/6	-	4/6 [↑]	2/6 [↓]
	Direct sale from the farmer	-	-	2/6	4/6	-	-	2/6	4/6
	Cooperatives	-	-	2/6	4/6	-	-	2/6	4/6
	Community or family gardens	-	-	2/6	4/6	-	-	1/6 [↓]	5/6 [↑]
	Supermarket	3/6	3/6	-	-	3/6	3/6	-	-
STARCH	Bulk stores	-	-	2/6	4/6	-	-	4/6 [↑]	2/6 [↓]
	Market	1/6	-	4/6	1/6	↓	-	5/6 [↑]	1/6
	Cooperatives	-	-	3/6	3/6	-	-	2/6 [↓]	4/6 [↑]
	Supermarket	3/6	3/6	-	-	3/6	2/6 [↓]	1/6 [↑]	-
	Specialty stores	-	-	5/6	1/6	-	-	5/6	1/6
	Not possible to achieve both criteria	-	-	-	-	6/6 [↑]	-	-	-
DAIRY	Specialty stores	1/6	-	3/6	2/6	1/6	1/6 [↑]	4/6 [↑]	↓
	Market	1/6	-	4/6	1/6	1/6	1/6 [↑]	4/6	↓
	Cooperatives	1/6	-	3/6	2/6	1/6	-	2/6 [↓]	3/6 [↑]
	Supermarket	4/6	2/6	-	-	3/6 [↓]	3/6 [↑]	-	-
	Direct sale from the farmer	1/6	-	1/6	4/6	1/6	1/6 [↑]	1/6	3/6 [↓]
MEAT	Butcher shop	1/6	-	3/6	2/6	1/6	1/6 [↑]	2/6 [↓]	2/6
	Butcher at the local market	1/6	-	2/6	3/6	1/6	1/6 [↑]	1/6 [↓]	3/6
	Cooperatives	1/6	-	2/6	3/6	1/6	-	2/6	3/6
	Supermarket	4/6	1/6	1/6	-	3/6 [↓]	3/6 [↑]	↓	-
	Supermarket in glass package	-	-	-	-	1/6 [↑]	2/6 [↑]	3/6 [↑]	-

Table 2. Cont.

Food Categories	Purchase Locations	Non-Restrained Scenario				Budget Scenario			
		Strongly Disagree	Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Agree	Strongly Agree
FISH	Fish shop	1/6	-	2/6	3/6	1/6	1/6 [↑]	2/6	2/6 [↓]
	Fish shop at the local market	1/6	-	1/6	4/6	1/6	1/6 [↑]	1/6	3/6 [↓]
	Supermarket	4/6	1/6	1/6	-	3/6 [↓]	2/6 [↑]	1/6	-
	Fish shop (choosing the most economic species)	-	-	-	-	1/6 [↑]	-	1/6 [↑]	4/6 [↑]
NUTS	Bulk stores	-	-	2/6	4/6	-	-	4/6 [↑]	2/6 [↓]
	Fruit and vegetable grocery shops	-	1/6	5/6	-	-	1/6	5/6	-
	Market local	-	2/6	2/6	2/6	-	1/6 [↓]	4/6 [↑]	1/6 [↓]
	Cooperatives	-	-	3/6	3/6	-	-	2/6 [↓]	4/6 [↑]
	Supermarket	3/6	3/6	-	-	3/6	2/6 [↓]	1/6 [↑]	-
SPECIES ¹	Bulk stores	-	1/6	1/6	4/6	-	1/6	2/6 [↑]	3/6 [↓]
	Market local	1/6	1/6	2/6	2/6	↓	1/6	4/6 [↑]	1/6 [↓]
	Cooperatives	-	1/6	2/6	3/6	-	1/6	2/6	3/6
	Supermarket	3/6	3/6	-	-	3/6	3/6	-	-
	Warehouse with retail sale	-	-	-	-	-	1/6 [↑]	5/6 [↑]	-
OTHERS ²	Bulk stores	1/6	2/6	-	3/6	↓	↓	↓	↓
	Coffee shop	2/6	1/6	1/6	2/6	2/6	1/6	2/6 [↑]	1/6 [↓]
	Market	2/6	1/6	2/6	1/6	↓	↓	↓	↓
	Cooperatives	1/6	1/6	1/6	3/6	↓	↓	↓	↓
	Supermarket	3/6	3/6	-	-	3/6	2/6 [↓]	1/6 [↑]	-
	Warehouse with retail sales	-	-	-	-	1/6 [↑]	1/6 [↑]	4/6 [↑]	-

¹ Species, condiments, flour. ² Includes coffee and chocolate. ↓ Indicates a decrease in responses with regard to a non-restrained budget scenario. ↑ Indicates an increase in responses with regard to a non-restrained budget scenario.

2.3. Determination of the Food Acquisition for the Three Levels SSFRB and Pricing of the Baskets

After analysing the results of the expert consultation, three levels of sustainable food baskets were defined following the criteria depicted in Table 3. All levels (1 to 3) use the same reference intake of foods (Table 1), although the specific food items in the basket may vary across levels according to different sustainability parameters (seasonality, origin of the fresh product, packaging) and selection of the acquisition point for the pricing.

Table 3. Determination of the levels of sustainability and criteria to define them.

Levels of Sustainability Specific Criteria	Level 0 (Baseline) SHFRB-L0	Level 1 SSFRB-L1	Level 2 SSFRB-L2	Level 3 SSFRB-L3
Food amounts	SENC 2004	EAT-Lancet culturally adapted through SENC 2016 FBDG	EAT-Lancet culturally adapted through SENC 2016 FBDG	EAT-Lancet culturally adapted through SENC 2016 FBDG
Seasonality	All available	All available	In season	In season
Packaging	All available	All available	Minimally packed fresh food	Minimally packed fresh food
Origin of fresh product	All available	All available	Preferably Spain, also closer countries (Portugal, Morocco)	Preferably Catalonia, also Spain and closer countries (Portugal, Morocco)
Pricing	Widespread food retailer	Widespread food retailer	Widespread food retailer	Local distributors

SHFRB, Spanish Healthy Food Reference Budget; SSFRB, Spanish Sustainable Food Reference Budget; FBDG, Food Based Dietary Guideline.

With regard to the food acquisition point, the SHFRB-L0 criteria of ensuring minimum price and accessibility were maintained to prioritise that all foods can be acquired in a budget-friendly way in the same retailer [49]. The selection of retailer was based on the yearly study by the Spanish Consumers and Users Association [50], choosing one that is widespread in Spain and with prices about 10% higher than the cheapest one. That retailer was coincident with the one used by in the determination of the SHFRB [46], thus increasing comparability. Level 3 includes the consideration of the socioeconomic aspects of sustainability; therefore, price is based on local markets (still maintaining that all foods can be bought in the same enclosure but promoting local distribution points). In this paper, we only report the results of levels 0–1–2. Level 3 development was forced to be rescheduled due to the variations in the pricing of food in Spain that the COVID-19 pandemics has induced [51,52].

At each level, products meeting the inclusion criteria with the minimum price were included. A variation of fresh products (fruits, vegetables, meat, fish) was preserved by selecting at least seven different items from each category, the same methodology used for the SHFRB. The average price was calculated by weighing as if the seven cheapest options were consumed 5 days per week, and the remaining ones, excluding the 10% most expensive, were consumed twice per week. Level 2 pricing for fresh and frozen fish was exceptionally carried out in a different manner; applying the restrictions to purchase sustainable options left only four types of fish to be considered in our baskets. In this case, we weighted the cheapest three options to be consumed three times per months and the remaining one once per month.

For comparison purposes, SHFRB-L0 was established as the baseline to develop all other levels of SSFRB in a way that each level allows to account for the added cost of extra sustainability criteria. Therefore, we maintained all possible features of SHFRB-0 that were compatible with the criteria established at each level.

SSFRB-L1 variations with SHFRB-0 stemmed only from the reference FBDG, and for each food, the cheapest product/type available was included (see specifications for fresh food below), without considering seasonality, packaging or origin of the fresh product.

SSFRB-L2 is based on the same FBDG parameters as SSFRB-L1 but includes only minimally packed fresh foods, with origin in Spain or neighbouring countries and in-season fresh products (Table 4). In terms of origin, we aimed at setting Spain as the default origin option. However, geographical boundaries were finally widened to Portugal and Morocco for fresh vegetables and canned fish, due to availability reasons and also because in some areas of Spain, buying foods produced in these places is closer than buying foods from another Spanish region. When the origin of the product was not available, as it occurs in those products that contain more than one ingredient, the country of production was taken as a reference. Proximity from fresh and frozen fish was defined by the FAO Major Fishing Areas 27, 34 and 37 [53]. Regarding seasonality, only fresh fruits, vegetables and fish in season at the time of doing the consultation were selected (February–May 2020). Only foods preserved with the minimal packaging were chosen, except for potatoes. In this case, even though there was the possibility to buy them in bulk, we prioritised proximity. Seasonality of fruits and vegetables was assessed according to the Spanish and Catalan seasonal calendar for these products [54,55]. For fish, we used the Catalan [56] and the Greenpeace-Spain [57] seasonal calendar.

Table 4. Inclusion criteria for fresh products in level 2 for the development of the Spanish Sustainable Food Reference Budget.

Wholegrain bread and pasta	Origin Packaging Seasonality	Spain Minimum Not considered	Fresh vegetables ¹	Origin Packaging Seasonality	Spain Minimum February–May
Wholegrain rice	Origin Packaging Seasonality	Spain Minimum Not considered	Frozen vegetables	Origin Packaging Seasonality	Spain Minimum Not considered
Potatoes	Origin Packaging Seasonality	Spain Minimum Not considered	Fresh fruits	Origin Packaging Seasonality	Spain, Portugal, Morocco Minimum February–May
Legumes	Origin Packaging Seasonality	Spain Minimum Not considered	Fresh fish ¹	Origin Packaging Seasonality	FAO fishing areas 27, 34, 37 Minimum February–May
Charcuterie	Origin Packaging Seasonality	Spain Minimum Not considered	Frozen fish	Origin Packaging Seasonality	FAO fishing areas 27, 34, 37 Minimum Not considered
Lean and fatter meat	Origin Packaging Seasonality	Spain Minimum Not considered	Canned fish	Origin Packaging Seasonality	Spain and Morocco Minimum Not considered

¹ We also considered frozen products which have not have any other processing than cutting and freezing, following the methodology on EU RBs development by Goedemé et al. [13], which is the same used in the SHFRB-L0 [46].

3. Results

In this section, we present the final SSFRB. Table 5 shows the content of the different levels of the SSFRB, detailing for each food category the included amount and cost. At the same time are reported the differences between levels L0–L1 and L1–L2 in terms of amount (g/day) and cost (EUR/month) (see also Table S1 for complementary details by food item: the included amount, the purchased product, the cost per unit or kg and the monthly cost).

Table 5. Price and reference intake comparison by food groups between the Spanish Healthy Food Reference Budget (SHFRB) and levels 1 and 2 of the Spanish Sustainable Food Reference Budget (SSFRB).

FOOD CATEGORIES	SHFRB-0		SSFRB-1				SSFRB-2			
	Amount (g/Day)	Cost (EUR/Month)	Amount (g/Day)	Cost (EUR/Month)	Change Amount L1–0 (g/Day)	Change Cost L0–1 (EUR/Month)	Amount (g/Day)	Cost (EUR/Month)	Change Amount L2–L1 (g/Day)	Change Cost L2–L1 (EUR/Month)
Cereals and potatoes	390.35	17.49	332.27	28.06	↓ 58	↑ 10.57	332.27	28.06	0	0
Fruit	448.77	26.78	359.01	21.43	↓ 90	↓ 5.35	359.01	25.35	0	↑ 3.92
Vegetables	398.90	21.13	398.91	21.13	0	0	398.91	23.74	0	↑ 2.61
Dairy	604.45	24.11	501.42	17.90	↓ 103.03	↓ 6.21	501.42	17.90	0	0
Animal protein sources ¹	227.95	40.46	149.95	28.24	↓ 78	↓ 12.22	149.95	37.25	0	↑ 9.01
Vegetable protein ² sources	71.24	9.87	163.00	15.82	↑ 91.76	↑ 5.95	163.00	19.58	0	↑ 3.76
Fat (sunflower and olive oil)	39.89	3.57	39.89	3.57	0	0	39.89	3.57	0	0
Residual	97.97	11.01	97.97	10.98	0	0.03	97.97	11.17	0	↑ 0.19
Total	2279.52	154.40	2042.42	147.13	-	-	2042.42	166.62	-	-

¹ Includes meat, eggs, poultry and fish. ² Includes legumes and nuts. ↓ Indicates a decrease in the amount (g/Day) or cost (EUR/Month) when compared to the previous level. ↑ Indicates an increase in the amount (g/Day) or cost (EUR/Month) when compared to the previous level. SHFRB, Spanish Healthy Food Reference Budget; SSFRB, Spanish Sustainable Food Reference Budget.

As described in the methodology section, changes from level 0 (L0) to level 1 (L1) are explained by the switch from the SENC to the EAT-Lancet guidelines which entail variations in terms of amounts of food groups and processing of food items.

Additionally, to separate animal and vegetal protein, several changes in the categorisation of foods occurred regarding SHFRB-L0. In this way, pulses were moved from the starch group to the newly created vegetal protein category. Likewise, to follow most current FBDG, nuts were incorporated into the vegetal protein category. The starch group is composed of bread, potatoes, rice and pasta, and the animal protein contains meat, poultry, fish and eggs. In the fats group, only olive and sunflower oil remain. Table 5 shows SHFRB-L0 already with the new categorisation system to make the data comparable.

Changes in the grains and tubercles food group stem from the FBDG reduction from 390 to 332 g which was introduced by diminishing the amount of bread (202 to 143 g) and potatoes (114 to 100 g) and increasing the amount of rice and pasta (from 40 and 34 g to 45 and 45 g, respectively). Dietary intake of carbohydrates is compensated by the increase in weekly pulses (now in the vegetal protein category). Moreover, there is a change in the characteristics of the bread, rice and pasta included, which in L1 are wholegrain, and altogether entails an increase in the cost, mainly due to the elevated cost of wholegrain bread (8.89 to 19.87 EUR/month) (see Table S1).

Amount and type of vegetables included in L1 remain equal than in L0, but fruit consumption is reduced from 449 g to 359 g as per the reference FBDG. Therefore, the cost of the fruit basket is reduced by 5.35 EUR/month.

The total quantity of dairy products is reduced by approximately 100 g/day, in the form of yogurt (from 249 g to 196 g), mature cheese (from 17 to 15 g) and cottage cheese (from 89 to 40 g). Qualitative changes only affect milk, which changes from low fat to whole fat. The cost difference is of 6.21 EUR/month, L1 being cheaper.

Protein-based foods is the group with greater changes: total amount of animal foods (meat, fish, eggs) is reduced from 228 to 150 g, reducing the cost from EUR 40.46 to 28.24, which entails over a 30% saving. On the other hand, the amount of vegetal protein source (pulses and nuts) increases (from 71 g to 163 g wet weight, or 17 to 58 dried weight in the case of pulses, and from 20 to 25 g in the case of nuts), increasing the monthly basket by EUR 5.95. Overall, though, the cost of protein foods (animal and vegetal) is reduced by 6.27 EUR/month.

No change in the composition nor cost of the fat group occurred. The residual group, which contains coffee, chocolate, jam, species and condiments, suffers no modification from L0 to L1. With those changes, the total cost of the food basket from L0 to L1 is reduced by 7.27 EUR/month.

Changes from L1 to L2 derive exclusively from the selection of food items, as amounts are maintained from L1, and result in a budget increase of 19.49 EUR/month. Except for sugar (which in L2 is brown sugar) and nuts (which in L2 are from Spain), all other changes are applied in the fresh products. Opting for seasonal fruit and vegetables grown in proximity increases the cost by EUR 6.53 (EUR 3.92 fruit plus EUR 2.61 vegetables). The same criteria applied to the animal protein food stuff adds an extra cost of 9.01 EUR/month. More precisely, the greatest contribution in this group comes from the constraints applied on fish. The acquisition of fresh and frozen fish fished within the FAO areas 27, 34 and 37 and that were in season at the time of pricing (this only applied to fresh fish) resulted in a reduction in food items (fresh fish: 48 vs. 4; frozen fish: 18 vs. 4) and consequently, the price increased from level 1 to 2 by 43.1% and 66.66%, respectively.

Estimations from L1 and L2 show that the application of a more sustainable dietary pattern as recommended by the EAT-Lancet Commission Report can reduce the cost of the monthly diet by almost 5%, taking into consideration the fact that changing white bread by wholegrain bread from L0 to L1 (and L2) almost doubles the cost of this food product, whereas the consideration of aspects of seasonality and origin may increase the cost of an already sustainable basket (L1) by 15%.

Finally, Figure 1 illustrates the total monthly budget obtained for the different levels of the SSFRB (L1 and 2) compared to the SHFRB (L0) by food category for a man of active age. The SHFRB-0 has a total cost of 154.40 EUR/month, while the SSFRB-1 decreases slightly to 147.13 EUR/month. The SSFRB-2 increases up to 166.62 EUR/month for the reasons explained above.

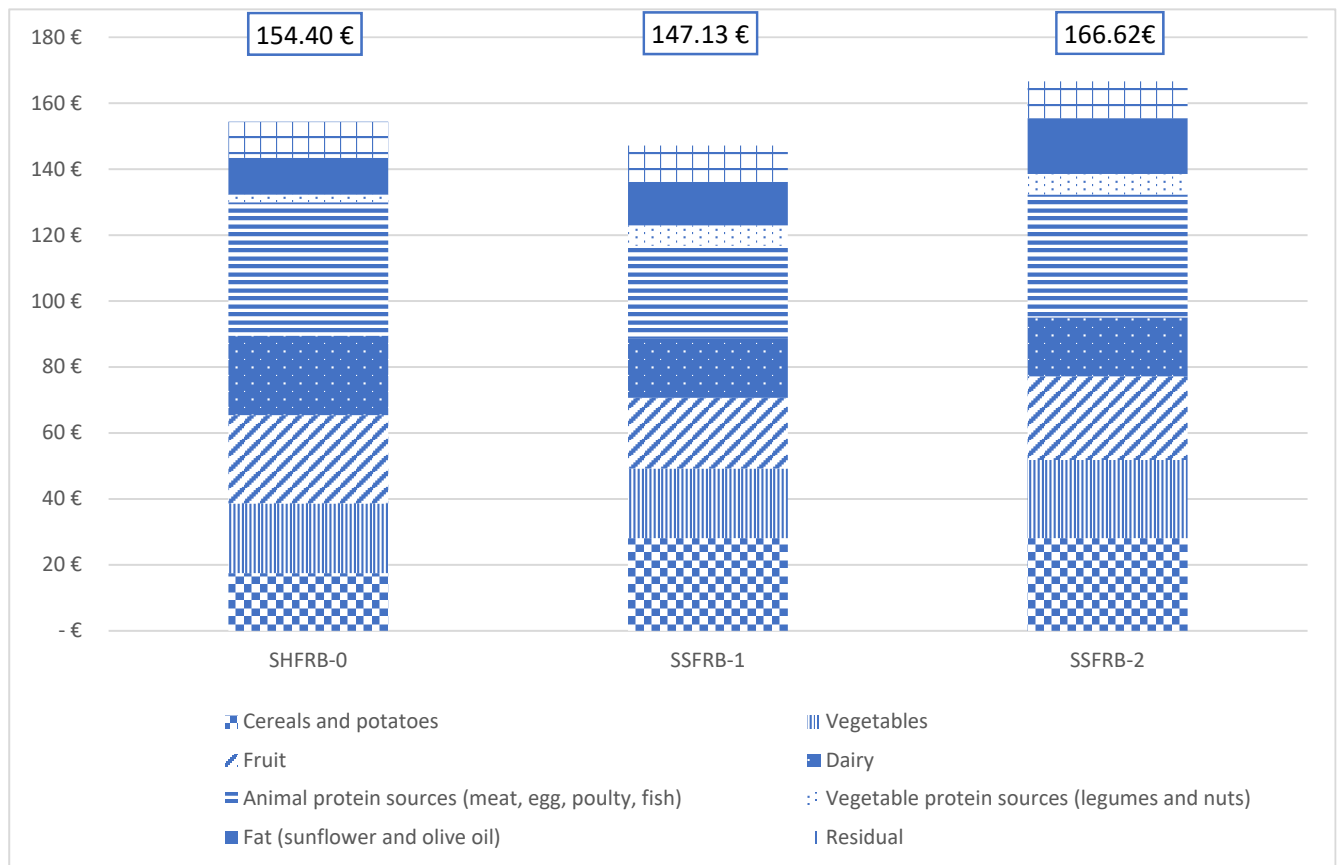


Figure 1. Total monthly budget in Euros of the different levels of the Spanish Sustainable Food Reference Budget (SSFRB-1 and SSFRB-2) for a man of active age by food category compared to the Spanish Healthy Food Reference Budget (SHFRB-0). Barcelona, 2020. Components for each food group are as follows: Cereals and potatoes—bread, rice, pasta and potatoes; Vegetables—fresh and frozen; Dairy—milk, yogurt, cottage cheese and mature cheese; Animal protein—charcuterie, meat, poultry, fish and egg; Vegetable protein—legumes and nuts; Fats—sunflower and olive oil; Residual—coffee, tea, cocoa powder, chocolate, jam, sugar, pepper, iodized salt, nutmeg, oregano, cinnamon, flour, mayonnaise, tomato sauce, vinegar.

4. Discussion

This paper introduces a set of two Sustainable Food RBs estimating the minimum cost of a healthy and sustainable diet for a healthy man in Spain by adapting the methodology for the development of RB in Europe [49]. The consideration of two different levels stems from both scientific and social reasons. At the scientific level, we intended to estimate the cost of applying different criteria known to improve dietary sustainability. In the social domain, SFRB at different levels of sustainability can support the ecological transition, since providing different levels of adherence to a sustainable dietary pattern will ease its access across socioeconomic groups.

The SSFRB do not intend to prescribe what people should eat, but to estimate a minimum budget threshold below which sustainable and healthy eating is not possible for an adult man in Barcelona (Spain). Our results show a sustainable diet based on a combination of the EAT-Lancet and SENC FBDG (SHFRB-L0) is EUR 7.27 more affordable, within a monthly budget, than current dietary recommendations (Figure 1). The transition

towards a food model characterised by a shift towards plant-based foods explains this variation, something that has been shown in other analysis [58]. However, disagreement is found when these values are compared with current spending on food, which, in recent years, is being Westernised [59]. In Spain, current average purchased food baskets, estimated by consumption surveys from the Spanish Ministry of Agriculture, Fishery and Food, cost EUR 22.33 less than the proposed SSFRB-L1 [60], similarly to the results from the Spanish SUN project [61]. Fresán et al. demonstrated that although pro-vegetarian diets are more affordable than the recommended Mediterranean diet, they are not when compared with a Western dietary pattern. Other studies within the Mediterranean region have reached the same conclusions [62].

Protein sources represent the greatest monetary contribution for both SHFRB and SSFRB-L1. In second place, vegetables account for 14% of the SHFRB, whereas in the SSFRB, grains and potatoes take the second position by contributing to the overall budget by more than 19%. This is explained by the exponential increase in the food price of whole grains (particularly bread) in SSFRB-L1-2 which account for an extra cost of EUR 8.22. Since bread is a staple food for the Spanish population, price divergence is greatly reflected and, since cost is a great determinant of food choices, represents a huge barrier for citizens to purchase healthier and more sustainable foods. For example, a study evaluating sociocultural determinants of plant-based diets showed that about 11–13% of their sample would follow a more vegetarian pattern if it was cheaper [63]. Food taxation and subsidies are proposed as a strategy to increase access to nutritious foods across vulnerable groups [64] and to decrease the purchase of unhealthier foods [65]. Such actions would not only increase access but savings on healthcare and improvement in quality of life in a time-frame of 30 years, according to a simulation study conducted in the Netherlands [66].

On the contrary, reductions in dairy and animal-based protein sources in the SSFRB-L1 contributed to diminishing the overall price of the food basket by EUR 7.27, which represented a saving of up to 13.45%. In Spain, consumption of meat and its by-products represent the second food group most consumed, after grains and cereals [67]. There are major drivers that explain this pattern, including socioeconomic determinants [68,69]. Therefore, achieving a shift towards more plant-based food sources would benefit health, economy and environment.

When additional variables were included in the SSFRB-L2, such as proximity, packaging and seasonality (see criteria in Table 4 for each food product), the overall budget increased by 13.2% in comparison with L1. Apart from economic considerations, socio-cultural aspects determine the feasibility to purchase the SSFRB-L2. A study assessing consumers' behaviour in following a sustainable diet highlighted their perception of the importance of avoiding plastic packaging for preserving the environment and placed the consumption of meat products as less detrimental [70]. This emphasises the need to promote educational programmes to increase awareness, knowledge and competences on sustainable diets across the population.

Acceptance from the population in following the SSFRB may be hindered by the dietary changes required. A European survey show that there is a widespread reluctance to reduce meat and dairy products, the two food groups that contribute the most to polluting the environment and are greater reduced in the SSFRB compared with the SENC recommendations [71]. This reflects one of the limitations of this study, which is the consideration of consumers' perceptions to construct the SSFRB. Previous research on RB used focus group techniques to define an acceptable HFB [46], whereas Reynolds et al. used linear programming in order to specify dietary recommendations with the minimum contribution on GHGe and minimise the deviation from current food purchases across socioeconomic groups [40]. Either method entails future research lines and would facilitate the integration of the SSFRB in national policies and nutritional interventions. However, although assessment of citizens' acceptance of the SSFRB has not been possible, a first strength of this study is the cultural adaptation of the EAT-Lancet Commission dietary threshold using the Spanish FBDG. Since the EAT-Lancet report was issued, another study

conducted in Australia calculated the affordability of their recommendations [72], albeit adaptation to national guidelines was not applied. This can be a starting point to bring sustainable dietary recommendations to the population and ease the ecological transition at the consumption level. Additionally, the determination of different levels of sustainability provides a stepwise approach for the identification of priorities when designing nutritional interventions, educational programmes and for the update of current FDBG.

A second strength of our research is the introduction of the sustainability criteria when developing food baskets using the RB indicator. As far as we know, this is the first attempt to do so. Because of this, we designed a specific method based on guidelines and specific literature, supplemented with expert advice. This triangulation of information and data sources ensures the credibility of the results obtained, while the thorough description of the method in this paper confers rigour and transparency and guarantees transferability in other countries. To advance in this method, it will be necessary to validate the feasibility and acceptability of the SSFRB with citizens from both genders and different socio-economic backgrounds, and to develop the third level of the SSFRB considering the social economy dimensions of sustainability. Both elements constitute future lines of research, indispensable to use of this approach in our and other countries, which will inform the design of nutrition-sensitive food policies and promote sustainable and affordable diets and to advance towards making food systems more sustainable in the line of the *Milan Urban Food Policy Pact* [73] and the *Sustainable Development Goals* (SDGs) [74].

The use of the RB approach enables various social applications at the macro and/or micro level. Specifically, we foresee three strategic policy implications: (1) the promotion of sustainable diets to achieve food security; (2) the development of a safety net for social inclusion that considers the sustainability; and (3) the stimulation of sustainable and innovative practices of consumption patterns in urbanised areas, such as Barcelona.

With regard to the first approach, the SSFRB could be used at the macro level to assess and update the current Spanish FDBG to sustainable criteria. At the micro level, the SSFRB could be used to raise awareness, knowledge and competencies on sustainable diets through educational programmes, booklets or guidelines directed to citizens.

The second line of application of the SSFRB is the introduction of the sustainability dimension in the field of social protection policies. In 2019, 25.3% of Spaniards were at risk of poverty and social exclusion, 4% above the EU-27 average rate [75]. Although we still do not have poverty data for 2020, there is reason to believe that the social effects of the COVID-19 pandemic have worsened the living conditions of the population, especially in big cities, such as Barcelona [76], with its consequent effect on health [77]. In this context, the SSFRB is an instrument to assess and analyse diet-health related inequalities. At the micro level, the SSFRB could provide information and assessment to social entities and food banks to tackle poverty through the development of social assistance plans aligned with the SDGs. For example, municipal wallet cards or grocery vouchers that are sometimes used for social assistance could be designed considering the sustainability criteria, for example, of the kind of products that are acquired or the food stores in which they are exchanged.

Finally, the SSFRB, in its second level, considers proximity, packaging and seasonality criteria to stress an environmentally friendly food consumption. Therefore, a third level of action will be the stimulation of sustainable and innovative practices of consumption patterns in urbanised areas. At the macro level, this could be related to municipal policies oriented to protect the local producers and food stores, for instance, in the form of tax reductions or other kinds of favourable economic benefits to help those who act with sustainable criteria. At the micro level, the SSFRB could be applied to public or private canteens in our cities, such as school, hospitals, workers canteens, restaurants or hotels. All these practices could be a step forward to raise consciousness at different socioeconomic levels and social groups to advance to a healthy, sustainable and affordable diet in Spain.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/su13169401/s1>, Table S1: Pricing of the Spanish Healthy Food Reference Budget and levels 1 and 2 of the Spanish Sustainable Food Reference Budget.

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